Reinforcing Practice Teaching of Software Engineering for Fostering the Creative Talent

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***Abstract*—Software Engineering offers vast variety of methods and tools for improving the quality of software development and possesses comprehensive and highly practical characters. Traditional teaching method does not work well for Software Engineerining course in the third colleges. With further researching on teaching practice of Software Engineering course, this paper presents four measures to strength practice teaching, i.e., revising teaching syllabus, case study based on small project, increasing practice time and strengthening course design ,and inspiring Students' interest and improving teachers' ability. Through experiments in recent five years, these approaches can make student comprehend and master theories of Software Engineering better, enhance their creative spirits and practice ability, promote their competitiveness of employment, and improve teaching effect and teaching quality.**

Keywords—Software Engineering; practice teaching; case study; software talent; quality cultivation

I. INTRODUCTION

Software Engineering (SE) is an engineering discipline that embraces all aspects of software production from the early stages of system specification to maintaining the system after it has gone into use [1].Hence, SE course possesses highly practice and comprehensive features, it contains the core principle of software construction and maintenance, such as requirements analysis and design, development, validation and verification, evolution, and management. [2]

Nowadays, SE course is widely spread in almost all computer science curricular. The aims of SE course are to make students master essential skills and theories for developing large-scale software system. Due to this curriculum has many abstract theories, and course practice often is neglected in teaching processing, many students feel that the contents of SE course is abstract and boring, and not easy to understand. In the teaching process, how to organize practice teaching to promote theoretical learning, strengthen practical skills and improve students' comprehensive quality, has extremely vital significance. According to the actual situation of third college's students who foundation is not high, how to improve teaching effect and cultivate software professional who can meet the needs of industry, is an urgent teaching task.

II. BACKGROUND

Teaching SE has many difficulty because it involves a wide range of contents including concepts, principles, techniques, methodologies, tools, management and process, so it is difficult for students to master so much knowledge only in one semester.Generally,there is a gap between learning in schools and the need of current software industry. A great portion of employers complain about the level of readiness of university graduates for working in this industry. They are usually unsatisfied with lack of graduate's knowledge and expertise in some aspects such as requirement engineering, team working, testing, and measuring [3]. Meanwhile, teachers must have rich hands-on experiences of software development to fulfill teaching of SE and guidance of practice. In addition, practice is also not easy for students. If they want to develop a software project completely by practice, they need to have broad knowledge except SE, such as Database, UML, a programming language and design pattern.

The current approach of conducting SE course, which usually adopts traditional lecture-based teaching, seems to be primarily theoretical and unidirectional. The problem with classroom lectures is that the learning process becomes dry and less interactive [2].Usually, practice is not paid attention to by

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teachers and students. Even some leaders and teachers take SE course as a theoretical course and believe it is not need to practice, so that most students know less about software development in the end of the course, let alone how to conduct the project management, risk management, software quality management, software configuration management and software process management, etc. According to investigation, many teachers are not willing to teach SE course comparing with The Foundation of Computer, Programming Language Courses, etc., because it is often considered to be thankless. To cultivate qualified SE talents, SE teaching reform must be carried out and the practice teaching must be strengthen. Otherwise, students easily lost interest in learning of SE course.

In recent years, many teachers and experts have done some meaningful explorations and research for teaching mode and teaching method of SE course. Case study method has been widely used in teaching of SE course(Razali, R & Chitsaz,M,2010[2] ; Jianmin Zhang&Jian Li,2010[4] ; Jianguo Chen,et.al,2010 [5] ; Chunting Yang&Yang Liu,2010 [6] ; Zhen Li,et.al. ,2010 [7] ; Yong Cai&Qing fang Li,2007 [8] ; Dong ling Shi&Ying qiu Li ,2007 [9] ; Bao jun Tian ,2007 [10]); Experiment teaching also has been researched and applied in SE teaching(Xin Peng,et al.,2007）.However, there are great difference among universities in teaching conditions, teachers' ability, students' foundation,etc.,teaching reform of SE curriculum need to consider the actual conditions of each schools, especially for the third colleges.

III. METHODOLOGY

Through survey and years of teaching practice, we know that students generally believe SE course is very important and hope to learn SE by actual project case under the guidance of teacher or engineer who has hands-on experiences of software development. Actual case uses real data in the context of grappling with an open-ended problem. It makes the course more relevant and engaging, and can enhance students' skills in analysis and critical thinking [4]. Therefore, we decide to adopt case study based on small project because large scale project is not suitable for classroom teaching. To enhance practice teaching of SE course and improve teaching quality, under the support of leaders and teachers of school we adopt all measures are shown in Fig. 1.

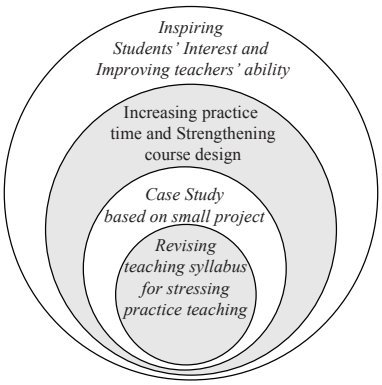

Figure 1 our practice teaching measures

A. Revising teaching syllabus for stressing practice teaching

The aims of SE course are to make students aware that planning, analysis, design, implementation and support are essential in actual project and to introduce basic principles and processes, which are widely used in industry, to students. It is true that merely classes cannot truly make students master so many contents of SE.Hence, practice teaching must be stressed. Nevertheless, classes are essential and could play an important role in the overall course [4].

To foster qualified SE talents who can meet industry requirement, we have revised teaching syllabus of SE course and stressed practice teaching in recent five years. According to the actual situation of the third college, we treat the knowledge of software development process as the main content of SE course, and put focus on the structural method and object-oriented method. The knowledge of project management is blended into practice by self-learning of students under the guidance of teachers. To promote the training of comprehensive qualities of students, the time of practice is increased and course design is emphasized. Every semester, there are many students who can take part in actual software development of our school. To provide more practical opportunities, many teachers also actively find suitable projects in society for practice of students.

B. Case Study based on small project

Case study has been used as an important pedagogical tool in academic fields since many years. A case is a description of the actual project which contains real and relevant data of an organization, its business and people. Students learn to decide based on the available information, by which they analyze

situations, develop alternatives, choose actions, communicate and defend their proposal. As the learning comprises individual preparation and group discussions, cases also help students to think independently, improve their self-confidence and collaborate with others [2].

In case study, we should not adopt large scale projects which are not suit to beginner. Though the scale of project we selected is small, it should run through the whole life cycle of software development. In teaching, we usually chose those projects that have been used or ready to develop. Students are encouraged to develop several variants of the case study, under our professional tutorship. The best variants are subsequently integrated, resulting in a start-up version. In addition, teachers will give students methodological guidance to monitoring of the contents during the process of making a case study. The methodological guidance must be agree with the methods of software and system engineering, and supported by CASE tools throughout the process. By this measure, in recent years students have developed some software system for school, such as Human Resource Assessment System, Assets Management System, Teaching Evaluation System, and many website of departments.

C. Increasing practice time and Strengthening course design

Generally, SE course needs about 56 class hours in a semester. Obviously practice time is not enough and it is unlikely to increase class hours by modifying teaching plan. To increase the time of practice teaching, the following measures are taken:

1）Adjusting Teaching Contents

Some contents like project management mainly depend on self-learning and actual project practice. Generally, students are divided into many small teams. Each team has 5 to 6 members and be in charge of a task of project development. In a team each student chooses a role such as project manager, test engineer and learns related knowledge by group discussion and self-learning under the control of teacher.

2）Strengthening Course Design

Course design is an important teaching chain. Students can solve concrete problems with learned knowledge by course design, and obtain hands-on experiences of software development and management and cooperative spirit. It also expands the opportunities for professional development of them after graduation. To emphasize course design, we increase its proportion in final course test(about 40-50%).Students must choose a project as course design after two week of class beginning, and hand in documents which are required for the process of SE.

3）Building and Opening SE Laboratories.

To provide practice conditions for students, our school has built SE Labs and open to use for students on schedule. It not only provides a practice environment, but also is convenient for team discussion and teacher's guidance. Furthermore, taking the school practices base as the foundation and supporting by the extracurricular enterprise practice base, the sustainable practice teaching activity is carried on.

Through the above measures to strengthen practice, and emphasize students' autonomous learning, not only teachers' workload do not need to add, but also teaching quality and students' innovative abilities can be improved.

D. Inspire Students' Interest and Improving teachers' ability

Teachers should pay more attention to cultivate students' learning interest except managing to improve teaching effect, so students are always encouraged to take part in the development of actual project. For example, when we developed "College Examination-Room Arrangement System", students read many literatures, adopting Genetic Algorithm, designed and developed this software which can meet the requirements of the automation of examination room arrangement. Meanwhile, they also won the prize of 200$, it further enhanced their enthusiasm of learning.

Practice teaching also has higher request to teacher. Firstly, teacher must have a profound understanding to SE theory. Secondly, they had better have certain industry background and hands-on experience. If thus, practice teaching is easily implemented by teacher and is helpful to foster students' interest. Thirdly, teachers need to keep learning new knowledge and technology. Due to new knowledge and technology emerging in endless, SE also keeps on developing forward. For example, traditional Structured Method and Jackson Method are seldom used now, Object-Oriented Method, Design patterns, etc., are very popular. Therefore, teachers must keep learning to master new knowledge and

technology, and should actively participate in the science research and the development of actual projects to accumulate hands-on experience. Of course, school can also recruit excellent SE talent from industry to improve the quality of practice teaching of SE course.

IV. RESULTS AND DISCUSSION

Recent five years, the effect of SE course has been improved evidently by our measures of practice teaching. The comprehensive ability and quality of students obviously promote, especially in the basic skill, team cooperation, data collection, interpersonal communication and project planning aspects. These will make them in an advantage position in the future competition of employment market.

Meanwhile, many application software of our school are developed by students, such as Class Schedule Management System, Human Resource Assessment System, Assets Management System, Teaching Evaluation System and OA System. These software not only accelerate the construction of informationization of school, but also improve office efficiency and can save on office expenses. Meanwhile, students may obtain more practical opportunities.

But, it will have much difficulty in practice aspect for students who want to develop a software system that can meet actual requirements. The meaning of strengthening practice teaching of SE course is mainly that students can be understand and experience the whole process of software development, and make them know how to use all methods and tools in process of development and management, and can exercise various ability, such as cooperation ability, to promote the improvement of their comprehensive quality.

V. CONCLUSION

Practice has proved: strengthening practice teaching and combining the actual situation of the third colleges, can promote the combination of theory and practice, make SE teaching not boring and abstract. This paper discusses four approaches to implement practice teaching of SE course. These methods provide students more opportunities to apply knowledge and many skills that are demanded by the industry.

Also, we are keeping the investigations on practice teaching on SE course and other related courses such as Software Test and Software Project Management. We believe that the experiences on teaching are sharable at least among these courses.

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