

Discussion and Innovation on the Intensive Cultivation Pattern of Software Engineering Talent^{*}

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Abstract The paper focuses on the existing cultivation pattern of software engineering talent in the major National Pilot Colleges of Software, and on the emerging new problems, analyses deeply the disadvantages of the Extensive cultivation pattern. Emphasize particularly on high-level and engineering talent cultivation. Through a series of innovation and attempts, we summarized the intensive talent cultivation of Software College, Shandong University in recent years, and bring forward a talent cultivation pattern based on "Software Workroom", and a cultivating idea that combined theory with practice, technical ability with comprehensive ability.

Key words engineering-type; intensive cultivation; "Software Workroom"

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1 Introduction

National Pilot Colleges of Software play an important role on the cultivation of junior and senior software talent for the information development of our country. Not only on the quantity, but also on the cultivation quality, they should meet the social talent requirements, and provide powerful support to our informationization. The Software Colleges must innovate constantly, sum up experience, analyze problems, improve unceasingly and try new cultivation pattern, transform from quantity satisfaction to have both quality and quantity.

The general cultivation project of National Pilot Colleges of Software prescribed: "The cultivation aim of Engineering Software is to satisfy the demand of national economy informationization construction and development, to meet the need of civil service institutions and businesses for the software engineering talents, and to cultivate high-level practical and comprehensive software engineering technical talent and software engineering management talent. As a qualified software engineering master, to be a high-level software talent, his/her basic capability should reach the level of senior programmer, system analysis and stylist and project manager." Li Pu, the general secretary of the National Colleges of Software Joint Conference, pointed out: "The college education reform has reached a phase to improve its quality... The practicability has already been the cultivation aim of Chinese higher education."

Therefore, in order to cultivate practical talent to

fit the competitive environment, firstly we must change the old traditional and stereotyped training methods, learn the advanced cultivation experience from software developed countries, like India. Take practice, practicality and compound as the teaching tenet. Make the students feel that the software exploitation is not boring, but interesting and exciting. Arouse the students' study interest, turn the passive learning into active, increase the learning efficiency and improve the graduates' innovation thinking fundamentally.

To realize the above goals, the extensive cultivation system cannot inspire students' interests on the software exploitation, and cannot cultivate all kinds of top software talent. Thus, how to reform the existing cultivation pattern and make the cultivation effect to satisfy the social needs are the main points of this lecture.

2 The Current Situation and Problems of Chinese Software Engineering Cultivation

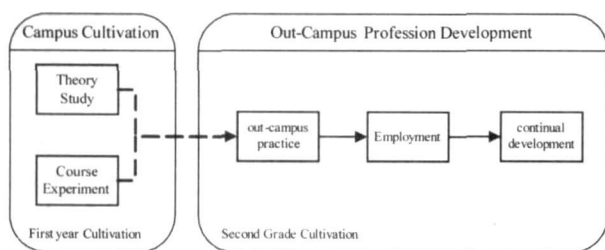
The first 35 National Pilot Colleges of Software were authorized in 2001. After 6 years development, Chinese junior and senior engineering talent cultivation has accumulated a lot of precious experience. For instance, a series of moves, such as "Cultivation aim: high-level engineering-type and internalization", "2-year intensive cultivation pattern", "Emphasis on the out-campus practice" and so on, make the cultivation possess its own distinctive features, and relax talent demand pressure.

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At the same time with the deep quest on cultivation and the continual thought and feedback of students and software industry, the inconsistency between college extensive cultivation and enterprise intensive demand became clear. And it became the most essential discrepancy on the supply and require between colleges and enterprises. In general, the requirements of a company for talent are always concrete. Almost all the companies expect that the freshman can master some kind of exploitation language or some concrete skills, and is able to assume an assignment independently in a short time. However, the key of college cultivation is on the knowledge integrality and talent commonness. So there exists a certain distance on this aspect between college and company.

At present, the major software colleges adopt "two-step" cultivation pattern in the process of engineering master cultivation. That is, for the first grade, only the necessary course study, no clear major, no certain tutor. The practice class mainly adopts course experiments. The students enter the company to practice in the second grade. This extensive cultivation pattern is as follows:



From the above scheme, although one year's out-campus practice lessens the contradiction between cultivation and employment, embody the connection between supply and demand, there still exists a series of problems, which display in the period of practice and extend from the practice. The problems focus on the following:

- 1) The extensive cultivation pattern exists a clear gap between theory and practice.
- 2) The students' technical ability cannot satisfy enterprises' demand and the requirements of practice.
- 3) Without the systematic training, the students' ability on team cooperation, communication, analyzing and solving problems, etc. are not good enough.
- 4) The blindness on study incited the blindness on the practice and employment, and finally affected their career.

From the aspect of the students' feedback, although the "out-campus practice" lessens the employment blindness, promote their whole professional life

At the same time, on one hand, a great number of students felt "The experiments of the first year don't work well", "The study of the first year is blind, without any idea of career plan and study plan", "When we are familiar with the theory, there is no chance to practice it, while on practice of the second year, we almost forget all the theory". On the other hand, the feedback of the companies is "Most of the students, at the beginning, have no theory and practical ability, and cannot assume any practical jobs". They didn't display any quality of high-level IT talents.

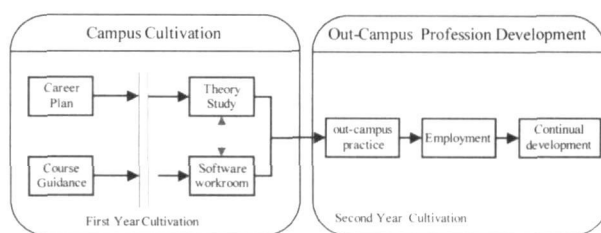
The lack of campus practice makes some colleges look for the off-campus cultivation resources. Many cultivation patterns appeared, like "Joint Cultivation between college and company", "customizing cultivation", and even send the students to professional practice organization to carry out some close training. Due to the great difference on features, kernel profits between college and company, the training effect is not good. High training cost, heavy burden of students, economy cause these attempts fail to make students, company and college satisfy. And finally these cannot become the mainstream of talent cultivation patterns.

3 A New Pattern of Engineering Talent Intensive Cultivation

This part is to solve the problems existing in the above extensive cultivation pattern through the innovation on the intensive cultivation pattern of engineering talent. At the same time, it discusses how this concept as a mainstream of cultivation pattern, to assume the responsibility that cultivate the social required talent under new situation.

3.1 Intensive Cultivation Pattern

The core concept of Intensive Cultivation Pattern is to solve the existing problems by a practical cultivation pattern combining "soft cultivation" like study guidance and career plan with "hard cultivation" that synchronize theory and practice. The intensive cultivation pattern is as follows:



From the above scheme, this cultivation pattern possesses rich content, balanced and reasonable cultivating schedule and content. There are three main as-

pects of cultivation content

First, use a half study period to enrich the campus practice, set up all kinds of “software workroom” with specific direction. Exercise the students’ technical and comprehensive ability through teamwork.

Seen from the cultivation form, we carry out “Item Course” cultivation, which refers to the software exploitation items, and also score course. The students who reach the requirements can achieve scores after the completion of the practical exploitation work. From the direction setting, our college established 3 directions of software workroom and 7 sub-directions. Please see the following.

- 1) Technical Software category: include J2EE, .NET and Software Test workroom.
- 2) Software Outsourcing category: include Japan Project and Euro-America software workroom.
- 3) Embedded Software category: include embedded software workroom and embedded hardware workroom.

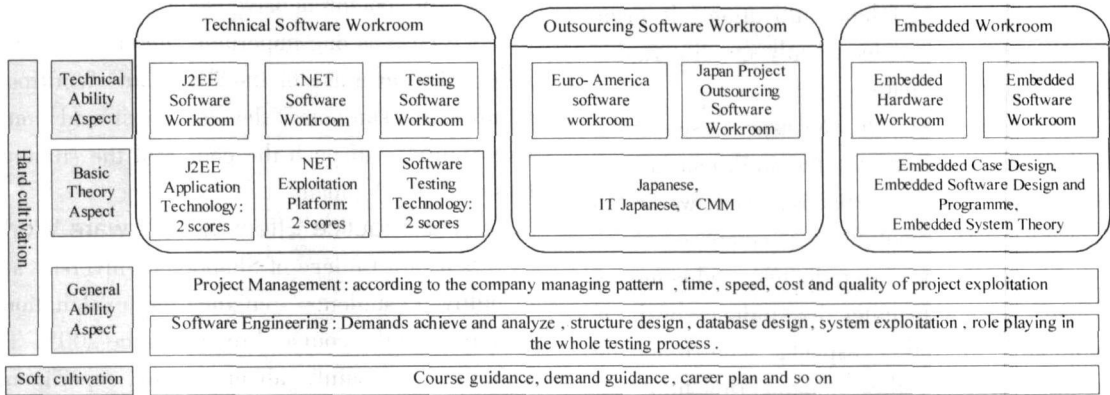
All the software workrooms are based on the concept of the software exploitation. It is the student who is in charge of the job from demand obtain and analysis, structure design, database design to system exploitation, deploy and testing. We manage the students according to the company style to practice the students’

comprehensive ability. The students in the workroom mainly did the practical projects exploitation exercises. And the guidance team offers practical theory illustration. On the time schedule, we optimize course time, and put the necessary and optional classes backward. Every Thursday, Friday, Saturday and Sunday are theory study time, the other three days as project exploitation time.

Secondly, we integrate regular course cultivation system with the “software workroom” related courses and guarantee the synchronization of the system theory.

Thirdly, during course study period, we introduce a series of contents like “General Course Cultivation Plan”, “Course Cultivation Way and Features”, “Practice Base Introduction”, “Industrial Technical Demand and Application” and the like to the students in advance, in order to strengthen freshmen’s course study plan, lead the students to work out suitable “study plan” and “career plan” according to their own personality and interest. On this basis, the students can choose one direction to carry our course study and project training.

Taken the “software workroom” as the main carrier, the detailed structure of the intensive cultivation pattern is as follows:



3.2 Distinctive Features and Main Problem of Intensive Cultivation Pattern

The reason for the intensive cultivation to be the main stream is that it has many distinctive features. The students cultivated by this pattern possess basic system theory, practical theory, technical exploitation and teamwork ability. It has received warm welcome from students and companies. The intensive pattern also solved many problems existing in the extensive pattern. The following is a summary of its features and solutions.

The following gives a brief introduction to the content of the table.

No	Cultivation Pattern Features	Main Problems solved
1	The intensive degree is consistent with the industrial demand	Barrier in the connection of talent supply and demand
2	The general cultivation flow is more balanced	Problems of Cultivation Flow gap
3	The teaching organization is more reasonable	Oneness of tutor guidance
4	Adequate projects and possess real and practical background	The students lack technical ability
5	Company Managing System, Project Managing Pattern	Problems on the students discipline, profession sensitivity and general ability

Feature 1. the division of cultivation directions is well situated. And the intensive degree is consistent with the company demand.

The “software workroom” could satisfy the need of the major units for the software talents. The students overcame the difficulty of blindness in the course study and become more active and definite in their career plan. It cleaned away the matching barrier in the process of practice base choice.

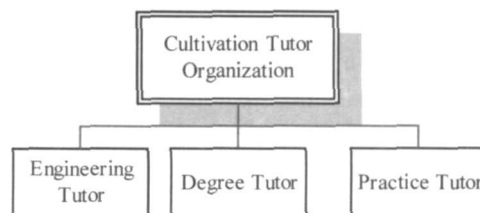
Feature 2. make the talent cultivation flow more reasonable and every cultivation part tighter.

The “software workrooms” pay more attention on the parallel cultivation of the engineering exploitation ability and basic theory ability, which solve the problem that the colleges focus more on theory than ability. The course study and engineering practice have a closer connection and solve completely the problem of ability deficiency. On one hand, it received warm welcome from the companies because it lessens the pressure of the companies “retraining” of the intern. On the other hand, the students achieved project exploitation ability and can assume the exploitation task quickly. So the practice quality is increased and also has a deep effect on the successive item implementation, paper writing and employment. Therefore, the students think highly of this pattern.

Feature 3. The teaching organization is more reasonable in the process of talent cultivation. It overcomes the phenomenon that focus only on dissertation tutoring in the traditional pattern.

There are two aspects. On one aspect, seen from the “Software Workroom” itself, the workroom adopts the method of team guidance, that is, every workroom has one chief tutor. The whole team is composed of experienced teachers, senior postgraduates, and company staff. The teams assume together the guidance of the item exploitation. On another aspect, seen from the whole cultivation process, the “engineering tutor”, “dissertation tutor”, and “out campus practice tutor” formed the cultivation team and assume together the guidance of the whole cultivation process.

Engineering tutor is responsible for the general work of first grade’s “Software Workroom”, and the cultivation of the students’ practical exploitation skill and comprehensive ability. Dissertation tutor is in charge of the dissertation writing, guiding and checking after practice. Out campus practice tutor is responsible for the guidance of the operation problems in the process of practice. The following is the form of tutor organization.



Feature 4. Adequate projects possess real and practical background.

All the exploitation projects in the workroom are real cases to engage in the practical application and exploitation, or exercises on the completed items. The exploitation tasks run through four semesters of the first year. The time is continual and central. It gets rid of the former disadvantages like loose experimental time and inadequate training quantity, and makes sure the practice result. Finally, the students possess practical technical exploitation ability before graduation.

Feature 5. The “Software Workroom” adopts Company Managing System and Project Managing Pattern to exercise the students’ comprehensive quality and ability.

The completed project quality will not be the only examining item. The evaluation contents of the final score include students’ attendance, working attitude, team spirit, quick learning ability, analysis and problem solving ability, communication and organization ability. The comprehensive score will be sent to the practice base as one important reference and evaluation index. The exercise of the “Software Workroom” will improve the students’ devoted spirit and comprehensive ability, and push the course of the students’ professional development.

3.3 The Practice Effect of “Software Workroom”

Software College of Shandong University attempted to cultivate students’ engineering exploitation ability according to the course direction since 2005. The early training was mainly about course experiment, case teaching. Due to its small workload and loose training time, it achieved a certain effect, but there was a big distance to the requirement of the companies. Since the college started to conceive the intensive and specific “Software Workroom”, the innovation of the cultivation pattern had a great influence on the students.

The first group of 69 students had four “Software Workrooms”: JEE, .NET, Embedded and Japan Project. Take JEE “Software Workroom” as an example. This workroom guiding team is composed of college teachers, technical backbones of the enterprises, and the senior postgraduates with long-term exploitation experience from the College Information Laboratory. Professor Li Xueqing, director of the work-

room is the chief teacher of JEE course of Software College. His JEE Application and Exploitation Technology is ranked as the 2007 Excellent Course by the Ministry of Education. Professor Li has been in charge of the college informationize construction, and accumulated a great deal of experience and materials on both theory and practical project exploitation. The other teachers are also the team members of JEE course, and have undertaken course teaching and project exploitation for many years. The guiding teachers from the enterprises are also the technical backbones on project exploitation.

After the establishment of “Software Workroom”, due to its advantages abundant project resource for training, training items close to the students daily study and life, outstanding guiding team, simple to complicate exploitation procedure, long and stable exploitation time, it got over the distance between the students and projects, and inspire the students interest and zest to the software exploitation. After 4-6 weeks, many students can assume the technical exploitation task assigned by the project group. At the same time, because the project exploitation adopts completely the concept of software engineering, the development of practical engineering improved greatly the students understanding and application of many theories and methods.

For the workroom management, on one hand, the workroom adopts management pattern of enterprises; on the other hand, for its emphasis on working attitude, team spirit, learning ability, problem analysis and solution, organization and communication ability, both technical and comprehensive ability and workroom management, have achieved satisfying result. When these groups of students enter the practice base next year, for their great improvement on self-knowledge,

technical ability, comprehensive personality and professional consciousness, they must be welcomed and affirmed by the enterprises.

4 Conclusion

After several years quest of engineering cultivation pattern, the college summarized objectively the problems of the original extensive cultivation pattern, carried out actively the attempts on the problem solution, put forward an intensive cultivation pattern. This pattern makes the college's cultivation direction more specific and accord with the enterprises talent demand.

Although these new patterns offer the corresponding solutions to the original problems, we recognize that no pattern is perfect. For the next step, the college will explore some more profound problems, for example, how to do well the process management of the “Software Workroom”? How to introduce enterprise culture and management system to the cultivation process and exert the relative function? All require us to solve them by reasonable management, specific management and intensive cultivation. We expect that the cultivating effect will be better and accord better with the social need by means of summary and solution of the emerging problems in the operation process.

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工程型软件人才精细化培养模式探讨与创新

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摘要: 立足于目前多数国家示范性软件学院现有的软件工程人才培养模式和不断出现的新问题, 深入分析了粗放式培养模式下人才培养的不足。并在此基础上, 以高层次、工程型人才培养为侧重点, 通过一系列的创新与尝试, 总结了近几年来山东大学软件学院人才精细化培养的整体思路, 提出了以“软件工作室”为主要载体的人才培养模式, 以及理论与实践并发培养、技术能力与综合能力并重的培养思路。

关键词: 工程型; 精细化培养; 软件工作室

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