To Cultivate Students' Engineering Practice Ability in Software Engineering Teaching

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Abstract. The software engineering is a professional course whose theoretical, practical and engineering are very strong. It aims at cultivating students' practical ability and studies the contents of teaching content, teaching method and examination method of "software engineering" course, In order to meet the needs of the employing units, combined with the teaching practice, some methods which can improve the teaching quality and cultivate the students' engineering practice ability are proposed in this article.

1 Introduction

In recent years, with the rapid development of computer application technology, software development has gradually become the core of information construction. At the same time, the complexity and scale of the software is increasing. It make more and more IT enterprises realize the importance of software development process standardization. It's continuous improvement of standardization degree of development process in domestic software enterprises [1-3]. The requirements of the employing units are becoming more and more highly to standardization degree of development process for this year's graduates. The general reflection of employing unit for computer science major is that students' practical ability is poor [4]. The subjects and contents of the professional courses are difficult to develop simultaneously with the IT and students have no characteristics [5]. The result is that graduates can not find a job, the enterprise can not hire the right computer personnel. Since twentieth century 80 time, domestic colleges and universities have set up a software engineering course [6][7]. But in the actual teaching process, the teaching effect of software engineering is not satisfactory, the pay and harvest of teaching and learning is not proportional, also difficult to achieve the objectives and expected teaching effect of software engineering[8][9]. The author combined with many years of software engineering teaching experience and research, The reform of the teaching method of the course is often carried out, to adjust teaching content, teaching methods and teaching mode, and increase the intensity of practice teaching, improve the teaching quality of software engineering, and meet the requirements of the employer for the engineering practical talents.

In the second section of this paper, author introduces problems in the teaching of traditional software engineering. In the 3rd section, author introduces to improve the teaching method of software engineering and cultivate students' practical. In the fourth section, author introduces diversification of teaching means. Diversified course assessment is introduced in the fifth section. The last section is conclusion.

2 Problems in the Teaching of Traditional Software Engineering

Software engineering is a professional required course that theoretical, practical and engineering is very strong. The traditional teaching mode has a lot of problems in both theory and practice. On the one hand, the current domestic colleges and universities "software engineering" course teaching is still based on classroom teaching. Or their practical experience has lagged behind the advanced

development mode and method of the current enterprise. Because most of the teachers lack the actual project experience, therefore, they are often one-sided emphasis on theoretical teaching. However, the theory teaching materials update delay relative to the emerging new technologies, new methods and new tools. On the other hand, because of the lack of practical project development experience, students can not be a good understanding of the theory of knowledge, do not know where they should learn to use, even if they think that these theories are dull and boring, they lose interest in active research. This leads to students' learning after the course is still difficult to face a complete software project development. There are many problems in the development of software, such as graduates are unable to meet the needs of social applications.

3 Improve Teaching Method of Software Engineering and Cultivate Students' Practical Ability

3.1 Teaching Content with the Times

The development of software engineering discipline has experienced four stages, as shown in Fig. 1. The first stage is the stage of the traditional software engineering, mainly to structured development methods, Jackson method as the representative, development system divided into seven parts. They are the problem definition, feasibility study, demand analysis, outline design, detailed design, coding and testing and operation and maintenance. The second stage is the object oriented software engineering stage, which mainly takes the object as the core, carries on the object model, the dynamic model and the function model design and the object-oriented realization. The third stage is the software process engineering stage, focus on the software process control and management, such as: project plan, cost estimation, quality assurance and software configuration management, etc. The fourth stage is the component engineering stage, which focuses on software reuse and software development method based component.
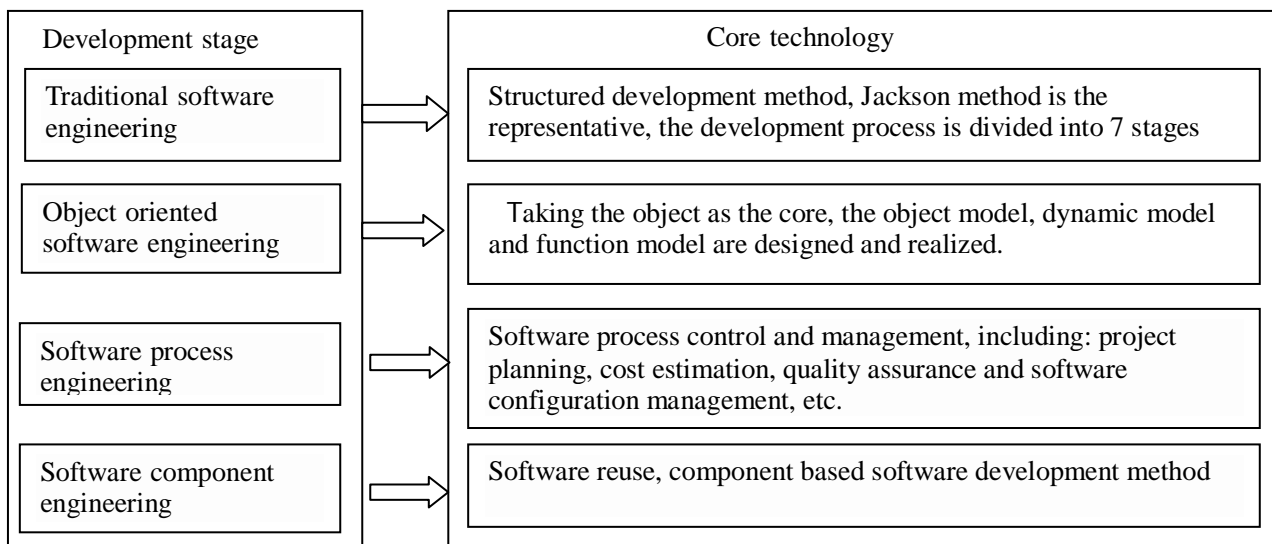
Development stage		Core technology	
Traditional software engineering	→	Structured development method, Jackson method is the representative, the development process is divided into 7 stages	
Object oriented software engineering	→	Taking the object as the core, the object model, dynamic model and function model are designed and realized.	
Software process engineering	→	Software process control and management, including: project planning, cost estimation, quality assurance and software configuration management, etc.	
Software component engineering	→	Software reuse, component based software development method	

Fig. 1. The Development Stage of Software Engineering

In the teaching of software engineering, many schools are still teaching the first stage of knowledge. They have seriously lagged behind the development of technology, teaching content should be with the times. First of all, we should abandon the traditional software engineering as the focus of the teaching of old-fashioned education, emphasis is focused on the software development method and the method based on component. And constantly adjust the teaching content, increasing the UML modeling language, RUP, extreme programming, SOA and other current popular technology and other new technologies. At the same time to ensure that students master the core ideas, and constantly expand their knowledge, improve the structure of knowledge, and enhance the competitiveness of students.

In the selection of teaching materials, most domestic textbooks exist some problems in the contents of the case, the selection of the case and the description of the icon etc. For example, the E_R graph representation method, there are many forms. The introduction of advanced technology in the teaching material is also relatively lack or introduction is superficial. In actual teaching, we can not simply rely on a textbook, But through the integrated a lot of materials especially foreign excellent software engineering materials, learn from each other, timely adjustment of teaching content. Otherwise, the teaching content will be seriously lagging behind the development of technology.

3.2 Flexible and Diverse Teaching Methods

In the course of teaching, we should use a variety of teaching methods, to avoid a single teaching method, so that students have a tired mood, so as to affect the teaching effect. Because of the theoretical, practical and engineering characteristics of the "software engineering" course. It can be integrated with case teaching method, project driven teaching method and heuristic teaching method and so on, as shown in Fig. 2, and can give full play to the advantages of various teaching methods, in order to better improve the students' engineering practice ability.
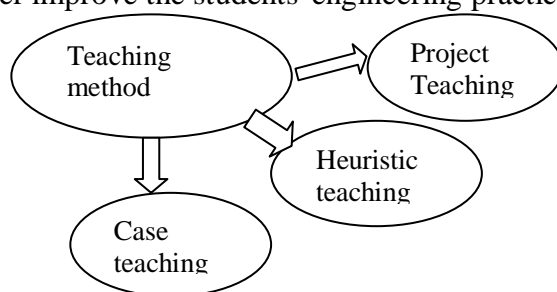

Fig. 2. Teaching Method of Software

1.Using case teaching method, establish the concept of software engineering, mobilize the enthusiasm of students learning.

In teaching, the case teaching throughout the whole process of "software engineering" teaching, In addition to explain the principle and method of software engineering through the case, we must also make students thinking in case analysis. In the classroom, teachers should organize the students to discuss in groups, and to cultivate students' ability of autonomous learning, to encourage students to put forward various problems through case. And guide students to find, read the relevant information and national standards and standards of GB series.

2. Using the project driven teaching method, students participate in the whole process of software engineering development, training engineering practice ability

In the practical teaching of "software engineering", the practical project is the object of practical teaching, integrate knowledge points into the project. The teacher takes a typical project as the basis, the project is decomposed into a task case analysis. Under the guidance of teachers, according to the requirements of the project issued by the teacher, the students complete the relevant task module, and finally put a task module "assemble" into a complete project. In this process, students' learning activities are completed in the process of project development and activities, and can understand and grasp the knowledge and skills in the process of practice.

3. Heuristic teaching method

In the classroom teaching of software engineering, should often use heuristic teaching method, gives the opportunity to students to think independently, as much as possible to avoid cramming method of teaching. Many theories in software engineering can be used in heuristic teaching method. The full participation of students, can be a good way to mobilize the enthusiasm and initiative of students learning, deepen understanding and mastery of knowledge.

3.3 Strengthen Comprehensive Practice Teaching Link

Software engineering is a practical course, which determines the position of practice in teaching. At present, most of the practice of "software engineering" in most colleges and universities is composed of two parts: classroom experiment and course design. But the classroom experiment time is generally less. If the experimental task is too large to be done.

The purpose of this experiment is to deepen the understanding of theoretical knowledge, digestion and application, and to lay a certain foundation for course design.

The course design is student-centered, provides a hands-on for students, and independent practice opportunities. Around the teaching idea, the teaching process of the course design mainly includes the following three steps:

1.Setting goals and requirements.

Let the students understand the importance of integrated course design, the need to complete the task and assessment objectives, and give the specific issues and problems.

2. The students are grouped according to the actual level and situation.

Students have some differences in the knowledge and use of knowledge. Some students have strong ability of analysis and understanding, but the practical ability is poor, but some students have strong practical ability, but the training in writing is less. To solve these problems, in the organization and management, to fully understand the characteristics of the students, the different types of students into a group, For example: in a group, up to 5 people, the reasonable combination and collocation. In this way, in a team, not only has a strong management awareness of students, students with strong programming skills, but also a certain writing ability of students. In the management team, let everyone to try the role of other team members, allowing them to learn from the team. Both they play their own expertise, but also fully develop the ability to develop software.

3. Implementation and guidance.

First, the teacher gives the team member to explain the purpose and significance of the course design, the background of the topic, and the knowledge involved.The majority of students are the first to complete such a large software development problems, the lack of adequate confidence, the teacher needs to help students to help clear the psychological barriers. At the beginning, students do not have a clear thinking and planning for the whole work. Teachers should therefore guide the students to plan according to the project development methods, including time arrangement, task allocation, determine the key, consulting the documents and materials, and so on. In this way, they can think about the problem independently and gradually get rid of the dependence on the teacher. The teacher uses the form of the periodic inspection task progress, the team meeting, the discussion question and so on to pay attention and examine the student's design situation. According to the number and importance of the problems of the students, the teachers do not regularly do some special guidance of software development knowledge, such as software programming specification, interface and database design, software architecture, etc. After the completion of the system, to guide students to write experimental reports on the basis of document specifications. In the process of writing, it is a problem to appear in the process of confusion, unclear, and so on, the teacher to explain the corresponding writing templates and examples to strengthen the students' writing training. Finally, all kinds of documents submitted by the students, teachers use analysis, discussion and other ways to score and assessment.

4 Diversification of Teaching Means

The diversification of teaching process, in the process of modernization teaching not only use the teaching means of blackboard, multimedia, demonstration projects and make full use of the software engineering network course" to extend classroom teaching, students and teachers can on the Internet for communication and answering, resulting in limited hours of teaching into the read during the course of teaching.

5 Diversified Course Assessment

Software engineering is a very practical course. Therefore, the focus of the course examination should not be the theoretical examination results, but should increase the proportion of practical examination (Experiment and course design). For these students who actively participate in the practice and thinking, good performance, teachers should give full recognition and bonus points. In this case, you can fully mobilize the enthusiasm and initiative of the students in the class, so as to improve the students to use the knowledge to analyze problems and problem-solving ability, cultivate their sense of innovation. In the written examination questions, comprehensive and design issues should be accounted for the main part of the examination, At the same time, it can also increase the students' free play, in which the students can explain the personal views, phenomenon analysis and so on. These questions can test the students' understanding and use of the knowledge.

6 Conclusion

The rapid development and wide application of computer technology, it enterprise gradually aware the importance of software development process specification. The degree of standardization of software development process is in the continuous upgrading. The standardization requirements of the development process of the graduates are also getting higher and higher. Employer generally require students to have experience in engineering practice, which makes the teaching of the course are also put forward higher requirements. Therefore, in teaching, teachers should constantly adapt to the new form, reform the teaching content and method, grasp the students' characteristics, explore the effective way of teaching, training students' ability of engineering practice, and improve the quality of teaching.

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References

[1] Xiaolong Zhang, Innovation and Practices of Software Engineering Course for Application Personnel Training[J], Computer Education, 2010,113(5): 10-13.

[2] Huiqiang Lin, Caixing Liu etc., Research and Practice of the Elicitation Teaching Method of Software Engineering Course[J],Research and Exploration in Laboratory, 2008, 71(5): 112-114 .

[3] Hui Zhao, Wanlong Li etc., The Teaching Mode of Software Engineering Based on Project Driven Case[J], Computer Education, 2012, 10(5): 89-92 .

[4] Jing Liao, Lihua Yue, Reform of Software Engineering Course, Promote Engineering Application Personnel Training[J], Computer Education, 2008, 10: 10-13.

[5] Liping Liao, Hongze Liu etc., Teaching Reform of Software Engineering Course for Application Oriented Personnel Training[J], Computer Education, 2014, 14 (7): 19-21, 40 .

[6] Xiufang Li, Lihua Song etc., Teaching Reform and Practice of Software Engineering for Application Oriented Personnel Training[J],China Electric Power Education, 2012, 5: 37-40.

[7] Jing Du, Ying Li, Yanhong Zhang. Research on the Construction of Software Engineering Course Based on CDIO[J], Modern Computer, 2014, 1: 49-51 .

[8] Bin Luo, Jidong Ge etc., Research and Innovative Practice of Software Engineering Course[J], Computer Education, 2010,10: 9-13.

[9] Zhihua Wang, Jinsheng Kong, The Application Software Talents Training For Enhance Students' Practical Ability[J], Computer Education, 2014, 2: 1-5.