Exploration and Practice of Training Program for Applied Software Engineering Talents

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Abstract. In view of the problems that engineers need to constantly update their knowledge to keep up with the development of the industry encountered in the reform of the training program of applied software engineering, this paper puts forward the general train of thought of the training plan, in order to realize the goal of the combination of professional education and technology industry and market demand. Through the teaching reform of constructing applied curriculum system, enterprise quality management system, application of intelligent information platform and the construction of teachers and other aspects of the training programs to meet the current employment market, social demand and the future of students' growth characteristics.

1 Introduction

With the rapid development of Internet technology and software requirements, the development speed of software engineering is obviously accelerated [1]. At the same time, engaged in the professional engineers need to constantly update knowledge in order to keep up with the development of the industry, which is a major challenge for undergraduate software engineering [2]. At present, China has 1,055 non-“211” universities [3], "orientation line" to key universities, so that a considerable part of these schools are facing the employment rate is low, professional counterparts rate is low, the quality of employment is not high survival dilemma. Local colleges to application-oriented university have been regarded as the starting point to structural adjustment of higher education, the Ministry of education "oriented transformation" of 600 universities. Maybe the school overall transformation is difficult; but the software engineering "transformation" of higher proportion. Software engineering professional training plan to take the student as the center, the courage to break the traditional limitations of the scientific meaning, oriented to improve the competitiveness of students in the job market, the construction of the application oriented curriculum resources system, establishing the teaching staffs, to achieve the overall goal, orientation and pursuit.

2 The Overall Plan of Training Program Diffusion of Innovation Theory

In order to make the training program truly meet the current employment market, social needs and the characteristics of the future growth of the students themselves, a large number of basic research, analysis and statistical work. We plan to develop a software engineering training program in accordance with the steps shown in Fig. 1.

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(1) Refer to the domestic and foreign mature software engineering training programs and ideas, including SE2001[4], SE2004[5], GSWE2009[6], software engineering, Computer Engineering Graduates Association ACM and IEEE requirements, and the foundation of modern fusion pioneer field of computer technology and software engineering of David Parnas view of software talents, refine the training goal of software engineering talents based on the reality of the students.

(2) Investigation of enterprise employment market, analysis of job responsibilities ability demand: according to the Ministry of industry and information statistics, over the past five years (2009-2013 years), the software industry overall stability, rapid growth in software revenue, improve the efficiency and stability of development, market prospects. According to the analysis of job responsibilities and future worries recruit and other major domestic demand for talent recruitment website, knowledge, skills and qualities summed up the employment market, clear training goal.

(3) The students set up training evaluation baseline use IFLYTEK Software Engineer Quality Evaluation System: the evaluation system according to the experience of Xunfei education training education for many years, according to the guidance of Professor of psychology at home and abroad well-known institutions theory and psychology, four reliability optimization. Evaluation results combined with the college entrance examination results form evaluation report, evaluation results and recommendations for curriculum settings and optimization to provide data support.

(4) According to the actual characteristics of the source of the three to adjust the training plan: make reference to numerous domestic and foreign views about the training of software engineering curriculum system and personnel training of software engineering project, but the school will inevitably consider cultural differences and diversity of students, in order to make the training plan of scientific and effective, so in learning advanced I need the theory and analysis of the educational background and the characteristics of students. The characteristics of the source are analyzed from two aspects: one is the analysis on the Sino US high school graduates to distinguish differences, and the United States Chinese special training ideas in software talents; two is the analysis of domestic students and three of the students differences, distinguish the difference between students of colleges and universities of applied research.

After a series of statistics and analysis, from the training objectives, knowledge system, curriculum and educational system, teaching mode, process management and quality evaluation, gradually improve the characteristic and meet the social needs of students and software engineering.

3 Construction of Applied Curriculum System.

3.1 Training objectives and training programs
3.1.1 Professional training objectives and programs of the development process and principles

ADDIE theory and methods, drawing on SE2004[5] and other ideas and methods to develop professional training objectives, as shown in Fig. 2, Fig. 3.

(1) The knowledge and ability of the professional competency related enterprises and their structural analysis.

(2) The knowledge and ability to describe the specific, accurate, and can be assessed and evaluated (to avoid the traditional understanding, understanding and mastery of such words, described in terms of operational language, for example, what can be done).

(3) Practical skills and abilities and project work with clear and specific requirements.
(4) The relevant national or international recognized professional and technical level, professional certification and qualification standards.
(5) School and enterprise experts to prove (completely eliminate the school staff to complete their own school closed door).
(6) The continuous evaluation of feedback and modification mechanism.

![Diagram of Training Objective and Quality Ability]

**Figure 2. Professional training objectives.**

### 3.1.2 Schooling, semester and credits

1. **Schooling and term**
   - College undergraduate four years, every year three semesters, each year before the Spring Festival in September 1st for the first semester (fall semester), after the Spring Festival (the appropriate semester in advance to June 10th) for the second semester (spring semester), from June 11th to July 20th for the third semester (summer semester), according to the lunar calendar every year China and different grade characteristics and other factors can make the appropriate adjustments in the time period.

2. **Credit system and credit requirements**
   - The college has adopted the term credit system in the near future, and it will be fully implemented after the conditions are ripe.
   - Graduation has clear credit requirements for the classification. For example, it includes professional core courses, project courses, practical training courses, business practice, comprehensive quality courses, and the accounting method of credit and the majority of universities in Europe and America.

### 3.1.3 Curriculum system and Curriculum

Follow the following guidelines and ideas:

1. **A systematic project of curriculum and curriculum**. From the basic professional courses, from theory to practice, from knowledge imparting, ability training to quality training and other comprehensive and comprehensive design and develop goals and guidance.

2. **The curriculum system and curriculum should be geared to the needs of the talent market**. There are experts in the relevant enterprises, human resources and the famous university professor to participate in a full understanding of the needs of the market, to avoid the school education and talent market demand disjointed.

3. **The curriculum and the teaching content must be considered together**. Avoid the name of the course, regardless of the content of the course, resulting in the so-called "advanced" course name, which is actually outdated teaching content.

4. **The curriculum and teaching content should be dynamic**, with the changes in the needs of the talent market and technological progress should be constantly adjusted and updated.
(5) Break through the traditional course of balance between, strengthen the focus on curriculum knowledge depth and breadth of knowledge of general courses; for example, the computer specialty will increase the math class, physics course and reduce the depth.

(6) Ability training and quality education should be carried out in all the courses, as shown in Fig. 4.

![Figure 3. Training of knowledge and system ability.](image)

3.1.4 Training model

(1) "Sandwich" training model.

Undergraduate 2.5+1+0.5 model (different professions can be differentiated). 2.5 years ago as the foundation and professional basic theory courses and course assignments, experiments, practice of small projects and practical skills training; the middle 1 years project practice training courses, professional courses, internship and graduation thesis (Design); the last 0.5 years as the graduation thesis (Design) and capstone courses.

(2) Set summer term.

The end of one or two grade 2, 3 for a period of 35-40 days in the summer semester, mainly for training courses, professional skills training, intensive English, culture, management, postgraduate counseling classes, and students have failed in batch and failed to obtain credit course.

(3) Flexible and diverse curriculum teaching and arrangement mode.

Have project courses, training courses, network courses and other types of courses, there are half a semester or even 2 weeks short courses, individual courses due to business part-time teacher, is scheduled on Saturday or Sunday.

3.2 The introduction of enterprise technology and industry standards, the application of modular curriculum system

On the basis of SE2004[5] and a series of software engineering talent training scheme, combined with the mainstream of software enterprises especially the corresponding IFLYTEK mature rank level ability domain knowledge ability tree system, the introduction of enterprise technology standard system, optimize the module of software engineering curriculum. The module of the course system is divided into the basic knowledge ability learning domain, the discipline basic knowledge domain and the specialized basic knowledge domain.
3.3 Application of curriculum resources and enterprise project library construction

Based on the teaching goal of "LBD" teaching idea of and practical ability training[7], establishing rules of curriculum development: from the curriculum research, to basic courses, professional courses, teaching, training and outreach activities such as literacy curriculum resources design detailed specification, all resource developers must develop resources in accordance with the curriculum standard. Each course is set up by the person in charge of the course by the person in charge of the leadership of the development team for curriculum design ideas repeatedly discussed, modified, in strict accordance with the curriculum resources development process. After the end of the development of curriculum resources need to organize relevant experts to review, the review can only be used in the classroom.

4 Intelligent Information Platforms to Achieve Fine Management of Software Engineering Personnel Training Process

To assist the management and quality assessment process evaluation, with the help of new technologies in big data and cloud computing, software engineering, combined with the actual needs of students, the teaching process and the training process of the development of the UniBrain/I-Study intelligent education platform (hereinafter referred to as the "platform"), platform of the "learner centered", "design of student education service" concept the construction of digital campus, is an important application system. The platform around the goal of engineering teaching and personalized development ideas; support knowledge construction and other training methods; providing all kinds of resources and tools, integration of teaching, training and practice process of various types of data; help students autonomous learning and development, provide the basis for the timely adjustment of training programs and student management work.

In this platform, online quality management practice and operation, curriculum evaluation, learning and literacy test data collection and discovery, personalized learning portal (including personalized learning path map function), teaching resources management and sharing, service communication platform, data mining analysis, personnel archives, employment and enterprise recruitment in one, truly accurate personalized full name culture, to provide solid support and service for students.

5 The Construction of Practical Teaching Staff

Talent is the fundamental, software engineering professionals to build a group of skilled, strong combat effectiveness of the double division team, teaching team and instructor team, to provide protection for the application of personnel training.

5.1 Double teachers team building

At least three years of practical project development and management experience, and with different levels of classes, teaching experience. Take the following management methods for the double team:

(1) To adopt the mode of enterprise management, to clear the work standards and responsibilities, the establishment of standardized assessment and incentive mechanism, the use of the teaching process of the third party assessment mechanism for management and teaching effectiveness evaluation.

(2) The implementation of "rotation mechanism". The establishment of Engineering Education Center, and iFLYTEK enterprise platform and other enterprises to carry out cooperation, will put the center of the enterprise project leader responsible for the implementation of teachers, so that teachers can often participate in the enterprise project, follow up the development of new technology, enrich the teaching content; the two is the basis of teaching developed by the research center of teacher learning courses and regular teaching discussion course, improve teaching skills. The two lines cross, so that the lecturer in both skill and teaching, to maintain a good learning momentum.
3 To establish a good teacher and good teaching methods and standards for the development of double teacher rank, and do a good job in the development of the professional career planning.

5.2 Assistant team building

Based on the study of iFLYTEK and local university students resources; teaching assistant system by young students in Vocational College of software engineer and research direction. The teaching assistant team is responsible for the professional course answering and guidance, providing a full range of support for students' learning process. Take the following management methods for the teaching team:

(1) Classes and teaching assistants to achieve at least 1:1 equipped with the proportion of students to support all-weather counseling and answering work.

(2) Assist assistant two modes of answering the implementation of online and offline, responsible, reading and homework exercises to explain the test work necessary according to the students did not understand (Master) knowledge (skill), the implementation of PPT preparation courses seminars.

5.3 Counselor team building

The counselor has a very important influence on the learning motivation and learning state of college students, as well as the final learning effect. Construction of a responsible, highly skilled team of counselors is an integral part of the entire software engineering team building. According to the construction of the software engineering team:

(1) To implement the enterprise management and evaluation mechanism, through the use of standardized assessment system and incentive measures to improve the enthusiasm and initiative of counselors.

(2) Continuously to accumulate experience and practice, improve the professional quality of counselors and serve the students and parents, build a professional and dedicated team of counselors.

(3) To make full use of information technology to improve work efficiency. Such as the use of software service platform to achieve the current class situation and a student's personal dynamic tracking and automatic warning, in view of the existing problems, timely and effective intervention measures to prevent risks. In addition, through the WeChat parent service platform to achieve seamless sharing of information and timely communication with parents, to achieve two-way supervision of school and family. The student service platform portfolio, internship and employment tracking function and the enterprise students recommended, information sharing, service tracking, work performance tracking and other functions, ultimately promote the cultivation of promotion effect.

6 Strengthen Practice, Practice and Practice Base Construction

Adequate practical training and other basic experimental facilities are the basis and necessary conditions for teaching practice. At present, it is necessary to expand the training room and laboratory to meet the needs of the current teaching, learning and future development.

6.1 Establish engineering practice education center

To build a cooperative enterprise with at least 300 square meters, 50 station, room facilities comprehensive enterprise atmosphere engineering education center to software engineering (hereinafter referred to as the center), to serve the students as the center concept, encourage and support students' entrepreneurship, innovation, and enterprise development and try to use a horizontal cooperation. Xunfei enterprise platform provides the introduction of enterprise project and implementation by teachers’ team development. Software R & D team center and gradually establish a team of students and the school of software engineering, quality engineer Xunfei teachers as the main body of the professional and competitive power of market. Engineering practice education center also set up venture capital funds to support students with entrepreneurial projects.

6.2 Establishment of enterprise train training base

Software engineering and IFLYTEK mainstream software enterprise cooperation to build “enterprise train training base” project, provided by the enterprises of senior engineers and enterprise project resources, build business environment, for school students to provide enterprise training
service posts, do the school will be able to complete the new staff training. Eventually participate in train engineering software engineering students through the training after passing the examination can be directly related to the employment of cooperative enterprises.

6.3 Construction practice base
Relying on the rich IFLYTEK partners and industry platform, and many practice bases to establish about 80 in-depth cooperation employment enterprise, established close ties and long-term cooperation with hundreds of high tech enterprises. In IFLYTEK drive, a number of outstanding enterprises will be directly involved in the construction of the employment guidance center, providing authentic enterprise occupation training for students, and early accept corporate internship training, the students to contact the society, social cognition, strengthen the competitiveness of employment platform[8].

6.4 Establish a professional laboratory
In order to meet the needs of software engineering, the professional direction of construction daily practice teaching requirements and practical skills training teaching objectives, to establish professional laboratory grade enterprise software development (development and deployment test environment mainly includes the enterprise private cloud platform and virtual computing environment, common enterprise solutions), embedded system and Internet development (including the professional laboratory the commonly used embedded device development platform, enterprises need networking solutions development platform) and Internet software development laboratories (mainly divided into two parts, cloud computing, Internet and big data platform and application development environment development practice test based on mobile Internet distribution platform, based on the theory of knowledge) to enhance the students understanding and practical skills training.

7 Conclusion
In order to make the software engineering more suitable for social development, personnel training and technology industry and market demand more closely, through a series of statistics and analysis, from the construction of the application oriented curriculum system, enterprise quality management system, intelligent information platform, the construction of the teaching staffs and strengthen practice, training and Practice base construction and other aspects, to develop a set of application software engineering characteristic and meet the social needs of students and professional talent training scheme.

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