Research and Practice on Software Engineering Curriculum Group Construction Based

Xuehua Liao, Xiaoning Li, Tao Guo, Leyi Gou and Chi Li

ABSTRACT

With a professional certified background of engineering education, this paper takes software engineering students as the implementation object and introduces the concept of Outcome Based Education (OBE) into the curriculum group construction of software engineering. This paper analyses the significance and objectives of the curriculum group construction and gives the ideas, curriculum system, teaching staff construction, practical teaching, closed-loop monitoring and guarantee system of teaching quality to strengthen the cultivation of students’ professional ability. This paper cultivates students’ innovative thinking and practical ability to solve complex engineering problems, enhance the market competitiveness of graduates, and provide a good foundation for the smooth implementation of software engineering professional certification.

1. INTRODUCTION

Software engineering is a practical major, which requires students to have a solid theoretical basis, strong application ability and comprehensive quality related to software engineering technology. How to test or judge whether the professional training can achieve the recognition of the national or international community has become a key issue. Over the past decade, the state has also introduced some measures, such as the ministry of education's
evaluation of excellence in undergraduate and graduate teaching. With the increasingly close links between China's political economy and other countries in the world, our education and training also urgently need to be recognized by the international community, which will indirectly improve the international competitiveness of our graduates. In recent years, China has been promoting the professional certification of engineering education, which is another important measure after the evaluation of education and teaching in colleges and universities. The main purpose is to adjust the professional setting, optimize the professional structure, improve the professional training ability, and realize the substantial mutual recognition between Chinese and international engineering education majors. At present, the Washington agreement is the most influential international agreement for the mutual recognition of undergraduate engineering degrees in the world, and the most authoritative and systematic agreement for engineering education in the world. The purpose of the agreement is to promote the transnational practice of engineers through bilateral or multilateral recognition of engineering education qualification and engineer qualification. In 2013, China became a member of the 21st Washington agreement, and the quality of undergraduate engineering education was recognized by the international community, providing a "pass" with international recognized quality standards for Chinese engineering graduates to go global in the future. Therefore, the preparation and completion of the software engineering professional engineering education accreditation, and as the backing, for software engineering education curriculum system construction to provide a solid foundation, to develop in accordance with the requirements of international talents standard provide strong guarantee, further promote the close software engineering software engineering education reform, education links with the industry, speed up the internationalization of software engineering education[1].

The core concept of engineering education certification is student-centered and output-oriented, in order to improve the quality of student training through continuous improvement. It is of great significance to construct the quality control system and promote the reform method of engineering education in China in order to promote international mutual recognition and enhance international competitiveness of engineering and technical talents. Under this background, the construction of software engineering specialty faces both great challenges and historical opportunities. In this new situation, with professional certification as an opportunity, we take the market and industry demand for talent specification as a foothold, hope to maximize students interest in learning, cultivate students' innovative and practice ability, improve the professional qualities and employment
competitiveness of graduates, and further advance the implementation of software engineering professional education certification process.

2. RESEARCH SIGNIFICANCE AND OBJECTIVES

The construction of curriculum groups is the hot spot of curriculum reform in colleges and universities in recent years. It is an important means to promote the optimization and integration of specialized courses in Colleges and universities, deepen curriculum reform, textbook construction, and faculty building, and optimize the allocation of various teaching resources. Curriculum group construction through the integration of relevant courses, the establishment of structure optimization, and the organic integration of content of the curriculum system can better promote the realization of professional training objectives.

The concept of OBE - Outcome Based Education, also known as "Output-Oriented Education" or “Results-Oriented Education”, focuses on students’ ability to reach achievements after the course. Output-oriented is a core concept of engineering education certification, so it is particularly urgent to carry out research on teaching reform under the guidance of the OBE concept. The software engineering major of Sichuan Normal University has been selected as the pilot project of “Excellent Engineer Education and Training Program”, and has already carried out the certification of engineering education. To support the cultivation of ability in graduation requirements, this major will be under the guidance of the concept of OBE, based on industry demand, and solve the problem of complicated engineering ability. This major will carry out the research and practice of software engineering curriculum group construction, in order to make clear the ability training goal of curriculum group support and graduation requirements, perfect the system of the characteristics of curriculum group, strengthen the construction of double type teachers, strengthen the construction of conditions and strengthening practice teaching link, strengthen students' project practice ability training, and establish teaching quality guarantee system, thereby achieving the target of professional certification and improving the quality of students.
3. OUTPUT-ORIENTED SOFTWARE ENGINEERING PROFESSIONAL COURSE GROUP CONSTRUCTION

In order to achieve the above research objectives, this major is guided by the OBE concept and follows the general design idea of "taking industry demand as the starting point, training goal as the orientation, ability training as the core, and teaching activities as the end point", as shown in Figure 1:

![Figure 1. The general plan of curriculum group construction.](image)

This research program starts from the demand for talent cultivation in the IT industry and designs teaching requirements from top to bottom according to the requirements of ability cultivation. The program then optimizes, integrates and strengthens students’ ability to comprehensively apply professional knowledge and theories to solve complex engineering problems in the IT field [2].

The specific construction contents are as follows:

1. Revolving around the concept of "student-centered", we revised the training objectives and graduation requirements of the software major.

Aiming to solve the problems of unreasonable orientation of training target and short planning period, this paper revised and improved the training target of automation major from an international perspective. On the premise of engineering education professional certification standards, we aim to improve students' innovation and entrepreneurship abilities five years after graduation, and hope students will have the comprehensive ability and achievement requirements. We invite experts in software enterprises to help develop and adapt to the social and economic development in line with international standards of training objectives.

Aiming to solve the problems of incomplete comprehensive ability
requirements and lack of engineering innovation, the graduation requirements of the software engineering major are revised and improved according to the training objectives. The graduation requirements determine the comprehensive knowledge and skills of the humanities, science and engineering foundation, professional foundation, comprehensive design, teamwork, engineering practice, comprehensive innovation, organization and management, lifelong learning and international communication that students should have when they graduate. The different requirements of employment, postgraduate studies and going abroad will enable students to develop long-term comprehensive qualities and skills.

(1) Adhering to the OBE concept and establishing a curriculum system with software development to test as its core competence, we ensure that the proportion of curriculum types meets the requirements of national and engineering education certification standards.

Aiming at the unreasonable knowledge structure of the course system, the software professional knowledge structure is optimized and adjusted [3]. We refer to the training system of software engineering major in famous schools at home and abroad. According to the standard of engineering education professional demonstration, we use the knowledge of Humanities and social sciences, discipline foundation and specialty foundation, and specialty development and personality development courses to form the curriculum system. At the same time, through the curriculum system, we can strengthen the humanities and social education, broaden the discipline foundation, and condense the professional backbone. In addition, we rationally allocate the scientific proportions and relationships among various courses, so that these courses meet the requirements of national and engineering education certification standards, as shown in Figure 2:

Figure 2. Software Engineering Course System.
Adhering to the background characteristics of software engineering, we build a team of software engineering teachers.

At present, most college teachers lack engineering background. This is the key to build a team of engineering teachers with sufficient quantity, reasonable structure and high quality to cultivate engineering talents who meet the training objectives and graduation requirements.

In view of the low proportion of teachers with engineering background and other problems, the following measures are adopted to strengthen the software engineering experience and practice training of the teaching staff:

1) Adhering to the principle of "internal training and external introduction", the school has introduced outstanding talents, implemented the talent cultivation projects in four universities, and effectively increased the proportion of "double-qualified" teachers.

2) Relying on the provincial teaching team, teaching tasks are planned, process management is implemented, and education research in the unit of curriculum group construction is carried out.

3) Young teachers are encouraged to take part in engineering practice training and are guided to undertake lateral projects of software enterprises to increase opportunities for practice experience.

4) Software companies and selected part-time teachers such as Huawei and Ali are contacted to participate in practical teaching guidance and open frontier courses. Technical seminars and forums are held, a dynamic communication mechanism between colleges and enterprises is established, and the deep integration of schools and enterprises is realized. We should establish a team of teachers with special features and achieve the two-way dynamic flow of "sending out young teachers for training" and "hiring enterprise experts for teaching", so as to improve the engineering background and professional quality of the whole team of teachers.

4) Engineering enterprises are contacted to build software engineering characteristic laboratories and practice teaching resources and construct a progressive practical teaching system combining point, line and surface.

The certification standards for engineering education majors attach importance to and strengthen the links of practical teaching. This requires laboratories, practice and training bases, and related facilities to meet the needs of teaching in terms of quantity and function [4]. It is also required to cooperate with enterprises to build internship and training bases so as to provide a platform for students to participate in engineering practice in the learning process. In view of the shortage of laboratory resources and practice bases or places, we will increase the construction of school-enterprise joint practice teaching bases, actively carry out industry-university-research cooperation, and build off-campus training bases with software engineering features. In addition, we should strengthen the improvement of laboratory equipment and the construction of joint laboratories. In order to improve students' engineering practice ability and innovation ability, we analyzed the
demand of software engineering for software technology. We want to build a practical teaching system on the basis of the original practical curriculum by means of specialty construction, independent research and development, scientific research transformation and enterprise co-construction. The characteristics of the curriculum system are as follows: 1) it is based on the knowledge points of a course; 2) it aims at the integration of knowledge of the course group; 3) it focuses on the cultivation of the ability to solve complex engineering problems on the basis of school-enterprise cooperation. These three aspects constitute a progressive practical teaching system which combines point, line and surface, as shown in Figure 3.

4. CONCLUSIONS

The main purpose of engineering education professional certification is to enhance the international competitiveness of China's engineering and technical personnel. In this context, the construction of software engineering majors faces both enormous challenges and historical opportunities. Guided by the OBE concept, we take the professional certification as an opportunity and the demand for talent specifications in the market and industrial development as the foothold, develop the software-oriented professional course group system for output and talents. The reform and innovation of the training mechanism hope to maximize students' interest in learning, cultivate students' ability of innovation, practical ability and ability to solve complex engineering problems, improve the professional and technical quality and employment competitiveness of graduates, and further promote professional software engineering. This paper describes the implementation process of education professional certification.
REFERENCES


