

Exploration on School-Enterprise Integration Teaching of Software Project Management for Engineering Education Accreditation

Zhimin Han*

School of Information and Control, Shenyang Institute of Technology, Shenyang, China

hanzhiminjiayou@163.com

**Corresponding author*

Keywords: Engineering education professional accreditation, Mixed Teaching, Project Management, Curriculum Reform

Abstract: Engineering education accreditation is an important measure of higher education quality certification to ensure that graduates can meet the requirements of the industry. According to the characteristics of engineering education certification, combined with the talent training orientation and requirements of the school, this paper explores a teaching reform of software project management facing engineering education certification and combining with the actual situation of enterprises, aiming at a series of problems existing in the existing software project management, combined with the situation of colleges and majors, On the basis of mastering the main methods and skills of software project management, students can fully integrate with enterprise standards and requirements, improve students' practical ability and improve students' comprehensive literacy.

1. Introduction

Since China's accession to the Washington Agreement, many colleges and universities across the country have carried out multi-stage engineering education accreditation of Engineering Education (hereinafter referred to as engineering accreditation). Engineering accreditation is to investigate the external quality evaluation process of colleges and universities or majors in detail in order to ensure and improve the quality of higher education. It is the certification of specific majors or specialized schools of a school, the basic guarantee of the scope and quality of career preparation, and the training objectives, quality (graduation requirements), teaching staff, curriculum, experimental equipment, teaching management Comprehensive qualification evaluation of various teaching documents and original materials.

The university has also been promoting accreditation to deepen teaching reform and fundamentally improve the quality of education and teaching. Before and after the University, it has sent a number of teachers to study advanced education methods in well-known British universities,

and combined the cutting-edge advanced education and teaching ideas with the talent training orientation of the University's applied universities to further promote education and teaching. In the supplementary document of the opinions of Shenyang Institute of technology on the principle of formulating undergraduate professional talent training program , student-centered, achievement oriented and continuous improvement ", that is, to construct" output oriented " .

One of the key links in the implementation of the concept of engineering certification: demand orientation. The training objectives fit the school running orientation and social reality. When establishing the training objectives, they not only combine their own school running orientation and development history, but also fully communicate with enterprises, teachers, alumni and experts, and carry out multi-party research guided by the needs of society and students, so as to make the training objectives clearly point to the expected learning result.

The second key link in the implementation of the concept of engineering certification highlights the practicality of the teaching process. In order to help students adapt to their future life as soon as possible, obtain the knowledge and ability needed for today's social development and challenges, and form their own unique ability structure. According to the requirements, diversified practical projects should be added to all aspects of education and teaching, so that students can be placed in a complete process environment, Gain self professional knowledge and relevant basic abilities through exercise. Develop challenging gradient standards in practical projects to enable every student to have equal opportunities for success. Through continuous successful experience, encourage students to use team strength to deeply learn in complex tasks and obtain higher-level abilities; on the other hand, ensure that practical teaching conforms to the reality of each student In order to carry out personalized characteristic teaching, teachers' teaching should be based on a full understanding and research of students, accurately grasp each student's personality characteristics, knowledge and experience and growth track, so as to formulate a targeted and flexible teaching plan, and ensure that each student has the opportunity to fully present their learning achievements in terms of time and resources.

Under the concept of engineering certification, the university has built a "five in one" new mode of school enterprise cooperation, and implemented the "Teaching Steering Committee" - "off campus practice base" - "order class and title class" - "school enterprise co construction of secondary college" - "school enterprise alliance" Five in one new mode of school enterprise cooperation. At the same time, a sound mechanism is also the premise for the sustainable and benign development of school enterprise cooperation. The university has formulated a new mechanism for school enterprise cooperation of "six Communists", and carried out all-round school enterprise cooperation, namely "six Communists" of "joint management", "joint system", "joint education", "co construction", "joint research" and "sharing" In order to better play the role of deep integration of school enterprise cooperation, teachers should strengthen "coeducation" in curriculum construction Mode, fully mobilize enterprise resources, regularly invite enterprise senior managers and senior engineers into school classes, teach students, and hire them as practice instructors to realize collaborative education. Students also enter the front line of production, construction and management, participate in enterprise management under the guidance of enterprise engineers and senior managers, and constantly strengthen the training of students' practical ability Raise.

In the specific implementation process, the software engineering specialty has strengthened the exploration and co construction of practice and training base, jointly formulated talent training plan, jointly formulated curriculum system, jointly implemented training project and jointly reviewed syllabus, and gradually formed a talent training mode of co construction, co management and co education. The specialty is oriented by the needs of enterprises, highlights the practicality of

teaching process and aims at enterprises. The practical ability that is really needed, carry out curriculum construction and curriculum reform, deepen the integration of industry and education, realize the connection between teaching process and production process, teaching standards and enterprise standards, and implement the concept of engineering certification in the curriculum and classroom.

2. Course Teaching Status

Software project management is a professional backbone course and core competence course of software engineering specialty. Through the study of the course, students are trained to apply software project management technology to the development process of software system, combine professional knowledge with actual project management technology, and lay a solid foundation for engaging in the development, application and maintenance of computer software in the future. In the third grade, the students learned database development and programming language before. Most of the students' thinking is still in the development stage, their identity and position are still in the development perspective, they are still confused in the process of changing from developer to manager, they still do not have a deep understanding of some management ideas and management technologies, their application is not flexible, and the way to deal with problems in the project is still unclear. From the perspective of a development engineer. At this time, teachers need to understand the specific reasons, guide students to change their roles, and comprehensively carry out project management from the perspective of managers and the overall situation. Only by constantly changing the teaching methods and methods of the course, can the teaching process meet the individual needs of students, achieve the course objectives, support the graduation requirements, and finally cultivate students who meet the social needs. Application-oriented talents who will meet the demand.

Judging from the implementation of the existing teaching process, there are two problems in this teaching method of simulating projects and implementing them all the time:

First, for the implementation scenario of specific technologies and skills, students consider a single factor. Because it is a virtual project, the complexity and change degree are low, and the management of customers is relatively simple.

Second, the evaluation angle is thin, the evaluation method is only teacher evaluation and student mutual evaluation, and there is not too much enterprise participation, and the evaluation results are one-sided to a certain extent.

Third, as managers, students do not understand the management process of funding and participation required by project managers or implementation personnel in practical work, and the use of different technologies is still not flexible enough to draw inferences from one example.

In view of the above two problems, based on the existing teaching and the idea of engineering certification, it is proposed to further promote the joint education of schools and enterprises, introduce real enterprise projects of school enterprise cooperation, and carry out reverse design and positive implementation guided by market demand, which is the key to the teaching reform of this course.

The teaching reform of the course is to build the curriculum system according to the standards of professional certification, adopt the training mode of joint education between schools and enterprises, fully investigate the needs of enterprises, select real projects suitable for students, and divide different practical problems in the project into different chapters, so as to organically integrate each basic theory with the practical problems encountered in the project. For the practical

problems in each chapter, the corresponding countermeasures are given in the closing course, so that students can find the gap between their own solutions and the processing strategies in the real project, improve the solution ability of the real project, and finally make students feel immersive.

In order to deepen the curriculum reform and achieve better practical results, teachers should go out of school and enter project management posts such as enterprises and companies, so as to explore the actual completion of project management technology. Secondly, after practical research, teachers should improve the case content of classroom teaching and integrate the excellent technical means and unexpected problems in the existing cutting-edge real projects. Questions are introduced into the classroom to restore the real situation of the project, which requires teachers to "be both the classroom commander and the front-line manager", and better guide the real projects in the course through training and improvement in the real enterprise.

The implementation of the teaching reform of this course can enable students to improve their practical ability through practical exercises on the basis of mastering the theory of software project management. At the same time, it also plays a good role in promoting the series of courses of project management. The series of courses of project management can also adopt the practical teaching mode to form a mutually promoting and virtuous circle with this course, so that Professional courses are more practical and systematic.

3. Solution method

According to the requirements of engineering certification, improve students' practical ability and better complete the training objectives and graduation requirements. The curriculum reform focuses on deepening the joint education between schools and enterprises, and adopts "double introduction and four co construction" In terms of the introduction and actual operation of real projects in enterprises, it should be able to better serve the output orientation, deepen the joint education mechanism between schools and enterprises, introduce the working concept and real projects in enterprises into the classroom, add the evaluation, review and defense standards of real projects to the assessment and evaluation standards of courses, and manage them according to the real projects of enterprises. The whole process of teaching shall be decomposed, teaching drills shall be arranged, and the teaching process shall be designed according to the promotion process of the real project to realize "reality" Teaching. For example, the formulation of project charter, budgeting, design of work breakdown structure, software measurement, etc. can make students learn this course like entering the project practice, but also greatly enhance students' interest in learning; according to different learning effects of different students, there are differences in the arrangement and selection of teaching contents, which can not be "one size fits all and one standard" Carry out teaching, design different teaching tracks according to the peaks and expectations of different students, better complete the graduation requirements and improve the achievement of the course.

At present, there are some problems in software project management teaching: there are a large number of models and algorithms in the course, which are difficult for students to understand; the projects introduced by teachers into the course are virtual projects, students' learning interest can not be completely stimulated, and the learning effect is not ideal; the whole process of project management only involves teachers and students, without the participation of real enterprise personnel; from the perspective of participants in classroom evaluation, There are only teacher-student evaluation and student evaluation, and the evaluation role is less; there is a gap between the evaluation system of curriculum assessment and the assessment link and defense link of enterprise real projects, and the sense of authenticity is insufficient, resulting in students' lack of

deep understanding of the difficulties in obtaining project needs and large product changes in real projects after completing the course.

To sum up, according to the core idea of engineering certification and under the mechanism of further promoting joint education between schools and enterprises, the software project management course deeply studies the connotation of engineering certification, forming the reform strategy of "double introduction and four constructions".

3.1 Double Introduction

The introduction of enterprise engineers and enterprise real projects, the introduction of enterprise engineers to participate in the whole process of curriculum construction, and the introduction of enterprise completed real projects as the implementation of the project from beginning to end. Clarify students' learning achievements through revising the teaching objectives of chapters; help students achieve learning achievements through teaching design and teaching implementation; understand students' lack of learning through teaching evaluation The degree of achievement; ensure the continuous improvement of students' learning achievements through continuous improvement mechanism.

3.2 Cooperation

Project Cooperation, before the course, teachers participate in the project practice of enterprises, introduce real projects used in enterprises, and discuss, select and determine real projects with the engineers jointly built by schools and enterprises. For the determined projects, refine the teaching process, and design the project splitting methods and standards for different concerns and emphases in the ten fields of project management.

Courseware Cooperation, after the project is divided into specific chapters, teachers need to formulate curriculum courseware according to the project requirements. Courseware is an important means and basis for the teaching process. The sequence of curriculum design, the statement process of problems and tasks directly affect the teaching effect. In the process of courseware co construction, teachers widely absorb the practical experience of enterprise engineers and adjust teaching according to the teaching law learning process; the courseware can effectively guide practical teaching.

Assessment Cooperation, assessment is an important baton for teaching. The accuracy and scientificity of assessment standard setting can effectively improve the level and effectiveness of course construction. Software project management course is divided into process assessment and course completion assessment. In the practical teaching link, enterprise engineers should participate in the construction, improvement and review process of course evaluation standards to provide enterprise support for course evaluation According to the real requirements, teachers set up according to students' characteristics and learning trajectory to make the assessment achieve the expected effect.

Training Cooperation, in the course construction, systematic and systematic extracurricular training is designed with reference to the training scheme of enterprise managers and according to the specific pre job training scheme of project managers in enterprises. This course fully investigates the induction training, pre job training and business promotion training plans of project managers, and adopts lectures, series of training courses and courses according to relevant requirements and contents Carry out the second classroom teaching and complete the goal of joint construction of school enterprise training.

3.3 Process

The course system, course teaching and course assessment all support the graduation requirements. Therefore, this project is carried out from the following aspects:

(1) Clarify the achievement degree objectives. According to the requirements of engineering certification, the achievement of each student's graduation requirements is the goal of the course, which is both the starting point and the foothold. The course objectives closely follow the graduation requirements and serve the achievement degree of the course graduation requirements. The graduation requirements of the course are determined. According to the course objectives, the core practical ability required in the real project of the enterprise is fully considered to improve the course Process design.

(2) Optimize the curriculum system design. Further refine and optimize the curriculum design according to the curriculum achievement requirements and curriculum objectives, use real projects to implement the always implemented curriculum projects, introduce the problems, changes, uncertainties and other factors existing and emerging in the real projects, and disperse the relevant knowledge, theory and literacy required to solve the problems into specific chapters Through the study of chapters, gradually draw the skill trend map, skill map and practical map of project management, so as to provide real support and strong guarantee for the final achievement of the course.

(3) Strengthen personalized teaching. The main idea of engineering certification is that each student's learning trajectory is different. According to the objectives, foundation and situation of different students, formulate different teaching plans and provide different teaching support. Eliminate the previous "normalization" Objective: the goal of all students to complete the curriculum is to train the project manager, which should be guided differently in the curriculum according to the students' ultimate employment direction and goal. The curriculum formulates the personalized evaluation grade according to the individual differences of each student, and evaluates it in time, so as to accurately grasp the students' learning status and correct the teaching in time.

(4) Improve the evaluation matrix. According to the idea of engineering certification standard, deeply integrate the school enterprise coeducation mechanism, introduce the evaluation content, qualification evaluation process and model judgment system requirements of enterprise projects, invite enterprise engineers to participate in the formulation of process evaluation standards, experimental tasks and experimental evaluation standards of the course, and introduce the defense list of the maturity model of the actual project according to the defense link of the course, The whole process of project management is connected with the whole process of enterprise software maturity model construction and evaluation, the chapter content is connected with the main problem modules in the enterprise, and the teaching design and implementation process are improved.

(5) Deepen the awareness of CO education. According to the mechanism of joint education between schools and enterprises, this course conducts in-depth research in four aspects: Project Co construction, courseware co construction, evaluation standard co construction and students' practical training co construction. According to different students' expectations and learning objectives, it formulates a multi angle and multi collaborative curriculum management mode to serve students with the results of joint construction between schools and enterprises, So that each student can complete the learning objectives from primary to advanced and harvest their own peak achievements.

According to the idea of engineering certification, the professional talent training goal is the completion of students five years after graduation, and the graduation requirement is "professional

and professional achievements that can be achieved five years after graduation", while the graduation requirement is a description of "knowledge, skills and literacy that students should master when they graduate", and the relationship between graduation requirements and courses is shown in the figure 1:

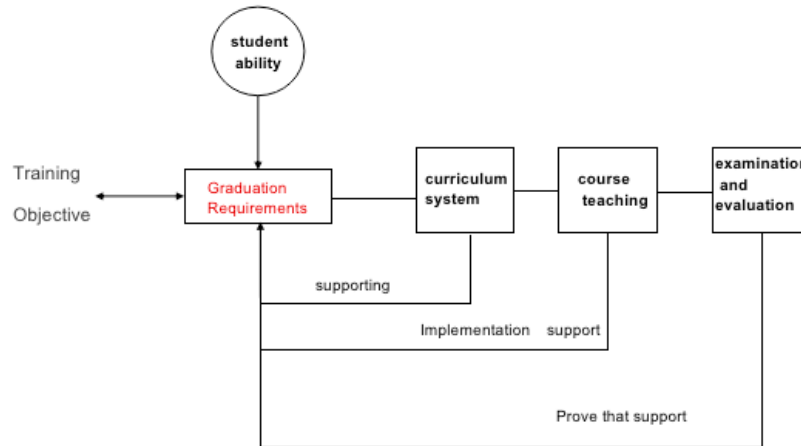


Figure 1: Relationship between graduation requirements and courses

Software project management is designed and implemented according to the ten process areas and the whole cycle of project management. Teachers introduce real cases, give the assumptions and limitations of project Party A, and let everyone enter the actual state; According to the employment direction of different students, determine their own roles in the group roles and complete different course tasks respectively; Through the practice of real projects, students can improve their practical ability in their respective roles, turn the classroom into a project site, turn the self-study room into an office, and complete their work requirements in different roles and positioning; After the completion of each stage of the course, the students will be evaluated according to the evaluation method revised with the participation of enterprise engineers. At the same time, the practical solutions and steps of real projects will be provided for students, so that students can find the difference between idealization and practice, improve students' practical ability, change from "I want to manage" to "I want to manage", and effectively improve students' enthusiasm and creativity; According to the progress of the project and the expected problems, arrange relevant training or lectures, train students through case sharing and failure test, provide students with more ideas, directions and solutions, and assist students to complete tasks through training.

In the course assessment, the enterprise's engineering practice certification standard and software maturity model are introduced, and the multi-dimensional and multi-faceted assessment form is strengthened according to the idea of engineering certification. This course is always implemented by practical projects and improves students' practical ability through multifaceted and multi-channel teaching means. In the teaching process of the ten major fields of the project, detailed assessment rules and scoring tables are formulated according to the real problems and solutions of the actual project; At the end of the course, the defense process of software maturity model is introduced. Through the design of serial problems, the students' ability to solve practical problems and their ability to respond to the comprehensive situation are comprehensively investigated.

Based on the standard of engineering certification, this course adopts the mode of "double introduction and four co construction" to deepen the curriculum reform, improve the practical

teaching system of the course and improve students' practical ability by deepening the integration of industry and education. Curriculum reform should be carried out in the setting of teaching objectives, the control of teaching design and the diversity of teaching means. The real projects and project materials used in this course can also be widely used in other courses to enable students to complete learning tasks in familiar real projects, improve learning interest, stimulate learning potential and effectively improve students' practical ability.

4. Conclusions

Take the engineering certification standard as the carrier, deeply integrate industry and education, realize the goal of joint education between schools and enterprises through the participation of enterprise engineers, carry out in-depth curriculum reform through the selection, screening and confirmation of enterprise real projects, inspire students with real projects, make students have practical experience and feelings, stimulate students' interest in learning, and improve students' ability to analyze problems Ability to solve and summarize problems, and improve students' practical ability.

Through the four modules of Project Co construction, courseware co construction, assessment standard co construction and training co construction, the real requirements and standards of enterprises are transferred to the classroom, so as to achieve the goal of docking teaching process and production process, classroom standards and enterprise standards, so as to enable students to quickly change their thinking, change from development thinking to management thinking, and improve their ability of comprehensive management. As a result of this teaching reform, each student can achieve self-improvement in the process, complete the learning track, and realize the engineering certification idea of reverse design and forward implementation of curriculum construction.

References

- [1] Zhu Fei. *Experimental Teaching exploration of Software Project Management for Engineering Education specialty certification* [J]. *Software*, 2018, 33 (12): 6, 187-190.
- [2] Li Yinglong. *Analysis on donation model of "software project Management" enterprise under the background of engineering certification* [J]. *Education and Teaching Forum*, 2020(01): 313-314.
- [3] Qin Huaibin, Dai Jianguo group *Discussion Teaching of Software Project Management* [J]. *Education and Teaching Forum*, 2018, (22):183-184.
- [4] Yang Gang. *Reform of English Curriculum for Automation Majors under the Background of Engineering Education Certification* [J]. *Education and Teaching Forum*, 2018, (52):97-98.
- [5] Yang Boxiong, Yu Ying. *Online teaching research and interactive Classroom design based on OBE Education Concept* [J]. *Modern Computers*, 2020 (27) : 68-71.
- [6] Qin Huaibin, Dai Jianguo, *Group Discussion Teaching of Software Project Management* [J]. *Education and Teaching Forum*, 2018, (22):183-184.