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A Comparative Study Of Engineering Education Quality Standards Between China And America

Yi Gao[1,2], Milagros Lara Tabasa[3]

1.University of San Carlos,Cebu City, 6000, Philippines.

2.Guiyang University, Guiyang, 550025, China.

3.University of San Carlos,Cebu City, 6000, Philippines.

Abstract: Starting from the development history of engineering education, researchers have analyzed and studied the historical process and technical differences of the formation of engineering education standards in China and the United States. In the course of the study, the historical reasons for the formation of the different standards in the two countries and the existing research results of scholars are analyzed, so that the implementation of engineering education quality standards in China, make basic analysis and judgment.

Keywords: Engineering Education; Standard Analysis; China-American Differences

The establishment of talent training standards in colleges and universities is student-centered, according to students' knowledge, development ability and training quality, to measure whether the standards are in line with the status quo[1]. The standard of engineering education focuses on training students' multi-discipline learning ability, engineering practice development ability and comprehensive ability. The standards for engineering talents require students to possess not only fundamental science knowledge related to their major, but also cross-disciplinary theoretical knowledge, and to develop good communication and social and ethical skills, cultivate good humanistic spirit, professional responsibility and good engineering ethics to meet the requirements of engineering-related industries.

On June 2,2016, China acceded to the Washington Agreement, effectively promoting our engineering education to the world. Washington Agreement (WA) is the most authoritative mutual recognition agreement for engineers in the world. The Washington Agreement sets out the quality requirements that graduates must meet. The quality of graduates consists of"Necessary knowledge" and"Level of problem solving", emphasizing the ability of engineers to solve complex and uncertain problems in engineering through professional study and practice, provide integrated solutions to complex engineering problems.

In this paper, the author studies the quality standards and connotation of engineering education in China and the United States respectively, and draws the following conclusions.

1. Research on quality standards for engineering education in the United States.

Study on the quality training of engineering talents in the United States. American engineering certification standard is embodied in the quality control of engineers, so that engineers can meet the great challenges brought by social development and technological change. The American Council for the professional development of Engineers (ECPD) was founded in New York in 1932 and later renamed the Accreditation Board for Engineering and Technology (ABET) , which sets standards and Accreditation for Engineering education in the United States. In October 1995, ABET promulgated and implemented a new certification standard, EC2000, in order to adapt to the great environmental changes in engineering education in the United States. The standard puts more emphasis on students' actual ability, highlighting the change from"Input" to"Output". The continuous improvement process of achievement evaluation and objective evaluation, as well as the use of evaluation results to improve teaching plans, is the core of this new standard, so as to pay more attention to the"Output" quality of engineering vocational education, that is, what students can do after graduation, students' actual ability to get unprecedented attention. EC2000 provides college graduates with 11 practical competencies to measure the quality and level of their graduation. Systematic learning is effective if graduates meet the following competency standards after

studying in the University Foundation and professional system. As shown in Table 1, the following are 11 EC2000 standards with actual capabilities.

Table1 EC2000"student learning outcomes"

Numbers	Learning Outcome
1	The application ability of basic subject knowledge
2	Independent control of the whole process
3	Under certain conditions, according to the actual requirements of design and Operation Capacity
4	Ability to work and learn in a multidisciplinary environment
5	Ability to identify, plan, and solve engineering problems
6	Awareness of professional and ethical responsibility
7	Effective interpersonal skills
8	The broad educational base needed to understand the impact of engineering on the global, economic and social environment
9	Recognize the power of lifelong learning
10	Knowledge of contemporary issues
11	Ability to use modern engineering tools

With the development of the idea of"Return Engineering", the American Engineering and Technology Education Accreditation Board (ABET) has put forward the basic ability and quality that engineering talents should have after graduation. By increasing the proportion of practical teaching, the degree of integration of schools, enterprises and society will be increased so that engineering graduates will be able to acquire the knowledge, competencies and qualities required for their profession, as shown in tables 2:

Table 2 Engineering Qualities of American engineering talent

Numbers	Learning Outcomes
1	The ability to master and apply relevant knowledge in engineering science
2	Ability to design and conduct experiments and analyze and process data
3	The ability to design systems and processes to meet the needs of sustainable socio-political and economic development
4	The ability to collaborate in interdisciplinary development
5	Ability to solve engineering problems effectively
6	Sense of responsibility of professional ethics and social ethics
7	Ability to express and communicate effectively
8	Grasp the development trend of social economy and science and technology
9	The ability to learn throughout life
10	Keep an eye on current events
11	Effective use of knowledge and skills to solve practical engineering problems

Between 2004 and 2005, the National Academy of Engineering, together with the NSF, has released two reports, engineers for 2020: A Vision for New Century Engineering and training engineers for 2020: teaching transformative engineering for a new century. "Engineers 2020: A Vision for engineering in the new century" analyses in detail the technical, social, international and professional background of engineering practice in 2020, based on this, it describes the key characteristics of the future engineers, makes a strategic design for the Reform and development of engineering education, and describes in detail the key capabilities that the future engineers should have.

The standards of engineering education in the United States focus on training students' multi-disciplinary learning ability, engineering practice development ability and comprehensive ability. The standards for engineering talents require students to possess not only fundamental science knowledge related to their major, but also cross-disciplinary theoretical knowledge, and to develop good communication and social and ethical skills, cultivate good humanistic spirit, professional responsibility and good engineering ethics to meet the requirements of engineering-related industries.

2. Research on quality standards of engineering education in China.

In January 2008, the Ministry of Education of China promulgated the"Engineering Education professional certification standards (trial implementation)", which provides a general standard for engineering education undergraduate level personnel training, and from the quality evaluation, curriculum system, teachers, support conditions, student development, management system and other six aspects of the requirements to ensure the quality of personnel training[2].Table 3 shows the requirements for graduates of China's engineering education professional certification standards, engineering education certification standards (common standards)(revised

in November 2017) .

Table 3 Graduation Requirements(2017)

Numbers	Learning Outcomes
1	Engineering knowledge
2	Problem Analysis
3	Design/develop solutions
4	Research
5	Using modern tools
6	Engineering and society
7	Environment and sustainable development
8	Professional standards
9	Individuals and teams
10	Communication
11	Project management
12	Life-long learning

Domestic scholars generally believe that engineering quality of engineering students mainly includes five basic elements: basic engineering knowledge, professional knowledge, basic engineering skills, engineering ability and quality, engineering awareness. In order to adapt to the ever-changing and complex engineering environment, engineering colleges should attach importance to the training of engineering students' innovative ability and engineering practice ability. In 2002, Zheng Zhaomei, in"On the cultivation of creative ability of higher engineering talents", thought that contemporary engineers have a good mentality and professionalism, broad and solid basic theoretical knowledge and innovative spirit, analytical and general ability, and good cooperation spirit. These knowledge and achievements are the basic ability and quality that must be possessed in dealing with modern engineering. In 2013, Wang said in his book on engineering quality in the era of big engineering that modern engineering is scientific, innovative, complex, social and coordinated, modern engineers should pay attention to the accumulation of cross-disciplinary knowledge, and should have the characteristics of systematic integration in innovative thinking and multi-dimensional structure in engineering ability[3].

With the rapid industrialisation of Chinese mainland, engineering education has become a larger part of the education system. Therefore, there are more and more researches on cultivating high-quality engineering talents and promoting the connotation development of higher engineering education. From the perspective of engineering philosophy, many scholars in China have also investigated and analyzed the engineering consciousness of engineering students, this paper probes into eight kinds of engineering consciousness that engineering college students should possess from the aspects of entrance education, professional course education, practical education, school-enterprise cooperation training, extracurricular scientific and technological activities, and campus culture edification, etc. , [4]the Ways and measures to cultivate engineering consciousness of engineering students are put forward. At the same time, after studying the ideas of large-scale engineering education contained in American Engineering Education certification standards, in the era of large-scale engineering, it is necessary to train excellent engineers with comprehensive cross-knowledge, integrated innovative thinking system, multi-dimensional ability structure and sound and harmonious engineering spirit, it provides a reference for the reform and development of engineering education and the training of engineering talents in China.

To sum up, the research and analysis on the quality of engineering education in China shows that engineering students should master extensive knowledge when they graduate, and learn to use the basic methods and techniques of engineering to solve complex engineering problems, the importance of modern engineering spirit and industrial ethics in engineering practice is emphasized. The engineering practice ability and communication and cooperation ability of engineers also play an important role in the quality structure of engineers. May be, it can be seen that non-technical quality plays a leading role in the future development of engineers.

References:

[1] Liang Peng, Xing Lixia Research on the undergraduate talent cultivation path of "student-centered" [J]. Times Economics and Trade, 2020, No.507 (10): 99-103.

[2] Yu Shanqi. Research on engineering quality training of students in engineering colleges [J]. Machinery Management Development, 2011, No.123 (05): 175-177.