

## Exploration on the New Ways of Personnel Cultivation Based on College General Education and Vocational Skill Training: Taking Mathematics Students Who Want to Work in the Software Industry as an Example

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### Abstract

Employment of college graduates is a major problem for both Chinese higher education and social enterprises. There are a series of contradictions between the personnel cultivation model of college general education and the needs of social enterprises, which are mainly shown in the inconformity between student's skills and the standards of society and enterprise. In this paper, we take the mathematics students who want to work in the software industry as an example to explore new ways of personnel cultivation. Based on the university general education and vocational skill training, it is proposed "New 3+3 Model" and "4+4 Model" of school and enterprise joint training. It has been proved that these two models are effective to improve the college student's ability and relieve the pressure of employment.

**Key words:** Joint training; "new 3+3 model"; "4+4 model"

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### INTRODUCTION

College general education is also translated as all-round education. Its core ideology is derived from liberal education (Zhu & Ma, 2015). Some 19<sup>th</sup> century European and American scholars thought academic divisions of

college education were too specialized and knowledge was severely categorized. Therefore they created the idea of general education. The purpose is to cultivate highly-competent students with independent thinking in comprehensive study of different areas. However, college general education has to face a very embarrassing situation of student employment problem with each passing year. All the industries with huge differences have a high requirement of professional skills to the employees. But the college graduates under the background of general education have superficial knowledge in all the areas but can't become skillful at anyone in generally speaking. It leads to that graduated college students cannot adapt to the demands of society and enterprises. Therefore, it has become an urgent task to explore new ways to cultivate talents with general education and professional skills training.

In the past ten years, many experts and scholars have actively explored new ways of student professional skills training. In 2005, with the school running experience in Shanghai Engineering Science University, Zhang (2005) came up with the idea that college education should be carried out around the industrial needs, training and shaping excellent engineers, and he stressed on-the-job experience. Miao et al. (2007) proposed school enterprise cooperation model to develop employment oriented graduates based on industry application field. Zhang (2009) analyzed the contradiction between the education supply structure and the demand structure of the labor force in our country, and put forward the third party college students' vocational training mode. Zhang (2010) proposed "3 + 1" school enterprise cooperation in faculty resources, technology, and operating conditions. It changed the traditional way of talents development and personnel training mode, met the market demand, and helped to ease the university graduate employment problem. Yu and Huang (2010) came up with a model of Entrepreneurship Talent Training in school enterprise

cooperation. It is a combination of entrepreneurship education and innovative talents cultivation. In 2011, Sun (2011) made “TOP” model of college student employment, entrepreneurship and micro skills training research, which put forward to increase the opportunities for students to participate in social practice through various channels in order to better resolve the problem of college students’ employment difficulty; Liu (2010) made a study of school enterprise cooperation from five aspects of “real business environment “,” real project management “,” real project manager “,” real work pressure” and “real job opportunity”, and put forward five kinds of school enterprise cooperation scheme of “the joint-developed curriculum”, “cooperated college teachers and enterprise trainers”, “enterprise cooperation curriculum “,” college enterprise classes” and “joint-organized extracurricular activities of science and technology”. Guo (2012) raised the training model of “three drives” about the phenomenon of school education out of line with business needs, which improves the students’ software development quality and innovation consciousness. Qin (2013) proposed “to get knowledge and certificates in three fields in two different workshops”, which provides theory instructions to the enterprise owned school of vocational education development; Guo and Pei (2013) made a study on the models of school and enterprise cooperation, and on multi-schools cooperation, taking information and computer science major as an example. Wang and Zhang (2014) proposed an innovative teaching model for software development vocational skills training, which put vocational skills training into the process of personnel training, and fully improve the students’ ability in real working environment. Su et al. (2015) put forward comprehensive teaching reform scheme on software testing major based on school enterprise cooperation, which promotes the method of “project driven, case teaching”, and cultivate high quality talents of software testing major for enterprises. The above researches show that the development of college student skills training is an important way to promote employment and entrepreneurship of college students, and school-enterprise joint training provides an effective platform for this work. In this paper, we take the training of mathematics students who want to work in the software development industry as an example.

## **1. ANALYSIS ON THE PROSPECT OF JOINT TRAINING BETWEEN SCHOOL AND ENTERPRISE**

### **1.1 Status Quo and Development Prospect of Software Industry**

In recent years, China’s software industry continues to be in full flourish. First of all, the software is used more

and more widely involved in various fields of daily life, military, education, and economy. Social demand for software increases gradually with the global software market growth at an average speed of 13% (Zhao et al., 2013). In addition, the Chinese government vigorously promotes the process of national economic and social information, and information technology to stimulate industrialization and a series of policies which will continue to push forward the development of the software industry. Second, the software industry and related products play a great role in the development of the national economy and own a considerable market share. The software industry will gradually become the pillar industry to promote economic development (Zhou, 2014). Therefore, with the rapid progress of the Internet, the software industry will more and more vigorously develop, and constantly move towards the service, networking, open, intelligent and integration. At the same time, there are still some problems in software industry: First of all, from the view of global countries, the pace of development of China’s software industry is still relatively slow, technology is not mature enough, core competitiveness is still lacking; second, in the talent structure, basic technical personnel account for the majority, lack of high-level personnel of core technology, badly in need of a number of proficient talents (Ibid.).

### **1.2 Software Industry Talent Demand Survey**

As is known to all, the demand gap of information talent, especially software talent is very big. On October 19, 2015, Nanjing Daily reported that enterprises for internet and software talent demand increases, especially for front-end development engineer, in 2015 college graduates job fair in Nanjing International Exhibition Center. February 2016, Nanjing Network Programmer Training Website reported that according to the relevant authoritative department statistics, within the next few years, China’s software industry practitioners demand is very big, and the annual demand of software talents will reach to 80-100 million, but an existing industry practitioners are only about 50 million people, and professional developers less than 25 million. China information technology personnel training summit also pointed out that in the next 5 years, China’s demand for information technology employees can reach to 20 million people, at least more than 400,000 each year.

### **1.3 The Advantages and Disadvantages of Mathematics Major Students in the Field of Software Development**

The requirement of software development for the design of the algorithm is high, which requires a strong logical thinking ability and algorithm design basis. Algorithm design essentially belongs to the category of mathematical research. During the period of school learning, mathematics majors achieve knowledge of “numerical

analysis”, “data structure”, “modern optimization algorithms”. Students with strict mathematical logic thinking training are sensitive to the algorithm, and have a high ability in algorithm design and program, which lay a solid foundation and create a unique advantage for them. However, students majored in math also have disadvantages of weak software development technology without systematic knowledge. The main reason is lack of the software development project training experience, and skill training system. In order to faster and better promote students to achieve the industry benchmark and meet the requirement of society and enterprise, we need to provide additional systematical and comprehensive skills training for those students that are willing to be engaged in the software industry when they achieve the basis of professional education and general education at the same time.

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## 2. STUDY ON JOINT TRAINING MODEL

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### 2.1 New 3+1 Model

New 3 + 1 mode refers to college general education for three years combined with vocational education based on school and enterprise cooperation for one year for university students. General education can provide training for students on strict logical thinking ability and self-learning ability in first three college years. In the fourth year, the enterprise can provide students with vocational skills and training. It can be summarized as the following four methods in the fourth year school-enterprise cooperation.

#### 2.1.1 Enterprise Entering Into College

College brings in enterprise to cooperate in the training. College is responsible for providing classrooms, teaching aids, and assistant teachers. Enterprise should provide qualified software development engineer as a training instructor and they can provide the actual project development case for students to make practice. In the process, the student’s performance is strictly evaluated according to the enterprise requirements and standards.

#### 2.1.2 College Student Internship in Enterprise

It means to organize students to make practice in the real business environment and participate in the project development process. The purpose is to enhance students’ vocational skills and competitiveness by filing, mentoring, training, evaluating in the internship.

#### 2.1.3 School-Enterprise Curriculum

This method suggests school and enterprise to make joint efforts in setting teaching goals, developing the contents of curriculum and carrying out practical training.

### 2.1.4 Industry Based Education

In this model, three parties of the enterprise, the school, and student jointly develop an industry-oriented talent training plan. According to the plan, the students will be trained at different levels. In the end, enterprises will sign up for those graduate students that meet with industry-oriented talent training plan.

### 2.2 4+4 Model

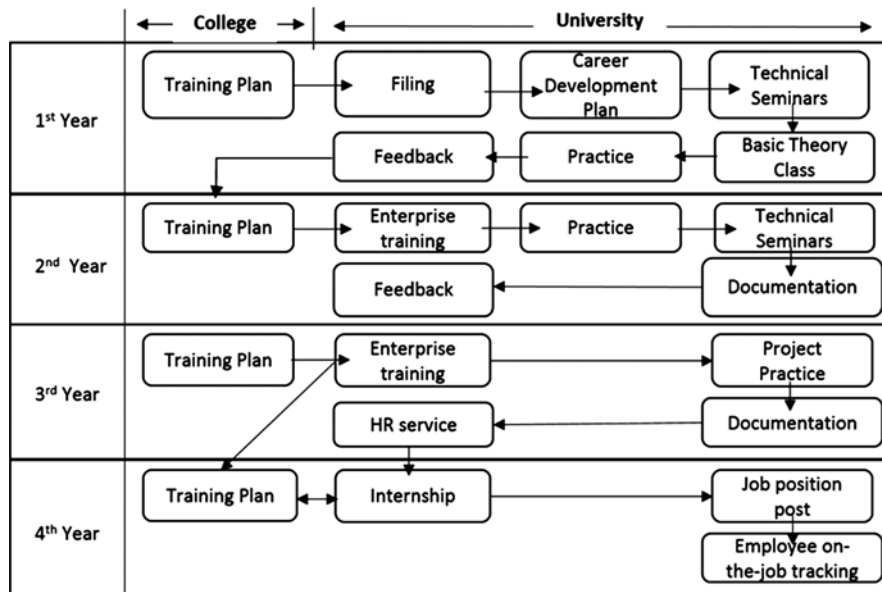
Both the school and the enterprise jointly develop a long-term combination of teaching plan for students from the beginning of college. In the first year, enterprises can provide “company visit”, “industry technical seminar”, “occupation planning seminar” and other activities and carry out vocational tendency analysis for students. Both the school and the enterprise establish professional students training archives. In the second year, according to the teaching plan, the enterprise should carry out the industry theory teaching, hold some technical seminars developed by the supervisor and project manager, and make face-to-face communication with students. The enterprise can also make analysis and evaluation of students through diagnostic tests, teaching feedback and students periodical performance, improve teaching plan. In the third year, the enterprise goes on with industry theory teaching accordance to the teaching plan, while it is also suggested to carry out technology development practice teaching, provide project training, and organize students to participate in the job fair. In the fourth year, enterprises help student start internship in the company, provide employment services for students, and follow up with those special position students like high-level position student or short-time promoted student. It is hoped for the enterprise to provide information of students after graduation when working in the company like promotion, job transfer, e.g. in order to complete closed-loop management of personnel service.

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## 3. PRACTICE AND EFFECT

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In actual teaching practice, we make use of New 3+1 and 4+4 Model in school and enterprise joint training with five enterprises like Chinese Software International Company, Beijing Qianfeng Internet Company and so on. By this way, our graduate employment rate has been increasing by 7% each year in recent three years. On average, 47% of total graduates engaged in software and related industry. The practice shows that those two school and enterprise joint training models have significant effect.



**Figure 1**  
**4+4 Model of School and Enterprise Joint Training**

## CONCLUSION

This paper takes the example of mathematics major graduates working in software development industry to study new methods of general education and vocational joint training in talent cultivation, and then make a comprehensive analysis of the prospects for the development of the software industry, and the advantages and disadvantages of the mathematics majors engaged in software industry. In the end, we proposed two kinds of talent cultivation methods of New 3+1 model and 4+4 Model to make full use of school and enterprise resources. The above two kinds of talent training models vigorously promote the students' interest in employment and entrepreneur, effectively resolve the graduate employment problem, and improve the social adaptability of college students.

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