On the Reform of Undergraduate Practical Teaching under the Background of Engineering Education Certification

Shuang-Quan LI
School of Automation, Harbin University of Science and Technology, China
Lshq@hrbust.edu.cn

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Abstract. According to the professional certification standard of engineering education, aiming at the problems existing in the engineering practice of automation major, this paper discusses some effective methods to promote the reform of engineering practice teaching. Engineering practice teaching should aim at the development needs of students and the cultivation of innovative talents, combine the needs of the industry, and promote the integration of theory teaching with each other, to establish a systematic and perfect engineering practice curriculum system and training mode.

Introduction

With the development of globalization, China is more and more deeply involved in the international competition. China's engineering education should also adapt to the development of the times to meet the new requirements from the domestic industry and face the new challenges from the international engineering education [1].

Practice is not only the soul of engineering, but also the basic characteristics of engineering education. The graduation requirements of engineering education professional certification clearly put forward the training objectives and detailed graduation requirements, requiring students not only to master knowledge, but also to apply knowledge, not only to solve simple engineering problems, but also to solve complex engineering problems, emphasizing the practical ability of graduates in many aspects [2]. Therefore, in order to train qualified engineering and technical personnel and meet the certification standards, we should strengthen the practical teaching link and focus on training students' learning ability, practical ability and innovation ability. Although the practical teaching of Engineering Education in this major has a relatively perfect system, it has been further reformed in combination with the standards and methods of engineering professional certification.

The Practical Teaching Reform

Automation major applied for engineering certification in 2015, so compared with the certification standards, the course system was greatly changed, and its own shortcomings were found, some problems were found, especially the problems in practical teaching were deeply analyzed, and reform measures and ways were explored.

Constructing a Scientific and Systematic Practical Teaching System

Most majors, including automation, have a certain degree of "theory is more important than practice." On the curriculum level, the theory curriculum is in the dominant position, the practice curriculum is ignored, and the practice curriculum system is not perfect. In this kind of curriculum structure, the students often master a rich theoretical system. But as soon as we get the practical problems, we are helpless.

Practical teaching is an important part of higher education teaching activities, which is the verification, supplement and expansion of theoretical teaching. Theory teaching focuses on the teaching of basic theories, principles, laws and other theoretical knowledge, which has abstract characteristics and is easy to cultivate students' abstract ability. Practical teaching focuses on the
verification, supplement and expansion of theoretical knowledge, with strong intuition and operability, aiming to cultivate students' practical operation ability, organizational management ability and innovation ability. College practical teaching is a long-term, systematic, scientific and comprehensive process of cultivating students' practical ability, especially innovation ability. From the perspective of practical teaching effect of practical courses in this major over the years, there are still teaching links that emphasize results, ignore processes, and lack of strong supervision of quality process management; the proportion of confirmatory experiment content in the total experimental hours is large, while the proportion of design and innovation experiments [3-5]. Therefore, we should build a more scientific and reasonable practical teaching system.

Guided by the concept of engineering education, optimize the practical teaching content, encourage students to carry out innovative experimental research, and build a multi-level progressive integrated practical teaching system of "classroom experiment→ comprehensive design→ innovative practice" guided by industrial demand. Classroom practical teaching activities mainly cover the first classroom of practical teaching, which is mainly composed of classroom experiment, curriculum design, comprehensive practice, graduation design and other courses. Meanwhile, a training mechanism for improving innovation ability, which is jointly participated by all students by means of competition, is established.

**Perfecting and Optimizing Practical Teaching Content**

The comprehensive practice course should promote the cultivation of comprehensive professional ability, and consider the economic, environmental, moral and legal, health and safety, social security, sustainable development and other issues comprehensively, so as to form the quality management goal of "meticulous design, strict process and commercialization of objectives." According to the way of course group, the courses are sorted out. Each course group has designed a comprehensive training to run through the theoretical knowledge learned with a systematic and complete design content, so as to improve the practical ability of students. For example, according to the professional direction, students have participated in the comprehensive training in three directions: measuring instrument, beer brewing control process design and motion control. The teacher gives the application background of the practical courses (such as industry, food production, smart home, etc.), and the student sub groups determine the content of the course design according to the content of the course through independent reference, discussion and thinking, expand the practical and innovative thinking, and finally complete the design, composition, evaluation, suggestion, report, guidance and supervision through simulation, simulation and welding of real objects Practice the process and complete the project presentation.

**Establishing a Compound and Diversified Practical Teaching Mode**

The subject competition is brought into the traditional training mode, which takes competition as the carrier of ability training and forms the training mode of "combination of teaching competition." In recent years, the Department of automation has made good achievements in the National College Students' electronic design competition, National College Students' mathematical modeling competition, robot competition, intelligent car competition and other competitions.

According to the characteristics of students' interests, school running resources and social enterprise resources, the rules for students to practice in enterprises and carry out graduation design are formulated. The training of students inside and outside the school exists together and is implemented in parallel. According to the principle of credit replacement, they can transform and integrate with each other, and finally meet the requirements of graduation ability.

**Construction of Practical Teaching Teachers**

Teachers' engineering practice ability and engineering experience are very important for the courses with obvious engineering. Therefore, the major adopts various measures to cultivate and improve the engineering practice ability of teachers, encourages and introduces professional teachers to carry out cooperation with enterprises in various ways and channels, and the vast majority of professional teachers undertake engineering projects. At the same time, for young
teachers, in order to further enhance their engineering ability, with the teaching links such as production practice and graduation design as the carrier, schools and enterprises interact to cultivate the engineering experience of professional teachers. In addition, they actively promote young teachers to integrate into the research team with rich experience, and train the engineering practice experience of young teachers in the process of completing the research of engineering projects. The major encourages teachers and enterprises to cooperate in the development of scientific research projects, advocates the combination of scientific research projects and teaching activities, strengthens the cultivation of engineering practice ability, improves professional scientific research ability and academic level of science and engineering, and promotes teaching development with scientific research achievements.

**Effect of Reform**

Under the guidance of engineering education certification standard, automation specialty strengthens practical teaching, attaches importance to all aspects of practical teaching, keeps pace with the development of the industry, closely contacts with enterprises, optimizes the curriculum system, increases the investment in practical teaching, strengthens the training of teachers, innovates the practice platform based on entrepreneurship, and adopts various practice modes to improve students' practical ability. The ability of strength, scientific research and innovation enables students to calmly face various challenges after graduation, and also cultivates more and better high-quality innovative talents for the country. The participation rate of students in direct practical activities, such as competitions and entrepreneurship projects for college students, has been greatly increased, and the number of school enterprise cooperation units has increased by 30%. Scores of national, provincial and ministerial awards have been awarded to students of this major.

With the promotion of engineering education certification, the requirements for practical teaching are becoming higher and higher. In the future, it is necessary to establish an organic unity of theoretical courses and practical courses, establish a systematic, long-term, sustainable and organic unity of theoretical and practical courses training system, train students with comprehensive and automatic abilities, and improve their employment competitiveness.

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**References**

[1] Xiong Ying. Professional certification of engineering education promotes the reform of engineering practice teaching in Colleges and Universities. Disciplines Exploration, 33 (2019) 56-57.

[2] Chen Pengyong. Innovating practical teaching mode and training high quality innovative talents. University Education in China, 6 (2010) 72-76.

[3] Liu Qifang. Practice teaching of electronic information under the background of new engineering. Journal of EEE, 6 (2019) 151-154.

[4] Huang Huafei. Practical teaching reform of electronic information specialty under the concept of achievement oriented education. Inner Mongolia: curriculum education research, 44 (2018) 254.

[5] Qu Zhaogui and Zhou Yongqiang. Exploration of practical teaching system of Applied Undergraduate Electronic Information Engineering Major. Shanghai: laboratory research and exploration, 37 (2018) 240-244.