

Research on the Training of Innovative Talents in Colleges and Universities under the Background of New Engineering

Lili Yu

College of Information and Electronic Technology,
Jiamusi University
Jiamusi, China
jmsyll@163.com

Hongyan Ren

Foreign Language Institute,
Jiamusi University
Jiamusi, China
15904541599@139.com

Xiaoguang Su

College of Information and Electronic Technology,
Jiamusi University
Jiamusi, China
Xiaoguang_yy@163.com

Xiaomin Liu*

College of Information and Electronic Technology,
Jiamusi University
Jiamusi, China
xiaominliu@vip.sina.com

Abstract—With the birth of new industries, higher requirements have been put forward for the cultivation of complex engineering talents. The new technology came into being; Fudan University, Tianjing University and Beijing University have set good examples and provided useful experience for the new engineering in colleges and universities. The innovative thinking, self-expanding knowledge, design thinking and technical understanding and leadership are the core and connotation in new engineering. How to change the teaching concept has become an urgent problem for colleges and universities to solve. Aiming at improving the quality of local university talents, this paper studies the innovative and entrepreneur training mode of local university engineering talents under the background of new engineering. By integrating ideological and political education with professional education, this study aims at highlighting the concept of engineering innovation, constructing the curriculum system of training engineering talents' innovation and entrepreneurship and proposing methods of implementation. Training new engineering talents can help to promote the innovation and entrepreneurship education reform and it can play a supporting role in promoting regional economic development and industrial upgrading.

Keywords—*component; new engineering; talent training; innovation*

I. INTRODUCTION

With the arrival of the intelligent age led by technology such as big data, cloud computing, intelligent robot and 3D printing, the state has introduced a series of strategic plans, such as innovation driven development, "one belt and one road", "made in China 2025", and "Internet +". The Seven

Strategic Newly-emerging Industries needs high-quality compound talents with strong engineering practice ability, strong innovation and competitiveness. It requires a certain discipline as well as interdisciplinary development. It is also necessary to face the development of new technology, new economy and emerging industries with a developing perspective. At the same time, it emphasizes the cultivation of economic, social and managerial abilities and humanistic qualities while being skilled in technology.

II. THE CORE AND CONNOTATION OF NEW ENGINEERING

New engineering is a new thing which is not defined in practice. But the core and connotation are to cultivate talents' thinking of pursuing innovation, the self-expanding knowledge structure, design thinking, technical understanding and leadership.

A. Innovative thinking

When facing with themselves, books, teachers and experts, students should have the spirit of questioning. The premise of questioning is to prove, verify and think with evidence and facts in a seriously scientific attitude, instead of blindly following and rigorously learning knowledge, otherwise there's no using talking about innovation. This requires a change in teaching mode. Due the serious shortage of class hours in new subjects, extra-curricular learning can be used as a supplement to in-class learning. With the aid of high-quality network teaching, online and offline learning can be combined to give full play to the role of teachers and students in-class and extra-curricular. At the same time, the teaching content should be reformed accordingly, and students' participation in learning should be improved through the effective combination of blended teaching and research learning.

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B. Self-expanding Knowledge

In order to expand students' knowledge and cultivate compound talents, our main approach in the past was to increase courses. However, practice has proved that the effect of this kind of "addition" reform is not remarkable. First, adding simply more courses cannot meet the individual's needs of students. Second, this self-righteously "compound" idea often lags behind the needs of society. Third, this kind of "compounds" of "more courses" often distracts the students. The students may want to study every course, but they cannot focus on all the courses.

To cultivate outstanding engineering talents, we need to develop the knowledge structure, but this kind of expansion should not be "it-expanding", but "self-expanding". Expanding knowledge structure is to solve practical problems and meet social needs. Because both practical problems and social needs are uncontrollable variables, it is essentially an "impossible task" to expand through pre-planned training programs. The so-called "self-expansion" refers to the ability of students to expand into any field of knowledge according to their talents and social needs through in-depth study, through which they have a thorough understanding of the natural principles contained in the core curriculum. Therefore, the construction of self-expanding knowledge structure requires "subtraction" rather than "addition", in other words, the construction needs to set up a small but refined core curriculum system, it needs a strict assessment and a solid foundation, in order to face various changing. In the years of 1977 and 1978, the total number of compulsory courses is far less than that now, but so many high-level talents have emerged. Isn't it worth our thinking? "Fewer courses, more talents", which is not only the philosophical idea of the first principle highly respected by Elon Musk, but also the ancient wisdom contained in Laozi's thought of "One is the child of the divine law. After one come two, after two come three, after three come all things".

Multidisciplinary and interdisciplinary integration is one of the most important characteristics of the new engineering. When it comes to interdisciplinary and compounding, people usually think about overlapping curriculum and simple merging of the same items. Students' time and energy are limited. It is easy to get the opposite result if they want to do more and more. We should think carefully about the curriculum design. What we should do is to strengthen the deep excavation of basic core courses, so that students can develop themselves in various fields. We need fewer and refined courses rather than anything else. The development of the times is changing with each passing day, and sometimes planning ahead of time might be useless. Only by adapting to the ever-changing situation with unchangeability, can the cultivation of continuous learning ability truly meet the needs of society and social development.

C. Technical understanding ability

Tool is an infinite extension of human ability. In a sense, an engineer's ability depends on the ability to use tools. In 2015, 440,000 papers were published in the field of cancer, and the most diligent doctors could only read 1,000 papers a year. But IBM's Watson Robot could read them in 10 minutes, not only

memorizing them comprehensively, but also summarizing and analyzing them. If our engineers are good at using these modern technological tools, their abilities will be improved greatly. The curriculum structure of the new engineer should not only have the plate of professional knowledge, but also include the curriculum of modern technology tools. Through this kind of course, it is only a basic goal to help students learn to apply modern technology tools. Especially, it can improve our future engineers' technical understanding ability.

D. Design thinking

In 1987, Professor ROWE of Harvard University School of Design used the concept of "design thinking" in *"Design Thinking"* for the first time [3]. In recent years, Stanford, Harvard and MIT have set off a trend of innovation and enterprise transformation in the United States. From creative APPLE, Bank of America, SAP, IKEA, Pepsi, to traditional industries such as GE, P&G, 3M, IBM, Samsung, etc., they have incorporated design thinking into their business strategies. Stanford University D. Scho OL, Harvard University, MIT and Illinois Polytechnic University have included "design thinking" in their curriculum and this course is very popular with students.

"Design thinking" can not be understood as "designer's thinking". On the contrary, it is a more engineering approach. By using logic and routine, "innovation" can occur steadily in the face of those complex and uncertain problems. Among so many descriptions of design thinking, the most common features include user-centered, repetitive work, prototyping, enjoying the process and learning from failure [4]. Design thinking is another way to solve the challenge of innovation. Design thinking does not start with technology, while it attempts to find a market for new technology. Design thinking begins with people's desires and needs, its understanding about consumers, getting inspiration from them, and using this as a starting point to seek breakthrough and innovation [5]. Engineers are used to focusing on "data interaction" rather than "human-computer interaction", but the starting point of solving the problem is users' needs, not business models or technology, so excellent engineering talents need to cultivate design thinking in order to design humanized products better.

E. Leadership ability

MIT, for "training future engineering leaders", put forward the concept of leadership earlier. MIT believes that engineers meet the needs of customers and society by designing and making products and that many engineers with effective leadership can achieve outstanding results through coordinated and concerted action. MIT is responsible for training students to be leaders in their future lives. MIT hopes to make continuous efforts to develop students' leadership such as innovative thinking, communicative competence, vision planning and realization. The stubbornness, poor communication and cooperation of engineering students require more training in this area. Since 2002, MIT has been conducting leadership training in every laboratory of the university regularly. In the new science and engineering era, the future belongs to people with leadership. Under the background of new engineering, we can learn from the

successful experience of foreign universities and make it suitable for China's national conditions.

III. CONSTRUCTING THE COURSE SYSTEM OF CULTIVATING INNOVATIVE AND ENTREPRENEURIAL ABILITY OF TALENTS IN NEW ENGINEERING

Under the background of new engineering, local colleges and universities bring innovation and entrepreneurship education into undergraduate talent training plan, like establishing and improving the curriculum system and measures system, improving teaching methods and contents, optimizing the training mode, and reconstructing the curriculum system of innovation and entrepreneurship training mode for new engineering talents. Reformation and construction of curriculum system of innovation and entrepreneurship education are being carried out in engineering. Through the pilot construction of typical cases, a scientific, reasonable and standardized talent training mode of innovation and entrepreneurship education in new engineering subjects is constructed. Firstly, general education of innovation and entrepreneurship should be carried out for all students. Secondly, professional innovation and entrepreneurship education courses should be offered to train students' professional innovation and entrepreneurship skills, which can guide students to carry out entrepreneurial practical activities in combination with their specialties, increase students' employment and enhance students' employment ability. Thirdly, public elective courses of innovation and entrepreneurship education should be offered. It can help students with innovative entrepreneurial potentials and interests to expand and enhance their innovative entrepreneurial abilities, and can also provide support for the declaration and incubation of innovative entrepreneurial projects, so as to form a curriculum system of "general training--professional training--practical training". Thus the quality of talent training can be effectively improved.

IV. CONCLUSION

Our colleges and universities take innovation and entrepreneurship education as the core and they constantly improve the new technology, innovation and entrepreneurship training mode for scientific talents. Through the construction of curriculum system and the implementation of innovative

entrepreneurship training for new engineering talents, initial results have been achieved in the quality of talent training. However, the development of the new discipline is dynamic, and it cannot be achieved overnight. In the construction, we need to constantly find problems and continue to adjust it, so that we can more clearly understand its connotation and characteristics. We must raise the training of innovative engineering talents to a strategic level. Only through continuous research, practice and continuous improvement, can we provide talent support and intellectual support for our innovative country.

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