Curriculum Reform of Software Engineering under the Background of Engineering Accreditation

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Abstract: Engineering accreditation is an internationally accepted quality assurance system for engineering education, which has become an important link in the construction and development of engineering education in universities. In order to adapt to the needs of professional and technical talents in various fields of computer application, students can deeply understand the ideas and methods of software engineering. This paper proposes a software engineering curriculum reform program under the background of engineering accreditation for the correspondence between engineering accreditation standards and software engineering curriculum content. Reconstructing the practical teaching system of software engineering curriculum from the perspective of engineering accreditation, continuous improvement concept runs through the whole process of engineering education accreditation, case-driven teaching method to help curriculum reform, engineering accreditation to promote student-centered teaching mode, engineering accreditation drives the construction of software engineering course groups.

1. Introduction

Engineering education is an important part of China's higher education. In the process of national industrialization, it plays an irreplaceable role in the formation and development of a complete and independent industrial system. Engineering education accreditation is an internationally accepted quality assurance system for engineering education. It is also an important basis for achieving international mutual recognition of engineering education and international recognition of engineer qualifications. The core of engineering education accreditation is to confirm that engineering graduates meet the established quality standards required by the industry, and is a qualification evaluation oriented to the training objectives and graduation export requirements. The accreditation of engineering education requires the establishment of professional curriculum system, the allocation of teaching staff, and the configuration of school conditions. All of them focus on the core tasks of students' graduation ability, and emphasize the establishment of professional continuous improvement mechanism and culture to ensure the quality of professional education and professional education.

"Software Engineering" is one of the important professional courses in computer science and technology, software engineering and other majors. It is a theoretical, comprehensive and practical course to cultivate students' complete and strict software engineering concepts and training. Students' software project development and management capabilities are targeted. Through the theoretical teaching of this course, students are required to understand the general process of software project development and maintenance, establish a good software design and development concept, and consciously follow the software engineering method to develop and maintain the software; master the latest methods and technologies of software development, and also learn to use analytical design tools to develop students' ability and quality in software development using engineering methods. Through the practical teaching of this course, students can carry out software engineering project analysis, design and implementation, as well as effective project management and document writing skills.

Engineering accreditation is an internationally accepted quality assurance system for engineering

education. It has actively participated in engineering accreditation and has become an important link in the construction and development of engineering education in domestic universities. Continuous improvement is one of the concepts of engineering accreditation, and achieving continuous improvement of the profession is the inherent requirement for the sustainable development of engineering professional education. The effective way to transform educational thoughts and educational concepts and achieve continuous improvement is curriculum reform, research on software engineering curriculum reform under the background of engineering accreditation, with special emphasis on teaching concepts with equal emphasis on theory and practice, to stimulate students' independent learning, and to enable students to deeply understand software. The ideas and methods of the project are used to guide the development of specific software projects, highlight the teaching effect, improve the level of student software development, and lay a solid foundation for students' lifelong learning and career development.

2. Corresponding Relationship between Engineering Accreditation Standard and Software Engineering Course Content

The "Engineering Education Accreditation Standards" are divided into general standards and professional supplementary standards, which are applicable to ordinary higher education. Common standards include students, training objectives, graduation requirements, continuous improvement, curriculum systems, faculty, and support conditions. Graduation requirements are a detailed description of the knowledge and abilities that students should master when they graduate, including the knowledge, skills, and literacy that students acquire through their majors. The software engineering course is a high-level university course and plays an important role in guiding students' work after graduation. Therefore, the software engineering curriculum reform must meet the graduation requirements of the accreditation standards. Engineering students must meet 12 requirements when they graduate; and the software engineering syllabus lists all the knowledge and content that a software engineering course should have. By comparison, it is found that there is a certain correspondence between the two, as shown in Fig. 1.
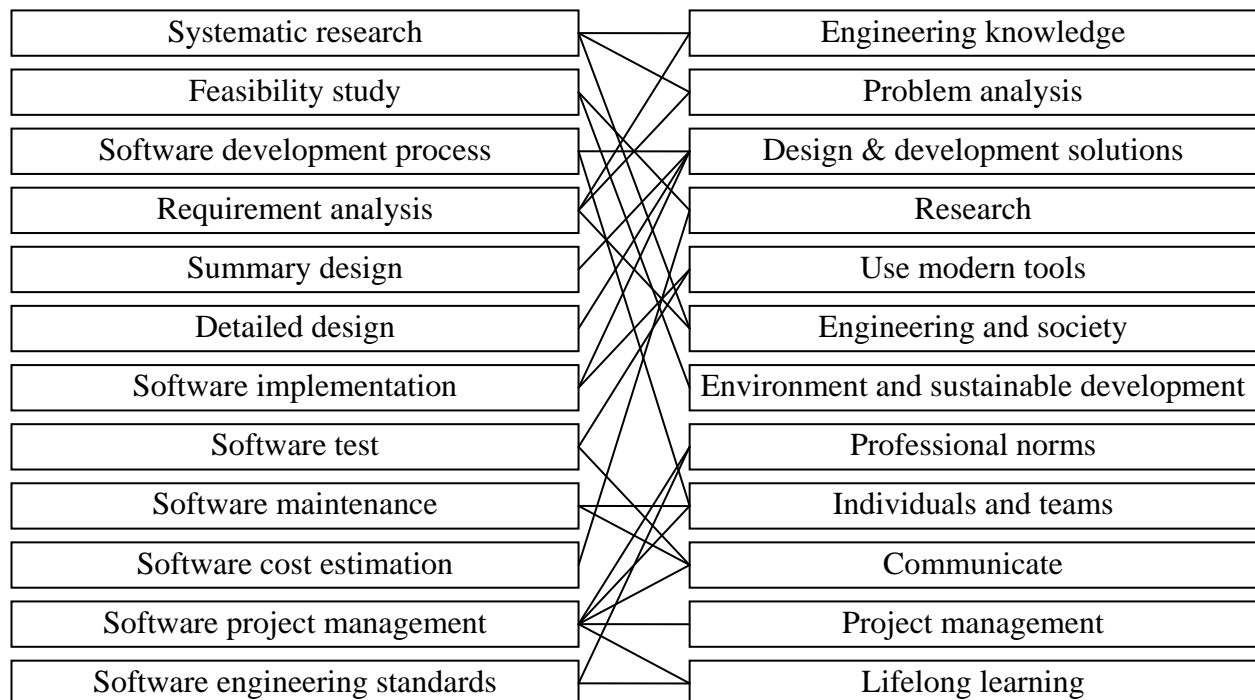
Systematic research	Engineering knowledge
Feasibility study	Problem analysis
Software development process	Design & development solutions
Requirement analysis	Research
Summary design	Use modern tools
Detailed design	Engineering and society
Software implementation	Environment and sustainable development
Software test	Professional norms
Software maintenance	Individuals and teams
Software cost estimation	Communicate
Software project management	Project management
Software engineering standards	Lifelong learning

Fig. 1. Corresponding relationship between engineering accreditation standard
and software engineering course content

3. Curriculum Reform Scheme of Software Engineering under the Background of Engineering Accreditation

According to the correspondence between engineering accreditation standards and software engineering course content, combined with the author's years of software engineering course teaching experience, the software engineering curriculum reform plan under the background of engineering accreditation proposed in this paper is as follows:

(1) Reconstructing the practical teaching system of software engineering course from the perspective of engineering accreditation. Practice teaching cannot only impart knowledge, verification theory and training skills; but also intuitive, practical, comprehensive, design and innovative compared to theoretical teaching. The professional accreditation of engineering education pays more attention to the cultivation of students' engineering practice ability, and has carried out related exploration and research at home and abroad. China's colleges and universities are also actively exploring the reform of engineering education practice teaching. Although some achievements have been made, there are also many problems, including: the fact that practical education is free from the core objectives of the project, the content and objectives of the practice are not matched, the characteristics of running schools are not clear, and the implementation methods are Obsolete, lack of practical experience in the engineering of teachers. To carry out the software engineering curriculum reform under the background of engineering accreditation, it is necessary to reconstruct the practical teaching system and focus on cultivating students' ability to solve complex engineering problems. Emphasis is placed on cultivating and understanding the basic knowledge, comprehensive quality and professional skills of complex engineering problems, and will develop the software ability of students to solve complex engineering problems in complex engineering activities throughout the entire software engineering practice teaching. Teachers should build a multi-level practical teaching system consisting of basic experiments, professional internships, open engineering training and scientific research quality training. Teachers also need to strengthen students' practical ability through various means, integrate theory into practice, consolidate theory in practice, and further improve teaching quality and teaching effects.

(2) The concept of continuous improvement runs through the entire process of engineering education accreditation. Engineering accreditation is both a process and a conclusion. On the one hand, it promotes the renewal of educational concepts, the improvement of the teaching system, and the improvement of teaching quality. On the one hand, it summarizes and judges the quality of teaching in the past. Professional accreditation places special emphasis on continuous improvement mechanisms and is an important opportunity to improve the personnel training system. The concept of continuous improvement is guided by results orientation, centered on student development, and runs through the training objectives, graduation requirements, curriculum system, teaching staff and support conditions, as shown in Fig. 2. In the specific implementation process, we must pay attention to two aspects: The first is the mechanism for continuous improvement. We must establish a closed-loop monitoring and guarantee system for teaching quality at both the school and the college level, formulate a series of management rules and regulations, organize, direct, control, supervise and evaluate the whole process of teaching, and ensure that the closed-loop monitoring and guarantee system can be coordinated and operated from the system. The second is the measure of continuous improvement. On the basis of the teaching quality tracking feedback and evaluation of each teaching link, we will realize the monitoring, management, evaluation, feedback and improvement of all aspects of the professional teaching process, continuously improve the quality of professional teaching, ensure the high quality of all aspects of teaching activities, and improve the satisfaction of student training goals.
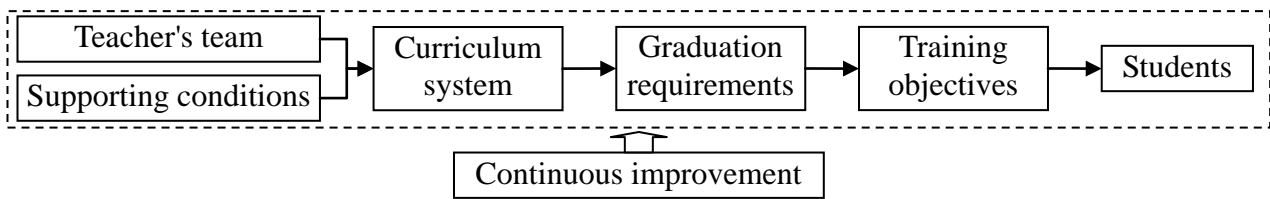
Fig. 2. The links of continuous improvement

(3) Case-driven teaching methods to help curriculum reform. This teaching method uses the case as the basic teaching material, and under the guidance of the teacher, organizes students to analyze, discuss and investigate cases. In order to enable students to better understand the relevant concepts in software engineering, the case-driven teaching method divides the development process of the entire software project into seven stages: feasibility study, needs analysis, summary design, detailed design, software implementation, and software testing and software maintenance. In order to better teach the development methods, processes and tools at each stage, the teacher selects the complete software project case throughout the teaching process, allowing students to better understand the software project development process, and deeply understand and use the methods and tools in software development. In order to cultivate the normative nature of software project development, teachers provide development documents for selected cases, and introduce the writing methods of software project development documents through specific examples to cultivate students' ability to read and write documents. The case-driven teaching method model of the software engineering course is shown in Fig. 3.
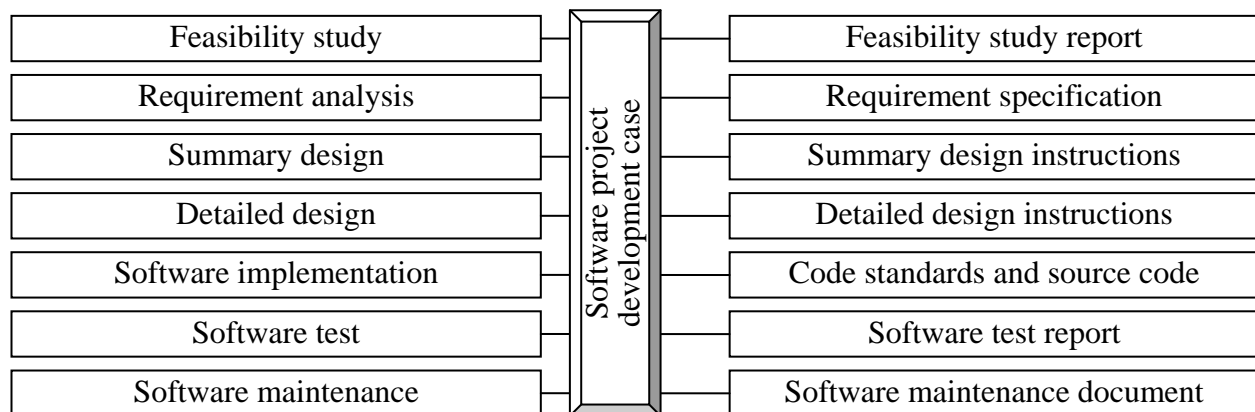

Fig. 3. Case-driven teaching method model of software engineering

(4) Engineering accreditation requires a student-centered teaching model. The traditional indoctrinating teaching mode overemphasizes the leading role of teachers. Students are only passively accepted, and it is difficult to mobilize the enthusiasm and initiative of students. Introducing engineering accreditation, we must change from the concept, let students take the initiative to participate in the study, give full play to the students' enthusiasm and subjectivity, and mobilize the students' internal drive. This emphasizes the close integration between the class and the extracurricular. Engineering certification emphasizes student ability development, active learning ability, practical ability, analytical problem ability, problem solving ability, team communication and cooperation ability. The foothold is student-centered. The school constantly improves the learning resources and platform to provide students with a good atmosphere, fully guide and explore the active learning potential of students. The school should establish a corresponding quality evaluation system, strictly follow the professional graduation requirements under the engineering accreditation to graduate students, and truly cultivate the software development talents required by the enterprise. Schools need to establish a scientific and rational management system, strengthen students' study guidance, career guidance and psychological counseling through various channels, improve students' comprehensive quality of software engineering, and meet the needs of employers as soon as possible.

(5) Promote the construction of software engineering course group with engineering accreditation. In the whole software engineering professional training system, the software engineering course is a basic compulsory course. Through theoretical and experimental teaching, supplemented by software engineering course design, students can use the knowledge they have learned to systematically learn and practice develop engineering software. It is precisely because of the basic role and general characteristics of this course that it can promote the construction of follow-up professional courses and professional elective courses, presenting the curriculum reform trend from basic to improvement, from summary to specific, from point to line and line-to-line. The software engineering professional course group system is mainly divided into four levels and multiple modules, such as basic compulsory, comprehensive compulsory, improved elective and innovative design, as shown in Fig. 4.
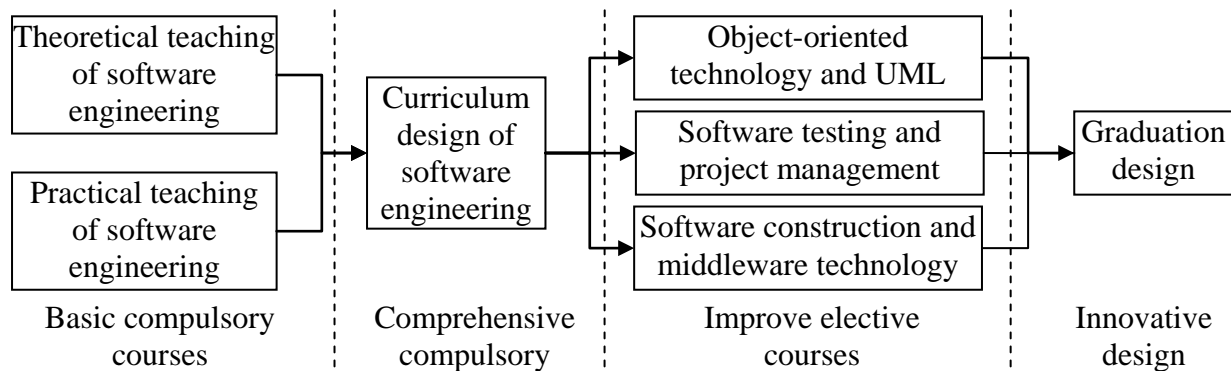

Fig. 4. System structure of software engineering course group

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