Research on the Status Quo of the Engineering Education Accreditation for the Specialties of Electronic Information and Electrical Engineering

Rui KONG and Bing ZHANG
School of Electrical and Information Engineering, Jinan University

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Abstract. This paper introduces the status quo of the engineering education accreditation for the specialties of electronic information and electrical engineering firstly, pointing out the problems that are prevalent in the certification process of some specialty and analyzing them. Aiming at the problems appearing in the process of the engineering education accreditation, this paper puts forward some ideas and methods to solve them.

Introduction

The system of engineering education accreditation is an international quality assurance system for engineering education. It is also an important basis for international mutual recognition of engineering education and engineers’ qualifications. The system of engineering education accreditation [1] originated from the United States in the 1930s and has developed into an internationally accepted education quality assurance system. “Washington Accord” is an international mutual recognition agreement accredited by undergraduate major of engineering education. In 1989, it was established by engineering professional teams in 6 countries in the United States, the United Kingdom, Canada, Ireland, Australia and New Zealand. The project aims to ensure the quality of engineering education through the qualification of accreditation of undergraduate major of engineering education, and the foundation for the mutual recognition of engineers' qualifications. All contracted members of the “Washington Accord” are independent, non-governmental and professional groups authorized by the national (regional) government. In June, 2013, the International Engineering Alliance Conference was held in South Korea, the General Assembly voted to pass China as a preparatory member of the “Washington Accord”. This shows to a certain extent that, after years of efforts, the quality of our engineering education has been recognized by the international community, joined the “Washington Accord”. The professional programmatic accreditation of the engineering education in China is substantially equivalent to the international. In 2006, China began to construct an international equivalent system of engineering education accreditation. By the end of 2014, it had been certified in 15 engineering fields. Under the leadership of the National Engineering Education Certification Committee of Experts, “the pilot working group on the electronic information and electrical engineering professional accreditation” was established in 2006, and the certification practice of this specialty was started. In March, 2013, China Engineering Education Accreditation Association approved the establishment of "Electronic Information and Electrical Engineering Professional Accreditation Committee.” In June 2, 2016, China Association for Science and Technology on behalf of China successfully become a full membership of the "Washington Accord". Joining the "Washington Agreement" is an important measure to promote the training of Chinese engineers in accordance with international standards and improve the quality of engineering and technical personnel training. It is the basis and key to promote the mutual recognition of engineers' qualifications. It is of great significance for China's engineering and technology field to cope with international competition and conform to the world. The Engineering Education accreditation in China is undertaken by the China Engineering Education Professional Accreditation Association (CEEEA). CEEEA is the only legal organization authorized by the Ministry of education to carry out engineering education accreditation in mainland China. It is a member unit of the China Association for science and technology, which is composed of 33 national industry organizations. At present, there are 15 professional accreditation committees, and it is responsible for organizing and implementing the certification work in this field.
The Necessity of the Engineering Education Accreditation

The engineering education accreditation aims to promote the mutual connection between universities and industry through professional certification, and strengthen collaborative innovation, so as to train engineering talents according to the market demand. The purpose is to promote higher engineering education in China to participate in international exchanges and cooperation, to enhance international competitiveness, to promote the reform and development of Higher Engineering Education in China, and to improve the overall level of higher engineering education. The engineering education accreditation is a relatively new concept for Chinese universities. The engineering education accreditation is still a new thing for higher education in China, and much work is still in the exploratory stage, and a lot of understanding needs to be deepened and improved. In 2014, China's engineering education volume was the first in the world. A total of 31 engineering majors have been established in China, accounting for 34% of the total number of professionals; 1110 universities in China have established engineering majors, accounting for 94% of the total number of colleges. The number of engineering students is 5.12 million thousand, accounting for 34% of the total number of students. However, the quality of Engineering Education in China is big but not strong. Proposed in the government work report in 2015, the guidelines for China's manufacturing transformation and upgrading in the next decade are “Chinese manufacturing 2025” and “Internet plus”. Now it is in urgent need of a large number of engineering and technical personnel in order to achieve the three major changes: made in China to create in China, Chinese products to Chinese brands, China's speed to the quality of China.

The Accreditation Standard of Engineering Education

The standard of engineering education accreditation consists of two parts: general standards and professional supplementary standards. The general standards specify the requirements of the students in seven aspects: "students", "training objectives", "graduation requirements", "continuous improvement", "curriculum system", "teaching staff" and "supporting conditions". The professional supplementary standard stipulates the special requirements of the corresponding specialty in three aspects: “the curriculum system”, “the teaching staff” and “the supporting conditions”. The logical relationship between the indicators of the certification standard, the focus of students, the training objectives and graduation requirements as the guide, through adequate teaching staff and complete support conditions to ensure the effective implementation of all kinds of curriculum teaching. It guarantees the continuous improvement and promotion of quality through the perfect internal quality guarantee mechanism, and finally makes the quality of students meet the requirements.

The Some Problems Existing in the Specialties of Electronic Information and Electrical Engineering

The electrical engineering and automation specialty of our school began to participate in the certification practice in September 2015. During the course of certification practice and peer exchange, we felt that the following problems were prevalent in engineering education for the Specialties of electronic information and electrical engineering:

There Is Insufficient Understanding of the Engineering Education Accreditation in Colleges and Universities, and the Preparation Is Inadequate

Some universities which participate in the engineering education accreditation are lack of a clear understanding of the organizational system, certification standards and certification procedures. To some extent, these universities equate professional accreditation with teaching evaluation. Teaching evaluation is to monitor the quality of teaching in colleges and universities, which is completed by the competent department of education and belongs to the internal work of the education sector. Professional engineering education accreditation is a special certification by the social intermediary organizations for the implementation of professional education colleges and professional education programs, and is the third party evaluation which is independent of the education sector. The
teaching evaluation takes the school as the evaluation object while the professional accreditation takes the specific specialty of University as the object of certification. The professional engineering education accreditation aims to promote the mutual connection between universities and industry through professional certification, and strengthen collaborative innovation, so as to train engineering talents according to the market demand. The purpose is to promote higher engineering education in China to participate in international exchanges and cooperation, to enhance international competitiveness, to promote the reform and development of Higher Engineering Education in China, and to improve the overall level of higher engineering education. The certification work brings a certain amount of extra work to the professional teachers, and some school leaders do not pay enough attention to it, which leads to the fact that the teachers who participate in the certification do not really understand the purpose of the engineering education accreditation. Therefore, the self-assessment reports written by these teachers are not detailed enough. It shows the advantages in a large amount of space, and does not attach importance to the objectivity of self-assessment reports. The self-evaluation of teachers is not good enough.

The Orientation of Training Objective Is Too Macro and Empty

"General standards" points out that the training objective is a general description of the professional and professional achievements that the graduates can achieve in about 5 years after graduation. The profession must have a deep understanding of social needs, have a correct expectation for future development, and combine the overall development goals of the school, formulate appropriate professional training objectives, and regularly revise the training objectives. Through various channels, the training objectives are understood and understood by all the relevant personnel, especially the teachers and students. At present, the common problem is that the orientation of professional training is too macro, and the expression is empty and cannot be realized.

There Is No Specific Teaching Activity to Support and Implement the Realization of “Graduation Requirement”

The “graduation requirements” in general standards are the specific description of the knowledge and ability that students should master when they graduate, including the knowledge, skills and accomplishment of students through the study of this major. In general standard, graduation requirement includes 12 elements: engineering knowledge, problem analysis, solution design / development, research, use of modern tools, engineering and social, environmental and sustainable development, occupation standard, individual and team communication, project management, lifelong learning. Specific to each requirement, it needs to have corresponding teaching activities to support and ensure the realization of the requirements. Some professional self-assessment reports cannot clearly point out what specific teaching activities should be adopted to implement each requirement in "graduation requirements".

There Is No Definite Teaching Quality Evaluation System and Improvement Mechanism

“Continuous improvement” in the “general standards” includes the following points: ①All Specialties should establish the quality control mechanism of teaching process, and should have clear quality requirements in each major teaching stage. And achieve the goal of training through curriculum teaching and evaluation methods to. The curriculum system and teaching quality should be evaluated regularly. ②The profession should establish the tracking feedback mechanism of graduates and the social evaluation mechanism involved by the participants outside the higher education system, and regularly evaluate whether the training objectives are reached or not. ③The profession should be able to demonstrate that the results of the evaluation are used for professional continual improvement. Some majors have no clear means and measures to supervise and guarantee the quality of teaching, and there is no clear way to carry out continuous improvement.
There Is No Production Practice Base, Cannot Carry out Production Practice Activities Effectively

The standard requires that “practice in a real production environment, and every student should have enough opportunities to be trained”. Some professions have taken some measures to complete the project practice teaching project in the campus practice base, and the practice activities as part of the production practice. They want to make up for the lack of practice in enterprises, but still lacks “the practice in the real production environment”\(^{[2]}\). Some professional graduation project (thesis) topic that are combined with the professional engineering problems are less, so that the students' engineering consciousness, team spirit and comprehensive application of knowledge to solve practical problems are insufficient. Besides, the guidance and examination of graduation project (thesis) generally lack the participation of enterprises and industry experts.

The Engineering Background of Teachers Is Relatively Insufficient

The “standard” requirements “teachers should possess engineering teaching ability and professional level, enough experience, communication skills, occupation development ability, and the ability to carry out research on the engineering practice, participate in academic exchanges, and teachers need to meet the engineering background of professional teaching”. The engineering background of some professional teachers is relatively insufficient, especially among young teachers, whom has been basically staying in schools and has less opportunity to go to enterprises. They lack engineering experience and cannot adapt to the needs of engineering education.

The Degree of Industry or Enterprise Participating in Engineering Education Is Not High

The “common standards” mentions that “industry or enterprise participation” engineering education problems in many times \(^{[2]}\). “Training objectives” emphasizes that “establish the necessary system, evaluate the degree of achievement of training objectives regularly, revise the training objectives regularly, and the evaluation and revision process should be involved in the industry or enterprise experts”. The “continuous improvement” emphasizes that “the profession should establish the tracking feedback mechanism of graduates and the social evaluation mechanism involved by the participants outside the higher education system, and regularly evaluate whether the training objectives are reached or not”. The “curriculum system” emphasizes that “the curriculum system should be designed by enterprises or industry experts” and “the guidance and assessment of graduation project (thesis) should be attended by experts in enterprises and industries”. The “teaching staff” points out that “the number of teachers can meet the teaching needs, the structure is reasonable, and there are enterprises and industry experts as part time teachers”. “Supporting conditions” emphasizes that “cooperating with enterprises to build practice and training base, and provides platform for students to participate in engineering practice in the process of teaching”. It can be seen that engineering education emphasizes the combination of specialty and industry or enterprise, which is the need of engineering education, and reflects the essential characteristics of engineering education. This is the weaknesses and difficulties of this specialty in engineering education, and it needs to raise awareness and takes effective measures to establish and build the mechanism of industry or enterprise, improve the industry or enterprise participation.

Suggestions on Promoting Engineering Education and Professional Accreditation of the Specialties of Electronic Information and Electrical Engineering

Based on the practice of engineering education accreditation of the specialties of electronic information and electrical engineering, the following suggestions are put forward to strengthen the engineering education of this specialty and to promote the engineering education accreditation of this specialty:
Strengthen the Publicity of Engineering Education and Certification Standards

It is necessary to strengthen the propaganda of engineering education certification concept to make all teachers clear the purpose and significance of certification, so that teachers can establish a student centered concept, output oriented concept and continuous improvement concept. At the same time, it is necessary to actively publicize the engineering education accreditation standards, especially the general standards, so that all accredited personnel can understand the standards. The rules and regulations of the professional education need to perfect and improve in accordance with the certification standards. In order to make full preparations to participate in professional certification, it is necessary to take targeted measures to improve the professional engineering education, especially to improve some common problems in engineering education in China, such as the training of common target location, teachers of engineering background, enterprise participation, quality evaluation and improvement mechanism of China's engineering education in some of the problems.

According to the Standard Requirements, the Existing Talent Training Program Should be Modified, and the Subject Oriented Curriculum System Should Be Shifted to the Student Centered and Result Oriented Curriculum System

According to the standard of engineering education accreditation [2], the major should have the training target, which should be open and conform to the school's orientation, and meet the need of social and economic development. The training objective is a general description of the professional and professional achievements that graduates can achieve in about 5 years after graduation. It is the general outline of the cultivation of professional talents, which is also the basic basis for constructing professional knowledge, ability, quality structure and forming course system and carrying out teaching activities. The standard also stipulates that the profession must have clear and open graduation requirements, graduation requirements should be able to support the accomplishment of the training objectives, and the curriculum system of talent training program should be able to support the graduation requirements. The graduation requirement is a description of the knowledge and ability that students should master when they graduate, including skills knowledge and ability that students learn through the professional learning. It is the learning achievement that students should achieve when they finish their studies. The development of training objectives and graduation requirements should be carried out in an in-depth social survey. Invite graduates, employers and other staff to participate in, and strive to develop the content in line with internal and external needs. The training plan must refine the graduation requirement (that is, the ability of graduates) to the ability index, so as to facilitate the implementation in the specific teaching process. And the training program should be a term that can be evaluated quantitatively or qualitatively. Teaching content is the support of meeting the requirements of graduation. The corresponding relationship between graduation requirements and teaching content are different from the corresponding relationship between graduation requirements and curriculum system. The former is partial, which is the correspondence of one or several graduation requirements with one or several courses, while the latter is holistic. The graduation requirements should be implemented one by one in each syllabus, so as to clarify the contribution of the teaching content of a specific course to the requirements of graduation. The syllabus of traditional education only arranges the teaching contents stipulated in the textbooks. It provides each chapter of content and teaching hours of each class, as for the relationship between the teaching content of each chapter, each class and graduation requirements, and the contribution to meet the graduation requirements is usually not mentioned, which often cause confusion between teachers and students. In the teaching design of “results oriented” of engineering education accreditation standards, the compilation of teaching syllabus must clear that which graduation requirements it has contributed to firstly. Then, the corresponding teaching content should be determined according to the graduation requirements one by one, and then the teaching hours required to complete the teaching contents are determined. The syllabus in the teaching design of “results oriented” is according to the related requirements for graduation entries, rather than by the textbook chapters written, so, for each class, both teachers and students
are very aware of which graduation requirements that their teaching or learning are contributed to. The corresponding relationship between graduation requirements and teaching content provides the basis for determining the teaching content and teaching hours of the course.

**Establish a Real effective Production Practice Base or Training Center**

In order to strengthen engineering practice teaching, the most urgent thing is to create practice in real production environment, so that every student has enough opportunity to be trained \(^4\). Engineering education must be geared to the needs of practical engineering. The specialties of electronic information and electrical engineering also need to further strengthen ties and cooperation with industries and enterprises, establish a real effective production practice base to meet “practice in the real production environment”. Production practice in real production environment is an important link for students to participate in engineering practice, form engineering thinking and obtain engineering experience, and cannot replace production practice with a single visiting process. Strengthen the engineering practice teaching must not only satisfy the requirements of hours or credit, is more important to comb, reform and improve in engineering practice teaching goal, system, content, methods, conditions and teaching staff and other aspects. We should actively participate in and implement the "excellent engineer education and training program" of the Ministry of education. Through the favorable conditions of the “excellent plan”, establish “National Engineering Practice Education Center” joint declaration with the business community to -. Through the "excellent plan" favorable conditions, school can joint declaration with the business community to create “National Engineering Practice Education Center”. Taking strengthen the engineering practice ability, engineering design ability and engineering innovation ability as the core, reconstruct curriculum system and teaching content, and integrate practice education into the whole process of education.

**Strengthening the Construction of Teaching Staff**

The supplementary standards of electronic information and electrical engineering education accreditation require that more than 20% of the teachers who have engaged in the teaching work of this specialty have the relevant experience of enterprises or related engineering practice. The school should have plans to send the young teachers to the relevant enterprises to have study training or participate in industry university research project cooperation, so as to accumulate engineering practice experience. Specialties should also employ staff with rich engineering experience as part-time teachers from enterprises and institutions to undertake some professional courses teaching task or guide students to carry out enterprise project development and graduation thesis (design) work. Besides, schools should further improve and perfect the system of appointment and assessment of teachers, so as to strengthen practical education.

**Reference**


