



# Research on the Construction and Practice of Software Engineer Talent Cultivation Mode Based on FDDD against the Background of New Engineering

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**Abstract.** Based on the experience and data from school-enterprise cooperation of Kunming University software engineering undergraduate specialty, we propose the FDDD (five-dimension & double-driven) innovation talent cultivation mode. This paper will introduce the framework. It also elaborates and analyzes the process and effect of software engineer cultivation. The advantages and possible issues are also researched and discussed in this paper.

**Keywords:** FDDD; talent cultivation; software engineering; school-enterprise cooperation.

## 1 Introduction

Since the concept of new engineering education was proposed in 2016, a higher requirement for improvement of engineering practical ability and reform of professional talent cultivation were put forward in Application-Oriented University [1].

Under the traditional teaching mode, students graduate with insufficient engineering ability which is a contradiction with the talent demand of enterprises. According to the OBE teaching philosophy of student-centered [2], output oriented and sustainable development, Information Engineering School of Kunming University cooperated with Z-Park (Zhongguancun Software Park) and began to enroll students majored in software engineering since September 2016. Meanwhile, the double driven cultivation mode in five dimensions was used which include School Runner, Students' Identity, Cultivation Process and Curriculum System and Evaluation System [3]. The School of Kunming University & Z-Park was built in 2018. More enterprises were participating in cooperation with our school ever since then. After continuous exploration and practice, the mode was been standardized and improved and been named FDDD mode. Educational effectiveness of the mode was proved in several batches of graduates. The FDDD mode provides support for achieving goals of training Objectives for Software Engineering Talents in first tier cities. It is also an innovation strategy for talent cultivation and specialty construction, which is played a demonstrative and leading role in the universities at the same level.

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## 2 The Framework of FDDD Mode

Considering the characteristic of software engineering specialty, this mode built the cultivation system from five aspects which are school-running mode, requirements for the graduates, curriculum system, teaching content, teaching method and evaluation method for the education quality. The framework of FDDD mode is shown in figure 1.

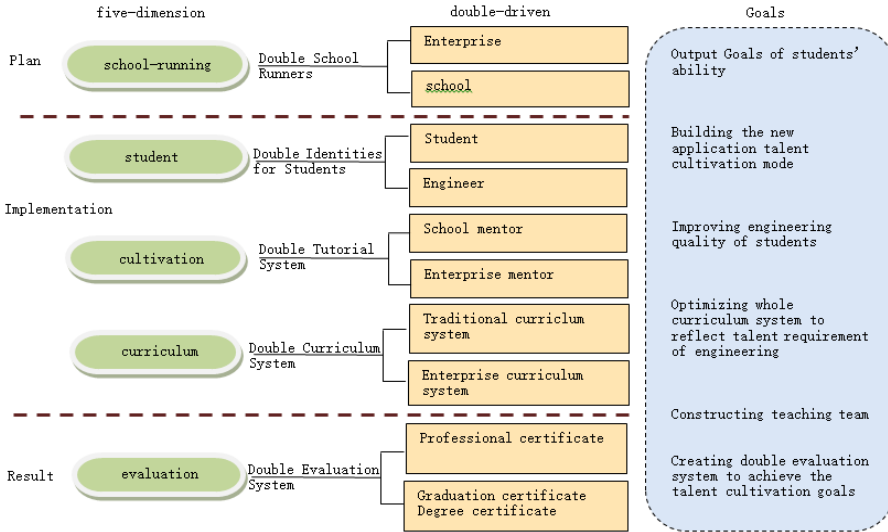


Fig. 1. The Framework of FDDD Mode

- **Double School Runners.** School and enterprise which both are the school operator will make the talent training plan, carry out the plan, develop curriculum resources and evaluate the training quality together in the process of talent training.
- **Double Identities for Students.** Students are trained to be both undergraduate and software engineer in the guidance of new engineering specialty construction policy, which is based on the demands for software talents.
- **Double Tutorial Training System.** Teachers from school and enterprises participate in talent cultivation together. Teachers from school are responsible for the cultivation of knowledge architecture. Tutors from enterprises are responsible for cultivation of application ability.
- **Double Curriculum System.** Double curriculum system which includes traditional curriculum system and enterprise training curriculum system is been built based on The National Education Quality Standards and The Engineering Certificate Standards in the process of implementation of training.
- **Double Evaluation System.** The evaluation for the talent cultivation is based on the undergraduate and engineering education system. Qualified graduates can acquire Bachelor's degree and Professional Certificate.

Cultivated by the FDDD mode, students will learn some professional lessons at school which is the real project-driven mode in the first three years. In the last year,

Students will become an intern and work in cooperative enterprises to improve their application ability, innovation ability and comprehensive professionalism. Students can not only accomplish their undergraduate education, but also find a job more easily.

### 3 Process and Method of Application Practice based on the FDDD Mode

#### 3.1 Process and Method of Double school Runners

Cultivating application talents with systematic theoretical knowledge as well as engineering application ability is the target of the school. It carries out the conception of industry-oriented demand and pays equal attention to knowledge, ability and quality in the process of talent cultivation [4]. The School of Kunming University & Z-park cooperated with enterprises, such as Kunming Engineering Corporation Limited and WinTech. Two parallel entities take part in the whole process of school-running. The undergraduate students finished their Professional Basic Training in school from the 1st to the 3rd academic year. The tutors from the enterprises finished the teaching schema of enterprise embedded courses at the same time. The students finished their Graduation Internship and Graduation Design Tasks in the 4th year which mainly organized by the Z-Park and supervised by the school. The whole cultivation framework is shown in figure 2.

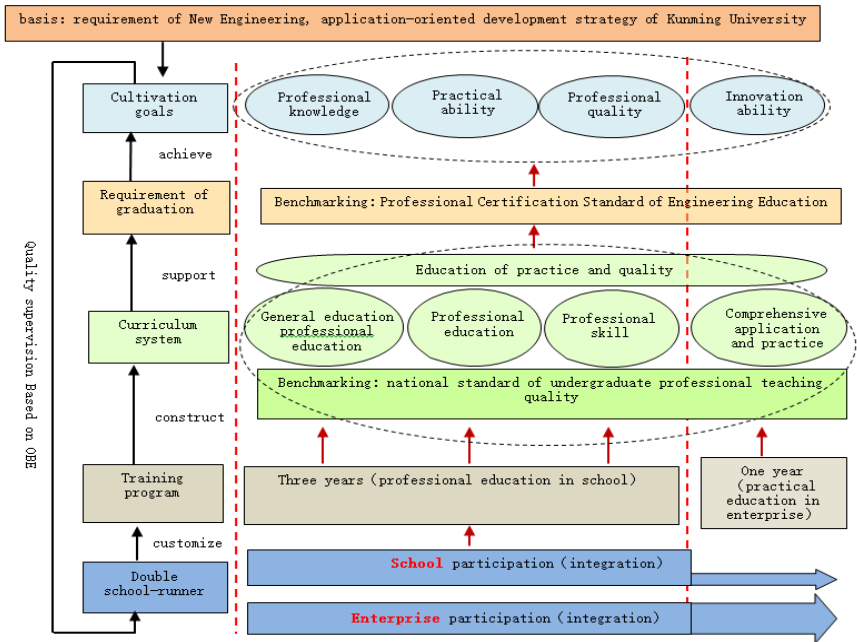


Fig. 2. the framework of Double School Runners

### 3.2 Process and Method of Double Identities for Students

According to the advanced foreign teaching experience and talent training theory of enterprise, such as NIIT, use the MCLA (Model Centered Learning Architecture) to train students [5].

School and enterprises make overall arrangement of practical training continuously during the eight terms, such as unit experiments, comprehensive experiments, curriculum design, graduation design, and internship. Teaching hours of practical lessons account for 40% of the total teaching hours. The practical curriculum system was redesigned comprehensively from admission to graduation.

Carrying out the exploration of practical teaching mode which includes project-oriented open experiment, interest group-study and subject contest, and organizing students to participate in computer application skill contests at different level can not only improve students' practical ability, but also meet the needs of individual development and practical training [6].

After practical training, students can improve their engineering ability. They participate in the enterprise projects as not only student but also software engineers during their internship.

### 3.3 Process and Method of Double Curriculum System

The School of Kunming University & Z-park cooperated with the local enterprise and made the double curriculum system carrying out in Kunming University which includes the classic theatrical curriculum and enterprise training curriculum. The curriculums form a mutual-supporting system. The double curriculum system is shown in figure 3.

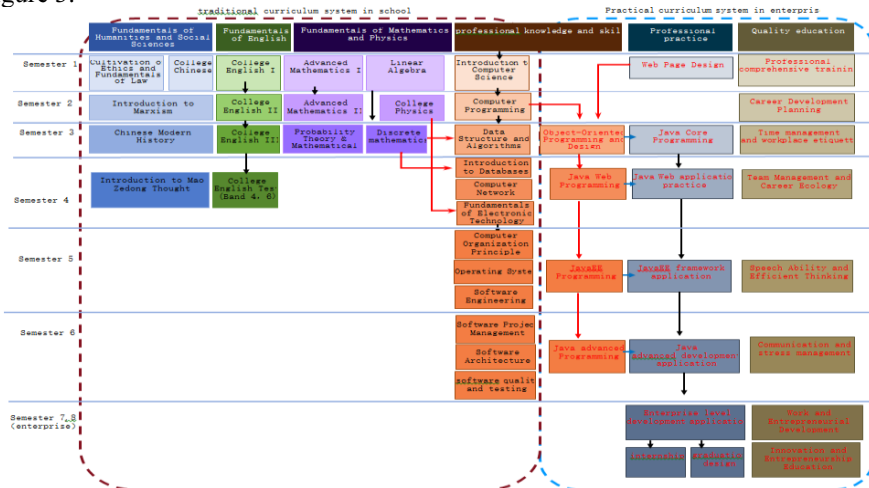


Fig. 3. core subjects and the supportive relations of school-enterprise embedded curriculum system

According to the course system, the course groups have been built which includes software theoretical and basic developing-related courses, enterprise project courses and innovation ability-based courses. Enterprise project courses and innovation ability-based courses were provided by the Z-park. Teachers from the several cooperative enterprises finished the teaching task. Two teaching platforms were established which include teaching platform mainly based on the high-quality courses, ternary practical teaching and engineering training platform of “experiment-intern-innovative & entrepreneurship”. The ternary platform was composed of experiment teaching center, intern base of Z-park and competition base of College Students' innovation and entrepreneurship training program.

Course integration and reconstruction are accelerated to solve the problems, such as independent planning, repeated content, redundancy knowledge, poor convergence, deficient engineering, insufficient training intensity, and so on.

### **3.4 Process and Method of Double-Identity for Teachers**

School tutor and enterprise tutor guided the students with Two-Tutor System in the process of graduation design, graduation intern and extracurricular activities. Students could obtain not only rigorous academic research quality but also advanced expertise.

Construction of Teacher's group was strengthened. According to the training agreement among school, Z-Park and Kunming Engineering Corporation Limited, teachers were sent to the enterprises in batch to improve their engineering practical ability through enterprise investigation and social practice.

Teachers with high academic standard and advanced educational background have been brought in to form the teaching troop. Related encourage policies were made to support teachers to apply for doctoral degree studies, take certification examination, or apply for different level of scientific project actively. Cultivating teacher's capability of new technology research and engineering application in the process of different level projects.

### **3.5 Process and Method of Double Evaluation System**

Based on the complete credit system, the school and the enterprise take different tasks with different evaluation method and make the different evaluation distributed in different teaching phases. They evaluate students' study quality not only on the process of theoretical process but also on the process of software engineering training [7]. The qualified students can have the graduation certificate and professional qualification certificate issued by the Z-park or other cooperative enterprises which means they graduated with double identities and could be accepted more quickly in the recruitment companies.

## **4 Main Application Effects of FDDD Mode**

### **4.1 The Effectiveness of Teaching System is Significant Through Optimizing Talent Cultivation Scheme and Catering to Social Needs**

Based on the targeted cultivation scheme and abundant resources of Z-park, all students obtain professional qualification certification when they graduated. Most students training in Beijing can get their job on recommendation of Z-park. The rate of professional counterparts was 99%. As of October 2023, more than 810 students of Kunming University majoring in software engineering were trained by the system. 40% of 410 graduate students were working in Beijing. The average initial employment rate is 95%. Some of them got the job in famous company, such as Sohu, Lenovo, AsiaInfo, Inspur and Taiji ect. More than 100 awards were won in the competitions, such as National College Mathematical Modeling Competition and “Blue Bridge Cup” National Software Competition. On the other hand, scientific research ability of students is also improved. More than 50% of students take part in the studios and obtain several Intellectual Property Rights (three of them were ranked first). Five articles were published (two of them were retrieved by EI, two of them were published on international conference).

### **4.2 Research on Teaching Reform and Course Construction Has Positive Outcomes**

More than 10 national or provincial teaching reform projects about new engineering research and practice have been approved. The first Z-park Industrial College has been built in Yunnan province. We also participated in construction of WinTech’s digital Industrial College and gave an auxiliary support for the authorization application of the Electronic Information Master's Degree Program. The construction of Software Master's Degree Program has been approved. Four textbooks were published. Several articles about teaching reform were published. One provincial first-class course has been approved. Four school-level cultivation projects of first-class courses were approved too.

### **4.3 Implementing Effects of the System Is Obvious and Has Significant Implications for Promotion and Application**

Based on the school-enterprise cooperation, the FDDD mode is proposed innovatively. The outcomes of construction process in different stage are publicized in different conferences, lectures and project presentations. The paper was selected for the 4th Chinese IT Education Forum organized by The Teaching Guidance Committee for Software Engineering in Higher Education Institutions of the Education Ministry, won the second prize, and publicized nationwide as excellent case of industry and education integration. As a classic case of “school-enterprise cooperation & double-hundred plan” in 2021, the talent cultivation program was selected for the 57th Higher Educa-

tion EXPO China & the 6th Industry-Education Integration Development Conference organized by China Association of Higher Education.

## 5 Summary

Based on the national and local economic development requirement for software engineering talent, considering the demand of national standard of computer professional teaching quality, engineering education certification and new engineering education, focusing on cultivating software engineering talent supported by the social-oriented application research and application-oriented teaching group, this mode construct first-class courses with high quality, reform talent cultivation mode, teaching mode, practical teaching system, quality evaluation and assurance system. This mode also construct high level distinctive characteristic application-oriented undergraduate specialty, create model of specialty construction and reform which is replicable, promotable and play a leading role in the application-oriented university. Optimization of framework, pluralism of cooperative enterprise and synchronization of practical training between school and enterprises are the following work.

## Acknowledgments

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