

# Exploration of Talents Training on Safety Engineering Major of Applied University under Emerging Engineering Education

Chen Zhangliang\*

School of Management Science and Engineering, Shandong  
Institute of Business and Technology  
Yantai, 264005, China  
Chenzhl\_yt@126.com

Shi Junwei

School of Management Science and Engineering, Shandong  
Institute of Business and Technology  
Yantai, 264005, China  
Shijunwei302@126.com

**Abstract**—The article analyses that the students should have five kinds of core competence under emerging engineering education. Combined with the concept of emerging engineering education and the guiding norms of undergraduate safety engineering, this article puts forward a feasible scheme for teaching content, teaching method and innovative practice teaching under emerging engineering education. At last, based on emerging engineering education, multi teaching quality evaluation is ensured, the quality and the personnel training of safety engineering major in applied universities are improved, and the training goal of applied talents is realized.

**Keywords**—Emerging Engineering Education; Applied University; Safety Engineering; Talent Training

## I. INTRODUCTION

In February 2017, the Ministry of education proposed the emerging engineering education action plan for higher engineering education in China as the 2 edition of the "excellent engineer" training program. Emerging engineering education is put forward to meet the strategic needs of new economy and new industries for emerging engineering education talents. It is urgent task for higher education to cultivate talents with scientific basis, thick engineering, strong engineering ability and comprehensive quality, and also an important turning point of higher education reform. How to adapt to the development of contemporary society and cultivate talents of Engineering in line with the needs of national construction has become an urgent problem for engineering majors in applied undergraduate universities [5].

At present, there is a considerable gap between the training mode of higher education talents and the requirements of emerging engineering education. Therefore, facing the construction of emerging engineering education, we should re-examine the discipline construction and re examine the talent training plan, teaching mode and teaching method, and put forward new requirements for teachers' ability and quality and teaching, which become a strong support for the construction of emerging engineering education. Safety engineering is the only major subject at the first level of "safety science and Engineering". The specialty of safety engineering is subordinate to the engineering discipline, which has high

requirements for the students' practical and innovative ability. Therefore, a new teaching model must be sought to ensure the goal of training talents at the present stage. Therefore, combined with the concept of emerging engineering education, this paper puts forward the difference between the traditional teaching mode of safety engineering major in applied university and the engineering education mode of emerging engineering education, and puts forward some suggestions for the reform of traditional teaching methods and ideas.

## II. THE CORE COMPETENCE OF THE STUDENTS UNDER EMERGING ENGINEERING EDUCATION

### A. The difference between the educational mode of the emerging engineering education and the traditional teaching model

Taking the safety engineering major of Shandong Institute of Business and Technology as an example, this paper expounds the difference between the training of safety engineering talents in applied universities and the training of traditional engineering talents. Shandong Institute of Business and Technology safety engineering has distinct engineering characteristics, training objectives are very clear, in the industrial enterprise safety as the foundation, we cultivate the safety science, safety technology and safety management of the basic theory, basic knowledge, basic skills, basic ability and quality in design, safety engineering research, testing, evaluation, supervision and management the work of the senior professional talents to the comprehensive development in the moral, intellectual and physical aspects of the three. At present, the main direction of safety engineering graduates employment is a large industrial enterprises, the construction unit of the production line, the basic requirements for graduates of industrial enterprises is the ability of practice, therefore, must be innovated in order to adapt to the training mode of Applied Talents in industrial enterprises. On the revision of the training program of applied talents, we should continue to compress theoretical class hours, improve the proportion of practice teaching, and complete the requirements of practice teaching credit proportion in the construction period, accounting for more than 30% of total credits[1]. These are the traditional teaching mode, and in the traditional

teaching mode, to cultivate students' engineering quality, it is difficult to exercise students' ability to solve practical engineering problems, not only can promote the development of students, but also affect the quality of training of safety engineering professionals.

The biggest difference between the educational model of emerging engineering education and the traditional teaching mode is that it pays more attention to the training of students' practical ability. In order to ensure the quality of graduates with design and construction, organization and management engineering, have mutual cooperation to solve engineering problems of practice ability, emerging engineering education and engineering education model based on actual engineering as the main line, the use of modern means of teaching, create a practice platform, will improve the students' ability in engineering design and Analysis on the important position, working to promote the integration of the growth of the students' knowledge, ability and quality[2].

#### *B. The core competence of the students under emerging engineering education*

According to the characteristics of Engineering Education in China, we discuss the core competency structure of Engineering Education under the background of "industrial 4", and put forward the training mode and evaluation measures for engineering students' core competence, which will have important practical significance and forward-looking value.

Ernst A.Hartmann and Marc Bovenschulte were the first to analyze the capacity requirements of "industrial 4". They put forward the method of forecasting the capacity demand based on the technical roadmap analysis and applied it to the qualitative analysis of the "industrial 4" capability structure. First, with the help of the documents provided by the

European intelligent system technology platform and the International Electrotechnical Commission, the technology roadmap of the intelligent system is analyzed, and the general skill requirements are obtained. Secondly, they analyzed the organizational situation and the technical / departmental matrix, and used it as a skill requirement analysis tool to obtain the requirements of qualitative and quantitative skills.

In 2015, Lars Gehrke and Arno T.K HN in Germany and the United States as an example, discusses the "4 industry" era of future factory workers qualifications and skills (Qualifications and Skills, QS). They used the derived task analysis method, the application of the "MuShCo" optimization technology, put forward an important group of skilled labor QS in the future. QS set consists of two parts QS technology and personal QS, and enumerates 20 specific knowledge and skills [3].

According to the above analysis, this paper puts forward the core competence matrix structure of the emerging engineering education students. First of all, we define competence as the excellent quality and performance of individuals. They can successfully apply knowledge, skills, behaviors and personalities to accomplish important tasks and tasks. Among them, personality includes psychological, intellectual, cognitive, physical and mental personal characteristics. Secondly, according to the "4 industry" under the background of the project development trend, from Ernst and Lars capacity requirement analysis method, put forward the "new core competence of engineering students classification structure, which is composed of 5 kinds of core competence, personal effectiveness, knowledge ability, academic ability, technical ability and social ability. Finally, the "MuShCo" optimization technique is used to construct the core competence matrix of students under emerging engineering education (see Table 1) [3].

TABLE 1. CORE COMPETENCE MATRIX OF STUDENTS UNDER EMERGING ENGINEERING EDUCATION

Ability type	Basic ability	Extensibility	Higher order ability
Personal efficacy	Lifelong learning	Adaptability	Self management
	integrity	Share Vision	time management
	Initiative	Understand others	Holding force
	Professionalism	Self-esteem	Ability to change
Knowledge ability	Mathematics	information technology	Business and Finance
	science and technology	Health and safety	Computer and network
	Social humanities art	Artificial intelligence	environmental science
	Engineering knowledge	Production process	Laws and regulations
scholarly competence	Problems and decisions	Quantitative reasoning	Academic writing
	critical thinking	Information literacy	knowledge management
	System thinking	Innovation and Entrepreneurship	Self evaluation
	Effective communication	Data decision	Self adaptation
Social competence	Engineering ethics	Global thinking	Contemporary problems
	effective communication	Interpersonal communication	risk awareness
	Team collaboration	Leadership ability	Spirit of adventure

### III. TEACHING REFORM BASED ON EMERGING ENGINEERING EDUCATION

Around the concept of emerging engineering education, we need to improve the traditional safety engineering talents training mode and curriculum system, and establish a three in one educational system of knowledge exploration, ability training and personality cultivation. The spirit of strengthening solid foundation, practical work, simple style and strong practice ability training characteristics, universities need to "new technology" concept into innovative education, focus on the cultivation of historical mission and social responsibility, innovative spirit, practical ability and international vision quality of safety engineering professional senior technical personnel in order to meet the needs of modern society. Based on the emerging engineering education, Shandong Institute of Business and Technology safety engineering is the construction of high level application oriented university education department of Shandong Province, the author finds the cultivation of professional, Shandong Institute of Business and Technology of safety engineering undergraduate teaching work carried out based on the emerging engineering education reform optimization[1].

#### A. Reform of teaching content

##### 1) Reform the teaching content with the aim of cultivating "excellent engineer".

In accordance with the "real training foundation and practice, strong ability, high quality, innovation" talent, professional teaching of safety engineering new features, new standards, new trends, new normal at home and abroad development of higher engineering education, local colleges and universities to actively participate in the national emerging engineering education construction and development, increase the engineering education required this course, students of the "big project" concept, let the students participate in the process of engineering construction, establish a "people-oriented science and technology engineering ethics value" concept, the students of Arts and infiltration, to enable students to become talents, the arts and have both ability and political integrity.

##### 2) Setting up a course of innovation and entrepreneurship education in undergraduate students.

We should guide students in classroom teaching, enable students to gradually understand the law of human innovation activities, recognize the initiative of innovation subjects and the universality of innovation objects, and recognize the new connotation of new quality in the new era. At the same time, it also allows students to understand innovation ability is the unity of innovation consciousness, innovation spirit and creative technique. There are three courses in the <foundation for entrepreneurship>, <career planning and design> and <employment guidance>, with a total of 4 credits.

##### 3) The "great engineering view" of the trinity of science and technology, engineering and Humanities.

Modern engineering is characterized by comprehensiveness, complicativeness and systematization. More and more engineering and technological problems depend on interdisciplinary and cross disciplinary knowledge. The emerging engineering education concept of "big engineering concept" is put forward for talents training in Applied Technology undergraduate universities. Therefore, it is imminent to establish a "big engineering view" project for the trinity of science and technology, engineering and humanities. Construction of knowledge structure and curriculum system based on the concept of "big project".

##### 4) Strengthening practice teaching and paying attention to the training of Applied Talents.

First, senior engineers and university scholars are invited to make academic reports for professional students. Finally, the safety engineering major established the safety engineering association in 2013, which became the bridge of communication between students and teachers [1].

#### B. Reform of teaching methods

Teaching method is a general term for behavior patterns adopted in teaching activities. Its intrinsic characteristics lie in the values of education and teaching, the restriction of teaching contents on teaching methods, and the influence and restriction of teaching organization form on teaching methods. The reform of teaching methods is mainly carried out in the following aspects.

- Reproduction engineering situation with modern means, strengthen the comprehensive practice training teaching through experiment and Simulation of the real engineering situation, to enable students to master the mechanical safety technology and management, electrical safety, construction safety management and technical progress in the organization management and control, the safety evaluation report preparation, CAD engineering drawing, building safety monitoring measurement and other practical skills. Each grade set up 7~8 student seminars, combined with the project of safety engineering, and carried out the discussion of safety engineering related topics every two weeks. Instruct students to publish professional papers and apply for 3~5 patents per year in national periodicals [1].
- In classroom teaching, we use heuristic teaching, participatory teaching, discussion teaching, questioning teaching, case teaching and other forms to cultivate students' innovative thinking ability, independent learning ability and engineering practice ability.
- According to the needs of curriculum contents, we should actively carry out bilingual teaching, use multimedia teaching and blackboard style teaching mode to achieve a clear, fast and interesting purpose.
- We should improve the construction of experimental and practical training bases, and actively declare the key project of Shandong provincial key subject

teaching and experiment center, "industrial safety accident prevention and control experiment center". Continue to improve the management system of the laboratory, constantly improving the quality of experimental teaching; put forward more comprehensive and practical projects and strong innovation, let the students participate in the construction, to explore the teaching mode of open experiment new, improve laboratory utilization; based on the existing maintenance practice base, expanding the practice base to attract more students contact the engineering practice opportunities, improve students' ability of social practice.

- Reform the teaching method of the experiment course. The teaching work of the experiment is carried out by the way of "intuitionistic, rational and practical" three steps. "Intuitive" before no experiment courses, intends to arrange students into the lab to help teachers carry out experiments, perceptual intuitive learning; classroom teaching of "rationality" is the experiment, which is an essential link of the teaching plan, let the student carry on Rational Learning Based on perceptual intuition; "practice" requires students to design experiments in accordance with the knowledge, and finish the experiment, write the experiment report.

#### *C. Innovative practice teaching based on the education model of emerging engineering education*

The role of practical teaching in the training of engineering education talents is very important. To further promote the reform of practical teaching in the "new science" under the background of engineering education new ideas, explore new mode of talent training, help to improve the students' comprehensive quality in the knowledge integration, critical thinking, lifelong learning and other aspects, improve the application type undergraduate teaching level and teaching quality.

*1) Take the student as the center, compare the engineering professional ability requirement, cultivate the students' learning interest and the habit of lifelong learning.*

Reform the evaluation and evaluation methods of experimental teaching. In order to improve the quality of experimental teaching, we should increase the proportion of comprehensive and designing experiments, and ask students to design and complete the experiment plan by themselves, and the experimental teachers should give necessary guidance and correction. According to students' design plan, learning attitude, operation skills, laboratory reports, laboratory defense and so on, we can comprehensively evaluate the experimental results, which can greatly avoid "going through the motions" phenomenon.

Update the traditional experimental teaching content. Use the safety engineering experiment center to develop a comprehensive and designed simulation experiment related to the course. The students with their interest in learning through computer modeling and experimental operation, not only can validate the feasibility of design scheme, deepen the understanding of theoretical knowledge, but also can cultivate students' innovation consciousness, experience the fun of learning autonomy, develop good study habits in the experiment.

The second class of students will be enriched to provide places and opportunities for training students' practical ability and scientific and technological innovation. Students should be encouraged to carry out scientific and technological innovation projects related to experimental teaching under the guidance of teachers' guidance. On the basis of relevant rules and regulations, students carry out independent innovation design in the laboratory and verify the feasibility of the program, which provides a basis for further optimization of innovation programs, and helps to train students' knowledge intercross ability and critical thinking.

*2) We should strengthen the construction of the team of experimental teachers and improve the engineering practice ability of the experimental teachers.*

In the new concept of emerging engineering education, experimental teaching is an indispensable and indivisible part of teaching activities, and experimental teachers play a leading role in this link.

Establish and improve the experimental teachers to carry out in-depth business practice system, encourage the experimental teachers in the enterprise testing exercise, to help enterprises solve practical engineering problems, improve their engineering ability in engineering practice.

Strengthen the training of the professional knowledge and skills of the experimental teachers. The school should make the plan of experimental teachers training is feasible, to provide special funds to support and encourage full-time teachers to participate in the construction of experimental teachers, give the necessary professional knowledge training for the experimental teachers, improve their professional level through training, training and other ways, the competent professional experimental teaching work.

To strengthen the experimental teachers' new teaching concept, new teaching mode of training, the teachers according to the emerging engineering education, and actively carry out the project, such as project case teaching method of the experiment based on the experiment, to mobilize the enthusiasm of the students, cultivate and improve the students' engineering occupation ability.



### 3) Increase the openness of professional laboratory and improve the utilization rate of professional laboratory.

The relevant graduation design is carried out around the experimental teaching content, and the needs of local economic development and enterprise technology innovation are needed. It can not only improve the utilization of professional laboratory resources, but also deepen the integration of production and education, school enterprise cooperation, and promote the upgrading and upgrading of the traditional engineering major.

Students should be encouraged to carry out relevant experimental research in the professional laboratory and actively declare the scientific and technological innovation projects of college and provincial and municipal students. In the laboratory, students through access to information, group discussion, design, test and production demonstration process, can fully mobilize students' initiative, enthusiasm and creativity, encourage students to independently design experiment, stimulates the students' creativity and critical thinking, to improve students' learning ability, practical ability, innovation ability and team cooperation ability.

#### IV. THE DIVERSIFIED TEACHING QUALITY EVALUATION BASED ON EMERGING ENGINEERING EDUCATION

To some extent, the emerging engineering education is not only a teaching reform, but also a student's full cycle and multi-faceted training pattern. It's a practice of the new idea of talent cultivation. Therefore, the diversification of the teaching quality evaluation system is essential. The emerging engineering education is indispensable for the training of talents. It is inseparable from the innovative and practical teaching staff, and evaluates its teaching quality, that is, to evaluate the teaching effect of teachers. Teaching evaluation is an important work of teaching evaluation. Objective and fair teaching evaluation is the basic premise of improving the teaching quality management system. In order to carry out student evaluation in a more scientific and effective way, we should comprehensively evaluate teachers' basic quality, teaching ability and scientific research level from aspects of teachers' ideology and morality, vocational skills, teaching contents and teaching methods. Usually, it includes the evaluation of teachers' teaching performance, the evaluation of the leadership on the quality of teachers' teaching and the evaluation of the quality of the teachers' teaching. From another point of view, teachers' evaluation of students should follow the emerging engineering education concept, mainly evaluate students' thinking, knowledge, personality and ability and many other elements, with the requirements of innovative engineering and technology talents limited, and adopt a variety of evaluation criteria[2].

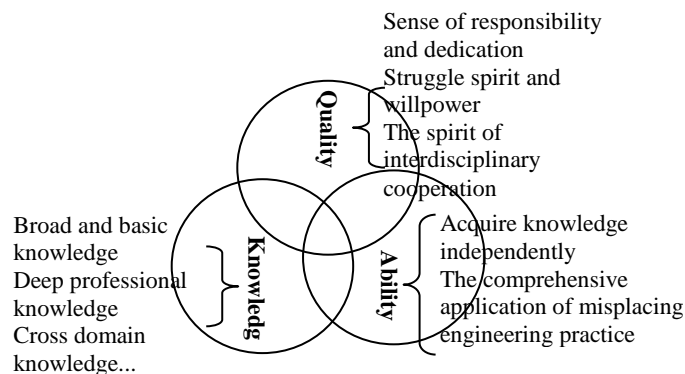


Fig. 1. The target elements of talent training under emerging engineering education

The course of emerging engineering education, we should consider the comprehensive intelligence and non intelligence factors in the evaluation of the quality of personnel training, and set up the three dimensions of the specifications, including knowledge, ability and quality (see Figure 1), we should highlight the reserves of interdisciplinary knowledge, multidisciplinary research ability and interdisciplinary cooperation spirit, so that trained talents have multidisciplinary thinking, composite knowledge, ability and quality [4].

#### V. CONCLUSION

In conclusion, training safety engineering professionals with innovative spirit and cross border integration capabilities is the fundamental starting point and foothold for the implementation of the emerging engineering education training plan. Emerging engineering education is a new thing in itself, and it is only a concept, which needs continuous exploration and improvement. However, the concept of emerging engineering education is the foundation to promote the development of academic research in engineering education, and we should pay attention to it. In this situation, based on the "new science" concept of safety engineering innovative talents education reform, basic knowledge and basic skills to deal with the subject of traditional training development, to build a more perfect curriculum system, teaching system, innovation practice system, effectively solve the application of university teaching and practice teaching of professional theory safety engineering problems in order to develop, need safety engineering innovative talents, complex and comprehensive talents.

#### ACKNOWLEDGMENT

This research was financially supported by Shandong Natural Science Foundation: Research on enterprise informatization introduction mode and enterprise value increment oriented to supply and demand network (Grant NO. ZR2012GM003) , Teaching Reform Project of Shandong Business School: A Study on Hybrid Teaching Model and Evaluation System Based on Application-oriented Talent Cultivation (Grant NO. 1168G201701) and 2016 "CAD

Engineering Drawing" of the Project of Blended Teaching  
Course of Shandong Business School (Grant NO. 04021203)

## REFERENCES

- [1] Shi Junwei, Chen Zhangliang and so on. The exploration and practice of the training of applied talents for safety engineering in Colleges and Universities [J]. Coal higher education, 35 (2): 53-56. (In Chinese).
- [2] Ren Zhenhua, Zeng Xiantao. Reform and exploration of the training of civil engineering professionals in Applied Universities under the background of emerging engineering education [J]. Expert forum, 2017(9): 1-3. (In Chinese)
- [3] Zhou Kaifa, Zeng Yuzhen. Exploration of the core competence and teaching mode of emerging engineering education [J]. The study of high education in Chongqing, 5(3): 22-35. (In Chinese)
- [4] Chen Hui, Chen Min. Thinking and exploring on the training of emerging engineering education talents in Comprehensive Universities [J]. Research on Higher Engineering Education, 2017(2): 19-23(In Chinese) .
- [5] Cai Xiaoping, Sun Changyin. Construction of quality guarantee mechanism for the training of Applied Undergraduate Talents under the background of emerging engineering education [J]. Journal of Yancheng Institute of Technology (SOCIAL SCIENCE), 30(4): 71-73(In Chinese)
- [6] Zhang Hai. The background, value orientation and expected effect of the construction of emerging engineering education [J] . Hubei Social Sciences, 2017(9): 167-173. (In Chinese) .
- [7] Shi Junwei, Chen Zhangliang and so on . Research and effect evaluation of mixed teaching reform in Colleges and Universities [J]. Educational technology and equipment in China, 2017(16): 114-117. (In Chinese)
- [8] Shi Junwei, Chen Zhangliang and so on. The study and evaluation of the teaching reform of the undergraduate course of safety engineering from CAD engineering drawing [J]. Energy technology and management, 42(1): 20-22. (In Chinese)