

# The Orientation and Construction Path of Software Engineering Technology Specialty at the Vocational Undergraduate Level

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**Abstract:** The development of undergraduate vocational education is the inevitable result of China's meeting the industry's demand for high-quality and multi-skilled talents. In the context of the rapid development of the domestic digital economy and the construction of information and innovation, the requirements for software technology talents are also changing. In order to meet the needs of regional industries, we should build a professional undergraduate software engineering technology major. Starting from the industrial demand, this paper first investigates and analyzes the employment demand and future trend of software technology-related enterprises, then analyzes the orientation of the specialty, and finally proposes the construction path of specialty construction and talent training, which provides support for the construction and development of software engineering technology specialty in vocational colleges.

**Keywords:** Vocational undergraduate education, Professional orientation, Personnel training, Software engineering technology.

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## 1. Introduction

In recent years, the state has issued a number of policies related to the development of vocational education at the undergraduate level, which has promoted the research and exploration of the development of vocational education at the undergraduate level. Undergraduate level vocational education is not only the upgrading of professional level vocational education, but also the advanced stage of vocational and professional education types. It is a major measure to realize the "different types and equally important" of vocational education, which is conducive to making students' educational choices more diverse and their growth path wider, and making their academic, career and social promotion channels more smooth[1].

Researchers at home and abroad have studied the degree construction, specialty construction, talent cultivation, development bottleneck and implementation path of undergraduate vocational education. As early as 2003, Yang Jintu proposed that undergraduate vocational education should be classified as higher vocational education and positioned to cultivate technical application-oriented talents from the perspective of changes in science and technology and the development trend of undergraduate education in China and the world [2]. Tu Xianghui believes that the training goal of undergraduate vocational education talents should be "to cultivate high-level technical applied talents with strong technical theoretical basis, practical skills and application ability, and serve the frontline of production, construction and management" [3]. Li Bingchang proposed that the undergraduate level vocational education is to train "high-end skilled professionals", which is reflected in high quality and high skills [4]. Fang Zeqiang pointed out that compared with junior vocational education and secondary vocational education, the talents trained in undergraduate vocational education highlight the characteristics of innovation, complexity, industry and sustainable

development [5]. Through sorting out the talent training mode of the German University of Applied Sciences, Xu Han believes that comprehensive professional ability, especially interdisciplinary and interdisciplinary ability, is the key direction of talent training in German undergraduate vocational education [6]. After studying the talent training mode of the German University of Applied Sciences, Liu Hailan and others believe that practice-oriented applied talents are the direction of talent training in German undergraduate vocational education [7]. Pan Jun and others took California Community College as a case to study the new orientation and development strategy of American Community College, and believed that American undergraduate vocational education should meet the dual needs of human development and the labor market, focus on people's lifelong learning and employment, and cultivate compound talents with academic achievements and high skills [8]. In general, researchers have not formed a consistent understanding of the basic issues and research contents of the construction of undergraduate vocational education majors. At the same time, there are few studies on the problems, connotation construction and improvement path faced in professional construction. Based on the background of information innovation construction and the development of digital economy, this paper investigates and analyzes the demand of regional industries for software technology talents, and proposes the orientation and construction path of software engineering technology specialty at undergraduate level.

## 2. Research on the Demand of Regional Industries for Software Technology Talents

### 2.1. Data source

This enterprise survey focuses on enterprises in the Wentai region of southern Zhejiang, and also surveys other cities in the province, such as Hangzhou and Ningbo, as well as

surrounding provinces and cities. The participating enterprises mainly come from software and information services, the Internet and manufacturing industries, and some enterprises come from education and training, finance, business services, e-commerce, transportation and other industries. Investigators include industry and enterprise experts, relevant personnel of industry management departments, enterprise heads and department heads, front-line workers, technicians, section heads, workshop directors and recent graduates of production enterprises; The survey takes the form of questionnaire survey and statistical data collection, supplemented by interviews with enterprises and teachers. In the course of the investigation, we should fully understand and carefully analyze the current demand of enterprises, teachers and students for software technology professional undergraduate students by feeling the truth, listening to the truth and seeking practical results.

## 2.2. Basic information of employees in regional software and information service industry

From the data in Table 1 and Table 2, it can be found that the demand of regional software industry enterprises for software technology talents has gradually increased, and the number of people in demand for each relevant position has increased, especially with the rise of new technologies such as artificial intelligence, the demand of enterprises for new technology application development talents such as artificial intelligence application development and large number of application development has increased sharply. At the same time, it is learned from the interview data that enterprises have higher requirements for talents' academic qualifications, The talents cultivated by vocational undergraduate have some characteristics of both ordinary undergraduate and vocational college, so the demand of enterprises for vocational undergraduate talents is rising rapidly.

**Table 1.** The demand trend of software technology talents of the surveyed industry enterprises in recent three years

enterprise personnel demand	unwanted	10-20 people required	20-40 people required	more than 50 people are required
nearly 3 years ago	1 (1.2%)	34 (4.1%)	29 (34.9%)	19(22.9%)
nearly 2 years ago	0(0%)	30(36%)	30(36.1%)	23(27.7%)
lately	0(0%)	20(24%)	34(41%)	29(34.9%)
trend	descent	descent	ascend	ascend

**Table 2.** The main positions provided by the surveyed industry enterprises for undergraduate students in the past three years

type	Front-end development engineer	Java development engineer	Mobile application development engineer	Database development and maintenance	AI application development	Big data application development	Internet of Things application development
3 years ago	54.4%	55.8%	45.2%	42%	2.4%	10.5%	30.5%
2 years ago	58.1%	60.1%	49%	43.5%	10.2%	17.4%	45%
lately	66%	67.7%	54.2%	48.2%	35.3%	45.8%	48.4%
trend	ascend	ascend	ascend	ascend	ascend	ascend	ascend

## 2.3. Analysis of professional ability corresponding to software engineering technology major at vocational undergraduate level

Through one-on-one in-depth interviews with 70 key employees, such as senior software engineers and technical supervisors, and the statistical results as shown in Table 3, it can be found that the backbone of the enterprise is relatively recognized for the professional skills of the current professional students, but more than half of the people think that the students' theoretical and comprehensive practical abilities need to be strengthened, especially some

comprehensive, enterprise-level project training, which needs to be added in the talent training program. In addition, the backbone of enterprises generally believe that students' new technology application ability and innovation ability have great deficiencies. According to the statistical results in Figure 1, the demand for new technology application talents and innovative technology talents in enterprises is increasing year by year, and the demand is increasing rapidly. It can be predicted that in the next few years, these two types of talents are still in a relatively large gap among regional enterprises, so it is urgent to cultivate a solid professional foundation for enterprises Talents with strong practical ability and new technology application ability and innovation ability.

**Table 3.** Shortcomings of vocational college students

content	theoretical knowledge	professional skills	comprehensive practical ability	new technology application	innovation ability
percentage	53.4%	10.2%	60.2%	80.5%	95.5%

### Number of people required by enterprises

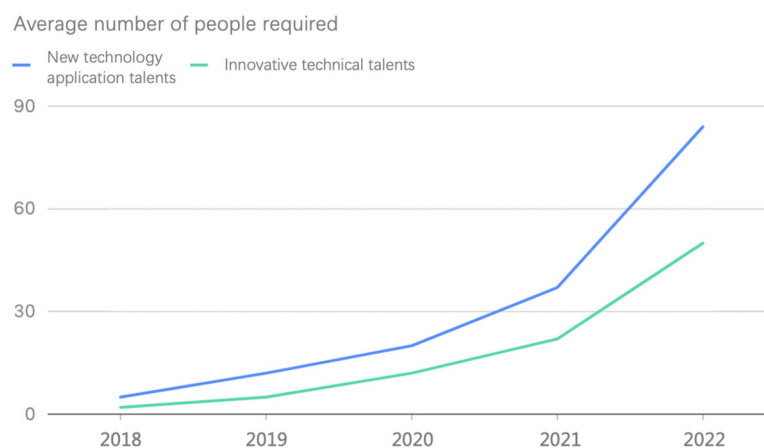


Figure 1. Average number of talents required by enterprises

### 3. Positioning of Software Engineering Technology Major for Vocational Undergraduate

The career belt theory is a talent structure theory about the relationship between the specification characteristics, dynamic evolution and corresponding education of engineering and technical personnel in the occupational field. The theory divides applied talents into three series: technical workers, technicians, and engineers. The difference between the three types of talents is that technicians mainly learn operating skills, technicians need to learn corresponding theoretical knowledge while learning operating skills, and engineers mainly learn technical theoretical knowledge on the basis of accumulating a large number of operating skills. With the development of economy, science, technology and industry, the number of skilled talents has gradually expanded, and the areas in the career belt have further expanded and there has been a differentiation at the level. In the software technology industry, engineers in the past need to have a comprehensive ability of combining theory and operation. With the upgrading of domestic industry, the trend of digitalization and intellectualization is obvious, and the requirements for engineers have changed. For high-level engineers, in addition to having a solid theoretical basis and practical ability, they also need to have a comprehensive development ability of cross-knowledge, cross-post and cross-occupation. Secondary vocational education can meet the needs of skilled personnel in general technical posts, while the responsibility of cultivating high-level compound high-skilled personnel needs to be borne by higher vocational education. In the past, vocational education at the junior college level mainly focused on training ordinary engineer-type talents, while training high-level technical and skill-type talents required undergraduate vocational education to achieve. Therefore, from the perspective of level positioning, undergraduate vocational education is the highest level in the current vocational higher education system, with the goal of cultivating high-level talents.

From the demand survey of regional industries, it can be seen that the demand of enterprises for new technology application talents and innovative technology talents is increasing year by year. In addition to traditional software development technology, talents also need to master new technologies such as artificial intelligence and big data. In

addition, the application of the new generation of information technology has promoted the integration of production, circulation and service fields. There are more and more intercommunications among different professions, and the occupational boundaries are increasingly blurred. One specialty with multiple abilities has gradually become the common standard for all kinds of professional positions. This also requires software technology talents to be compound talents with cross-border thinking. Therefore, high-level and complex software technology talents will be in short supply, which is also the guarantee for China's industrial transformation to high-level and emerging industries to be highly digital and intelligent. The goal of the software engineering technology major of the vocational college is to cultivate applicable high-level and complex software technology talents, follow the new trend of the development of relevant industries, and meet the new expectations of employers and the public.

### 4. Construction Path of Software Engineering Technology Major for Vocational Undergraduate

#### (1) Establish a correct concept of talent cultivation

At present, the undergraduate level vocational education in China is still in the practice stage, and the development of all aspects is not mature, and it is quite different from the professional level vocational education in terms of positioning, logic and implementation. Therefore, we should first establish a correct concept of talent training. China has begun to vigorously develop the information and innovation industry to solve the "neck" threat of domestic information technology, and achieve the goal of independent security and control from basic hardware to application software. In this context, the software-related industrial base and industrial chain will change. The software technology talents trained by the software technology majors at the undergraduate level must be able to adapt to the needs of the advanced industrial base and the modernization of the industrial chain, so as to reflect its high-level and advanced nature. Therefore, the construction of the specialty should start from the orientation of the undergraduate level, based on the new changes and new requirements of the industry, adhere to the people-oriented principle, establish a comprehensive concept of education, focus on the complexity of the talent quality structure and the sustainability of talent growth, and cultivate high-level talents

with rich theoretical knowledge, outstanding practical ability and active innovative thinking. This is quite different from the training of talents at the junior college level. From the school, teacher and student levels, we need to rethink, sort out and recognize the new concept of training.

(2) Create a curriculum system integrating general education and special education

Focusing on the new requirements of the construction of information and innovation, we will carry out in-depth cooperation between government, school, business and enterprise, and build a curriculum system of "foundation + technology + innovation" integrated with general education. First of all, we should pay attention to basic courses, including basic culture courses, basic general courses, software technology post group professional basic courses, etc., and add some public optional courses supplemented by career planning map to give students the space to choose. The basic courses lay a solid theoretical foundation for students, expand the scope of knowledge, and help cultivate students' lifelong learning ability and cross-disciplinary and cross-knowledge ability. Technology courses are the core courses, which focus on cultivating the professional knowledge and professional ability necessary for the software technology post group of students, while innovation courses are based on integrating cutting-edge technologies such as artificial intelligence and big data, which focus on cultivating students' new technology application ability and innovation development ability, so as to adapt to the rapid development of software technology and embrace the construction of information and innovation. Each skill direction and level is organized in the form of "curriculum package", which integrates the innovation ability and technical ability into the curriculum package.

(3) Construction of multiple evaluation system

Undergraduate-level vocational education needs the joint participation of government, schools and enterprises. In this context, industry enterprises, governments and schools are all the direct stakeholders in the cultivation of undergraduate vocational education talents. Therefore, the evaluation committee should be jointly formed by schools, industries and social institutions to evaluate the evaluation results, so as to maximize the industrialization and socialization of the evaluation results, and the evaluation criteria should adapt to the professional needs, So as to improve the vocational adaptability of graduates. The evaluation of talent training needs to be diversified, the evaluation criteria should reflect scientific nature, the setting of evaluation indicators should reflect the specifications and requirements of high-level technical talents, and the emphasis should be on measuring students' theoretical application and knowledge conversion ability. The evaluation needs to combine the real needs of the enterprise, start from the multi-dimensions of theory, practice and innovation, and jointly examine and evaluate the students in order to maximize the correction and incentive effect of the evaluation.

(4) Form the innovative and entrepreneurial talent training mode of "collaborative education, integration of production and education"

The integration of industry and education is an important mode of vocational education. Under the background of information and innovation construction, the new generation of information technology is developing rapidly. Only relying on the resources and teachers in the school cannot fully meet the needs of high-level skilled personnel training. At the same time, compared with the vocational education at the junior

college level, the practical teaching of the vocational education at the undergraduate level needs the deep participation of enterprises more and more because of the complexity and innovation of the work of the high-level technical and technical talents it trains. This participation must be a very stable practical teaching mode of talent cultivation established between the school and the enterprise. Therefore, it is possible to introduce enterprise software and hardware resources, build training platforms, and set up a full-time and part-time teaching team by combining well-known enterprises to build information and innovation bases, industrial colleges, and other ways, so that enterprises can deeply participate in professional discipline planning, teaching design, curriculum design, and practice training, and promote the integration of enterprise needs into all aspects of talent training, so as to form a truly effective talent training mode of "collaborative education, integration of industry and education".

## 5. Summary

With the promulgation of the National Vocational Education Reform and Implementation Plan, the undergraduate level vocational education pilot colleges have been carried out nationwide, and more and more vocational colleges and researchers have begun to explore the degree construction, specialty construction, talent training, development bottleneck and implementation path of undergraduate level vocational education. This paper analyzes the new needs of enterprises for software technology talents under the background of the construction of information innovation and the vigorous development of digital economy. This paper gives the orientation of the software engineering technology specialty at the undergraduate level, and expounds the construction path of the software engineering technology specialty at the vocational undergraduate level from the four aspects of establishing the concept, curriculum system, evaluation system and talent training mode. Undergraduate vocational education is still in its infancy, and it is still worth further in-depth study in college construction, specialty construction, talent training and other aspects.

## Acknowledgment

This work was supported in part by a grant from special research project of higher vocational education in Wenzhou Polytechnic [grant number WZYGJzd202205].

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