

# Research on the Cultivation of Big Data Technology Talents in Higher Vocational Based on Studio System

Desheng Zeng<sup>1,\*</sup> Shuanglong Pang<sup>1</sup> Lihua Chen<sup>1</sup> Xiaodan Chen<sup>1</sup> Cui Shao<sup>1</sup>

Pinzhang Xie<sup>2</sup> Yufang Tang<sup>3</sup>

<sup>1</sup> Information Engineering Institute, Guangdong Innovative Technical College, Dongguan, China

<sup>2</sup> Department of Intelligent Manufacturing, Zhanjiang University of Science and Technology, Zhanjiang, China

<sup>3</sup> School of Pharmacy Engineering, Guangdong Food and Drug Vocational College, Guangzhou, China

\*Corresponding author. Email: zengdesheng@vclimbers.org

## ABSTRACT

In this paper, by drawing on the experience of vocational education such as "dual system" and "apprenticeship", we deepen school-enterprise cooperation in the process of construction and talent training of big data technology majors, and deepen the cooperation between schools and enterprises by building equipment, teachers, curriculum, teaching materials, etc. Through the reform and construction of common teaching and scientific research, the two sides will build a platform for studio education and promote the formation of a community of destiny. The aim is to improve the vocational ability of big data technology students in multiple directions through the studio education platform jointly built by schools and enterprises, cultivate more big data talents that meet the needs of enterprises and society, and then promote the reform and innovation of talent training mode of higher vocational big data technology majors.

**Keywords:** Studio system, Talent training reform, Integration of curriculum and certification, Big data technology talent training.

## 1. INTRODUCTION

### 1.1. Background

In January 2019, the State Council issued the document "National Implementation Plan for Vocational Education Development". As China enters a new stage of development, industrial upgrading and economic restructuring are accelerating, the demand for technically skilled personnel in various industries is becoming more and more urgent, and the important status and role of vocational education is becoming more and more prominent, and institutions of higher education and enterprises are the two most important subjects for training high-quality technically skilled personnel. The program proposes to promote employment and adapt to the needs of industrial development as the guide, by drawing on "dual system" and other models, summarize the modern apprenticeship system and new apprenticeship pilot experience of enterprises, vocational colleges and universities should introduce new technologies, new techniques, new norms in a timely manner according to their own characteristics and the

needs of regional industries for talents, and schools and enterprises jointly develop Talent training programs, realize the professional and industrial docking, improve the modernization of vocational education in the new era, focus on training high-quality workers and technically skilled personnel, and provide quality talent resources to support the promotion of economic and social development and improve national competitiveness<sup>[1]</sup>.

In April 2019, the Ministry of Human Resources and Social Security followed the changes in the development of new technologies and occupations, established a dynamic adjustment mechanism for occupational classification, accelerated the development of occupational standards and other requirements, accelerated the construction of a modern occupational classification system in line with international standards and in line with China's national conditions, and released the artificial intelligence engineering technicians, Internet of Things engineering technicians, big data engineering technicians, cloud computing engineering technicians and other "Cloud. Big. Things. Intelligent" related new occupational information. The Ministry of Education, the Development and Reform Commission

and other four departments then issued a notice on the implementation of the "academic certificate + several vocational skills level certificate" system in institutions, promoting the launch of the "academic certificate + several vocational skills level certificate" (referred to as 1+X certificate) (1+X certificate) system<sup>[2]</sup>.

In May 2020, Premier Li Keqiang delivered the Government Work Report at the third session of the 13th National People's Congress, deploying the work tasks for the new year, among which higher vocational colleges and universities will continue to expand their enrollment by 2 million people, with the task of cultivating more high-quality technical skills talents.

In this paper, by drawing on "dual system", "apprenticeship" and other vocational education concepts, combined with the actual situation of our school, the school and enterprises to build a studio education platform. In the process of cultivating talents in big data technology, Huawei cloud computing vocational certification is introduced, a curriculum system of class certification integration is built, the studio education platform is used, close cooperation with enterprises, research and practice of talent cultivation mode is carried out, the quality of education of majors and vocational ability of graduates are improved, and more high-quality technical skills talents meeting the needs of social and economic development are cultivated<sup>[3]</sup>.

## **1.2. Significance**

### *1.2.1. Vocational scenarios help vocational training*

With the promotion of the construction of Guangdong-Hong Kong-Macao Greater Bay Area, the construction of both regional economic and social development will expand the demand for technical skills talents in big data. Therefore, in the process of talent cultivation in big data technology, our school explores the establishment of studio education platform, closely integrating professional construction, curriculum construction, faculty construction and social services to promote reform and innovation of talent cultivation mode, design of talent cultivation program and construction of curriculum reform, and strives to improve the quality of education and enhance the employability of graduates. Relying on the school-enterprise workshop, the school-enterprise collaborative construction, the school hires excellent enterprise engineers as enterprise mentors, and combines with full-time teachers to realize double mentorship. At the same time, simulating the real working scenes of enterprises and introducing real projects of enterprises, on the one hand, the good studio atmosphere can improve students' individual learning enthusiasm, on the other hand, the realistic skill training can fully improve students' professional skills and let

them reach the requirements of enterprises' vocational ability level, so as to realize the joint training of enterprises and schools, improve the quality of talents training and achieve the goal of professional talents training<sup>[4]</sup>.

### *1.2.2. Multi-party benefits and common improvement*

At present, the integration of industry and education is a major trend in the development of vocational education. With the studio as a carrier, new technologies and techniques of enterprises are introduced into the curriculum system of professional teaching, and through the professional scene atmosphere of the studio, exchanges such as collaboration and interaction in the process of learning and training are fully utilized to strengthen the communication among enterprise instructors, professional teachers and students, improve students' sense of teamwork and cultivate their professionalism. Through the studio nurturing platform, both schools and enterprises reconstruct education and teaching concepts, reorganize curriculum system, optimize teaching methods, promote the collaborative development of students' vocational literacy and professional skills, and help improve the quality of talent training<sup>[5]</sup>.

By deepening school-enterprise cooperation through the studio platform, students can get better professional skills training, teachers can improve their teaching ability and professional technical skills, and majors can effectively connect with local industries, so that they can introduce excellent enterprise teachers and train more professional talents according to the trend of industry and technology development in time. Enterprises can participate in the whole process of talent training, so that they can get more satisfactory talents. The school can introduce enterprises and industry associations according to the trend of regional economic development to create highlights, better serve the construction of the regional economy and enhance the image and influence of the school.

## **2. OVERVIEW OF THE STUDIO SYSTEM TALENT CULTIVATION MODEL**

### *2.1. Overview of the training mode*

Most people believe that the concept of "studio" teaching mode originated from the "workshop" teaching mode of the Bauhaus Design Academy in Germany in the early 20th century. In the form of teaching, the Bauhaus Design Academy provided an open teaching and practice environment for teachers and students by appointing artists and craftsmen to teach, integrating curriculum, teaching and practice, improving students' practical ability, and allowing the results of teaching to be directly

presented in the form of products, gradually forming a new teaching model that combines art education and handicraft. The main theoretical support for the "studio" teaching model is Michael Polanyi's 1958 study on the philosophy of art and craft. After years of development and practice, the "studio system" teaching model has achieved remarkable nurturing effects in Germany and has had a profound impact on vocational education worldwide<sup>[6]</sup>.

In China, the "studio system" teaching mode was first explored and practiced in some art and design majors in the 1980s. Many vocational colleges and universities have also started to explore the reform and practice of the "studio system" teaching mode one after another. The teaching mode of "studio system" mainly goes through the following stages of development, as shown in Table 1.

**Table 1.** Main development stages of the "studio system" teaching model

Stages	Name	Location	Responsible person	Teaching Features
Stage 1	Teachers' Studio	On-campus	On-campus teachers	Based on simulation projects
Stage 2	Dual-Teacher Studio	On-campus or corporate	On-Campus teachers and company engineers	Based on real projects
Stage 3	Enterprise Workstation	Corporate	On-campus master teachers and corporate craftsmen	Real projects
Stage 4	Skill Master Studio	On-campus or corporate	Master craftsmen	Real projects

Regarding the concept of "talent training mode", most scholars in China agree to the following definition: under the guidance of certain modern education theories and educational ideas, the process of implementing talent education with relatively stable teaching contents and curriculum system, management system and evaluation methods according to specific training objectives and talent specifications. In short, talent cultivation mode refers to the cultivation objectives and cultivation specifications of talents as well as the methods or means to achieve these cultivation objectives.

By analyzing the above-mentioned documents and literature, the talent cultivation mode in higher vocational institutions should include the following five key aspects: ①implement the Party's education policy, refer to the

national professional teaching standards, and formulate the talent cultivation objectives and cultivation specifications in line with the regional economic and social development; ②systematize the work process as the guide, highlight the applicability and practicability, focus on the cultivation of vocational ability and professionalism to systematize the work process, highlight the application and practicality, focus on the cultivation of vocational ability and professionalism, and adopt a modular approach to build a professional curriculum system; ③ according to the characteristics of the training target, actively explore alternating engineering, task-driven, project-oriented, on-the-job internship and other teaching modes conducive to enhancing students' abilities; ④ promote the construction of the teaching staff, train teachers with theoretical teaching and practical teaching skills ("dual-teacher" teachers); ⑤ Strictly control the two gates of teaching standards and quality standards of graduating students, standardize the process of talent cultivation, and improve the comprehensive quality evaluation mechanism of students.

In the actual talent cultivation process, the "studio system" teaching mode has been well promoted and applied as a teaching mode that combines theory with practice and engineering. As more and more vocational colleges and universities adopt the "studio system" teaching mode, many majors are constantly exploring and practicing, and the "studio system" teaching mode has gradually formed the following characteristics: ① Taking the studio as the teaching unit to carry out teaching, communication and practice; ②build enterprise work scenes to create a professional teaching environment; ③introduce real enterprise projects and cases to transform them into project-based teaching resources; ④build high-quality teachers in school and enterprise to implement double tutor teaching. However, the "studio system" teaching mode cannot be simply equated with the "studio system" talent training mode. With the deepening reform of vocational education, more and more enterprises start to participate in talent cultivation activities. According to their own characteristics and the needs of talent cultivation, both schools and enterprises can explore and practice in talent cultivation, innovation and entrepreneurship, social services and other aspects, and promote the deep participation of enterprises in collaborative education.

By analyzing the models of "dual education" and "apprenticeship", we can make full use of the characteristics of the "studio system" mentioned above, and rely on the "studio education platform" jointly built by schools and enterprises to organically integrate the five key aspects of the talent training model, namely, objectives and specifications, curriculum system, teaching mode, teacher team and evaluation mechanism,

so as to achieve the vision of transforming the "teaching model" into the "talent training model".

## ***2.2. Organization of the studio system talent training model***

### ***2.2.1. Composition***

In the process of cultivating talents for big data majors in our university, in order to achieve the vision of transforming "studio-based teaching mode" to "studio-based talent cultivation mode", the School of Information Engineering has built the studio into a comprehensive education platform through the joint construction of school and enterprise. Combined with the concept of engineering education, the corresponding system and management documents and the stakeholders of the studio are divided into six components: studio management system, students, teachers, majors, enterprises and school: ① Studio management system: the school provides the framework management system, and in the joint construction of the studio, each major negotiates with the specific partner enterprises to formulate the entry and exit mechanism, project operation management, rewards and incentives for students and instructors of the professional studio. ② Students: as teaching objects, they are important components of the talent training process and complete professional knowledge, skills training and professionalism learning through the studio education platform during their school years; ③ Teachers: usually shared by both schools and enterprises, they realize management measures such as selection and hiring, withdrawal and reward of studio instructors according to the corresponding management system; ④ Majors: according to the corresponding management system, joint research with enterprises, develop talent training program, design curriculum system in line with studio operation, jointly build studio practical training equipment, jointly build high-quality courses, and jointly write and publish practical project-based teaching materials; ⑤ enterprises: actively participate in the whole process of talent training, and guide the cultivation of more excellent talents; ⑥ schools: according to national policies and regional economic development, absorb Schools: according to the national policy and regional economic development, absorb high-quality enterprises, industry associations, etc., and jointly train high-quality technical skills talents to create highlights and characteristics.

### ***2.2.2. Organization***

The studio provides an open practice teaching place for teachers and students. As a new talent cultivation mode, the organization form of the studio-based talent

cultivation mode is mainly reflected in the following aspects.

#### ***2.2.2.1 Management mode***

The studio is an open teaching space, and the management mode is also more open. The school formulates a framework agreement for the formation of the studio, and coordinates the mechanism of the establishment, operation and withdrawal of the studio from the school level. Each major and the partner enterprise negotiate and formulate the corresponding studio management system, clarify the process of students' participation in studio training, and specify the measures of selecting and hiring, assessing, withdrawing and rewarding tutors.

#### ***2.2.2.2 Functions of the studio***

Different from the traditional training mode, the studio system talent training mode uses the open teaching and practice platform of the studio, with more autonomy and flexibility, teachers and students in the studio have a certain "teacher-apprentice relationship", more prominent practical teaching function. As an open platform for education, the studio can be used to build enterprise scenarios and create a professional teaching environment, and it is easy to introduce enterprise projects or cases, which can be transformed into high-quality project-based teaching resources. Both teachers and students can jointly conduct scientific research, project development and innovation and entrepreneurship practice activities with enterprises, making the studio a nurturing platform integrating teaching resources, project collaboration, knowledge sharing and communication interaction.

#### ***2.2.2.3 Teaching organization***

In terms of teaching form, different from the traditional teaching form, in the studio education platform, the communication and interaction between mentor students is more specific, and the mentor can make personalized learning programs for students, so that the teaching content is more suitable for students' personal situation, more specific and closer to the development trend of new technology. In the studio, you can make full use of the professional teaching environment created, group teaching and practice, strengthen the communication between tutors and students, and between students and students, which is conducive to cultivating students' professional abilities in teamwork and other aspects.

In terms of teachers, according to the management system related to the studio, excellent professional teachers are selected to serve as on-campus mentors. The

on-campus mentors can participate in enterprise projects through the nurturing platform to obtain the improvement of teachers' shadowing skills; excellent engineers or experts from enterprises are hired to serve as enterprise mentors. In the teaching process, the enterprise mentors provide technical resources, development documents, workflow and project management experience, etc., to jointly train students and closely combine knowledge, skill practice and professionalism to comprehensively improve students' comprehensive vocational ability.

In terms of teaching evaluation, students in the studio usually work in groups to complete the corresponding project work tasks, set learning objectives according to the identified learning themes, and then complete the corresponding practical training or practice projects according to the learning objectives to enhance students' skills. In terms of teaching evaluation, it can be completed by students' self-evaluation, group mutual evaluation and tutor's review, so that students can learn to express the design ideas of their works, share the design results and improve their communication and expression skills.

Through the above analysis and our school's experience in studio construction and operation and other aspects, the framework of the construction of the studio education platform for big data technology majors is shown in Figure 1.

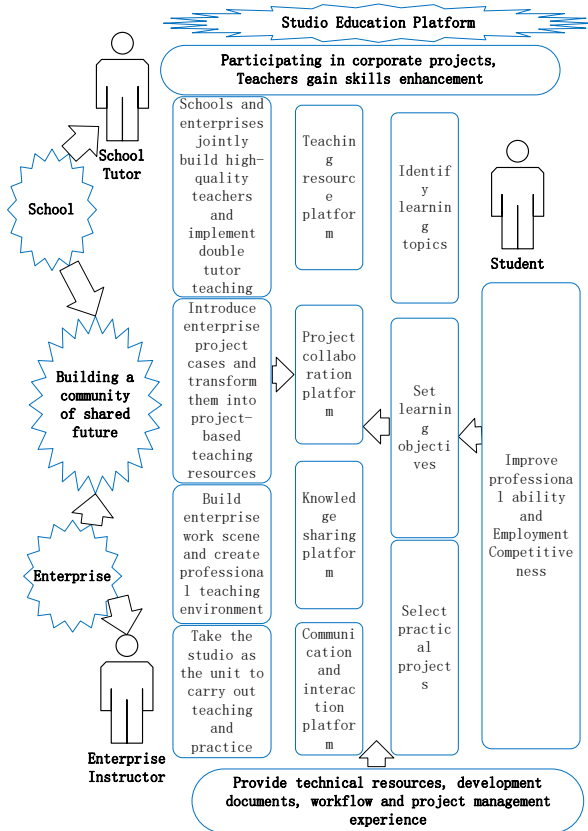


Figure 1 Framework of the education platform based on the studio system

### 3. DESIGN OF STUDIO SYSTEM TALENT TRAINING MODEL

#### 3.1. Design ideas

##### 3.1.1. Co-construction of equipment

In the process of setting up the studio, the school will provide office, study and practice places, equipped with corresponding tables and chairs, projection and other infrastructure required for study and office, and the enterprise will provide simulation software, practical training equipment, cloud access, etc. According to the working scenes of the enterprise, the studio teaching and practice places will be built together to create a good vocational teaching environment.

##### 3.1.2. Co-construction of faculty

The university and enterprises jointly develop the requirements for the construction of the studio faculty. The enterprise instructors complete pre-service training on teaching norms and teaching ability as stipulated by the school before they start their jobs. On-campus mentors regularly participate in new technology training and regularly go to enterprises for practice to improve professional and technical skills. Standardize the selection and appointment, withdrawal and incentive measures of studio tutors. Cultivate a professional backbone teacher team through mutual appointment and assignment between school and enterprise.

##### 3.1.3. Co-creation of curriculum

Higher vocational institutions mainly aim at cultivating high-quality technical skills talents. In the process of knowledge transfer, technical skills training and professionalism cultivation, the curriculum is the carrier between teachers and students. Based on typical work tasks or typical production processes of enterprises, the curriculum is jointly developed by engineers from enterprises and teachers on campus, incorporating new technologies, new processes, new norms of enterprises into the curriculum standards, and cooperating to develop curriculum teaching and practice contents that meet the needs of typical work tasks or the production line of enterprises.

##### 3.1.4. Co-creation of textbooks

On the basis of co-construction of courses, both schools and enterprises can integrate school-enterprise resources, combine the needs of regional industrial development, integrate successful cases of enterprises in the content of teaching materials, improve the interest of teaching characteristics of higher vocational students, write moderately theoretical and practical teaching

materials, and solve problems such as disconnect between curriculum and industrial needs.

### *3.1.5. Co-teaching*

In the workshop, the students are coached by the supervisor of the school and the supervisor of the enterprise, forming a "teacher-apprentice relationship". According to the teaching requirements of the curriculum, the school instructors teach students professional knowledge and basic skills, and the enterprise instructors teach production practice experience and professionalism according to the enterprise cases, so that the knowledge, skills practice and professionalism are closely integrated to improve students' comprehensive professional ability.

### *3.1.6. Co-complete scientific research*

In the studio, school instructors can introduce school research topics, and enterprise engineers can introduce enterprise research projects, so that schools and enterprises can jointly undertake topics and projects. Through the studio platform, schools can unite with enterprises and form technical consortia to jointly carry out scientific research, which not only solves problems such as production technology of enterprises, but also enhances teachers and students in technical application ability and innovation ability.

## **3.2. Design principles**

### *3.2.1. Integrate the concept of engineering education*

In the training process of big data students, we integrate engineering education concept (CDIO) from students, teachers, majors, enterprises and school stakeholders. The 12 standards of CDIO engineering education provide systematic and comprehensive guidelines for the implementation and testing of the whole model, which make the engineering education reform concrete, operable and measurable, and have important guiding significance for both students and teachers. development trend of engineering education. Both schools and enterprises, in collaboration with the construction of studio education platform, with the joint participation and determination of stakeholders, build an integrated curriculum system with the engineering background of enterprise demand and driven by engineering practice problems, so as to achieve the enhancement of students' practical ability.

### *3.2.2. Build a progressive curriculum system with integrated curriculum and certification*

First of all, the curriculum of big data majors should be adapted to the talent training objectives and training

specifications, the course content should be closely related to the actual production and labor and social practice, and the professional courses are set to cultivate students' professional knowledge, technology and skills. In the process of developing the talent training program of big data technology majors in our school, the examination syllabus of Huawei professional certification is integrated, which not only highlights the applicability and practicality, but also focuses on the comprehensive cultivation of students' professional ability and professional spirit.

Secondly, according to the idea of systematic orientation based on the work process, the required knowledge, technology, skills, literacy and other elements are deconstructed to improve the curriculum system based on the main line of work process requirements of the job. The project course of typical work tasks is a course starting from the work tasks of real occupational positions, in the work tasks to train students' job career comprehensive ability and level, the integration of enterprise job work process and students' school learning process with students' learning ability and personalized professional development, students through learning while doing, engineering integration, top internship and other teaching courses, so that the students' comprehensive ability and vocational job demand Through the teaching courses of learning by doing, engineering integration and on-the-job internship, the students' comprehensive ability will be connected with the needs of vocational positions, and the training of vocational skills training, job adaptability, technical application ability and innovation ability will be highlighted and run through the whole teaching process.

Finally, in the teaching process, each training mode has a specific combination of forms and objectives, and a universal training mode does not exist. Therefore, the examination syllabus of Huawei professional certification can be implemented into the whole process of talent training, and fully consider the characteristics of students in different grades, different learning levels and different levels, adopt different teaching methods, set different teaching objectives on the basis of ensuring students' professional core courses, appropriately adjust the course evaluation standards, establish a curriculum system with the integration of layered sectional teaching, improve students' The students' learning initiative and enthusiasm, and realize the progressive talent cultivation.

## **4. DESIGN OF TALENT TRAINING PROGRAM OF STUDIO SYSTEM**

### *4.1. Analysis of the career orientation of big data majors*

With the continuous promotion of the economic construction of Guangdong-Hong Kong-Macao Bay Area and the rapid development of new technologies

such as cloud computing and big data, the demand for traditional network management, operation and maintenance and other related positions in the computer-related industries is decreasing year by year, and the comprehensive positions such as system planning and construction, development and maintenance related to cloud computing and big data are increasing year by year.

In order to make the talent training program closely combine with the economic development of Guangdong-Hong Kong-Macao Bay Area and adapt to the needs of regional industrial transformation and upgrading, the school and enterprises jointly carry out talent demand research, timely track the changes of market demand for talents, grasp the changes of industrial structure adjustment on the demand for talents of higher vocational big data, analyze the current situation and trend of development of relevant industries in the region, the situation of practitioners, major vocational positions and corresponding vocational qualifications, etc., so that the positioning of big data technology majors is more scientific and accurate, and the goal of talent training is more in line with market demand, and timely adjustment of talent training mode, curriculum system and other contents.

#### *4.1.1. Career orientation*

According to the relevant planning of the Greater Bay Area and the above-mentioned research, taking into full consideration the current situation and trend of the development of the relevant industries in the Pearl River Delta region, combined with the orientation of our school, combined with the "Teaching Standards for Higher Vocational Schools" issued by the Ministry of Education, and referring to the teaching standards of the relevant professions such as accounting, networking, software and cloud computing in the electronic information category, the career orientation and the main qualification catalog of our big data technology major are selected.

#### *4.1.2. Job Competence Analysis*

Making full use of Huawei Information and Network Technology Institute's authorization of courses in big data and cloud computing, in the process of training talents in big data technology, big data system construction and operation and maintenance are selected as the main jobs for graduates, who are mainly engaged in the construction, development, operation and maintenance of big data systems on Hadoop platform and Kunpeng platform and big data resource management, which will be defined as "Big Data Engineer". According to the process of transforming career action fields into learning fields, according to the career information of "Big Data Engineer and Technician (2-02-10-11)" issued by the Ministry of Human Resources and Social Security,

and considering the learning ability and career development of senior vocational students, the "1+X" certificate was selected. The "1+X" certificate pilot has not yet taken the opportunity to select Huawei professional certification with high technical content and more mature as the entry point, and fully integrate the learning contents of the primary and intermediate examination syllabus of HCIA (primary), HCIP (intermediate) and HCIE (advanced) related to big data into the professional curriculum system to improve the quality of talent training. In the design of the curriculum system, the focus is on building the learning areas of big data system construction, operation and maintenance and big data development. Based on this, the analysis of the vocational ability of "Big Data Engineer".

### ***4.2. Design of training objectives and training specifications***

#### *4.2.1. Talent Training Objectives*

Cultivate students with strong ideology and politics, moral and technical training, comprehensive development, adapt to the development of economic construction in Guangdong, Hong Kong and Macao Bay Area, especially the development needs of electronic information industry in Dongguan City, have a correct world view, outlook on life and values, have a certain international perspective, innovation consciousness, entrepreneurial spirit, good professional ethics, master network planning and construction and operation and maintenance management, big data project deployment, implementation, maintenance, etc. Professional knowledge and skills for small and medium-sized computer enterprises, IDC industry and the emerging big data technology, artificial intelligence and other fields, can be engaged in the network system, big data system construction and management, big data system construction, development and resource management, maintenance and security management and other jobs of high-quality technical skills.

#### *4.2.2. Talent training specifications*

The cultivation specifications of the big data technology major are composed of three aspects: quality, knowledge and ability, as shown in Table 4.

##### *4.2.2.1. Quality Objectives*

1. have the basic cultural knowledge and professional ethics and legal awareness necessary for the profession;
2. have good professional ethics and professional conduct;
3. have a strong organizational concept and a strong sense of teamwork;
4. strong execution ability and high efficiency and safety consciousness;
5. Have certain professional innovation ability and enterprising spirit.



4.2.2.2. Knowledge Objectives

1. master the basic knowledge of computer; 2. knowledge of computer network management; 3. knowledge of programming and database system; 4. Knowledge of Linux operating system; 5. master the basic knowledge of engineering project management; 6. mastering the basic knowledge of cloud computing, big data and other new technology fields; 7. master the basic knowledge of network security.

4.2.2.3. Competency Objectives

1. Have the ability to configure, manage and maintain computer equipment; 2. Have the ability to configure and debug common network devices and troubleshoot and diagnose network devices; 3. Have the ability to use CentOS, Rocky Linux and other operating systems to build servers, set up and maintain network facilities and have the ability to manage and protect network security; 4. Have the ability to use Fusion and other virtualization platforms and tools to achieve the deployment and implementation of the integration of server resources.; 5. Have the ability to deploy and implement products and tools using the corresponding Hadoop and other big data platforms; 6. have the ability to use the big data platform to complete the development of big data applications; 7. have the basic information security prevention ability and the ability to deploy and implement information security systems; 8. Have the basic ability to provide project planning and design, pre-sales and after-sales technical support for the scope of the profession.

**4.3. Design of the curriculum system for the integration of courses and certificates**

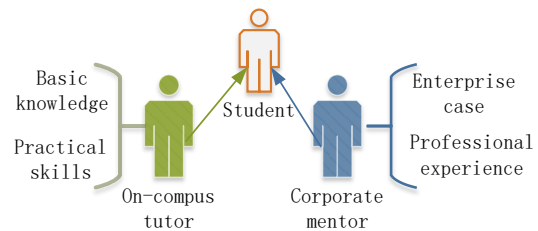
By analyzing the characteristics of higher vocational students, combining the relevant standards of Huawei's professional certification, making full use of the high-quality curriculum resources of Huawei School of Information and Network Technology for professional certification, and taking the professional ability cultivation demand of "Big Data Engineer" as the core, the examination syllabus of Huawei's Big Data professional certification is integrated into the professional curriculum system, and the professional curriculum system of class certification integration is constructed in a tiered and segmented way.

According to the requirements of the training specifications, the public quality courses and some professional foundation courses are completed in the first two semesters, the professional foundation courses are completed in the second three semesters, the professional core courses are completed in the third four semesters, the professional development courses are completed in the fifth semester, and the pre-job comprehensive

training, graduation design and on-the-job internship are completed in the sixth semester.

**4.4. Teaching mode**

In the studio environment, the school tutor and enterprise tutor are integrated, and the open teaching practice environment of the studio is used to integrate the concept of apprenticeship, as a new type of "teacher-apprentice" relationship, to strengthen the communication, exploration and collaboration between "teacher-apprentice" and innovative practice, and to build "Double tutor" teaching mode. On-campus instructors teach students basic knowledge and professional practical skills according to the curriculum standards of relevant courses, while enterprise instructors introduce enterprise cases and professional experience to teach production practice experience and professional literacy, closely combining knowledge, skills practice and professional literacy to improve students' comprehensive professional ability, as shown in Figure 2.



**Figure 2 Dual-tutor teaching mode**

**4.5. "Dual-qualification teacher" team building**

*4.5.1. Cultivate "dual-teacher" teachers by using the studio cultivation platform*

By the incentive and subsidy policies formulated by both schools and enterprises, such as class time subsidy, transportation subsidy, etc., we make full use of the studio cultivation platform to introduce enterprise experts, enterprise engineers and technical backbones, and hire high-quality enterprise instructors for practical training classes and internship guidance. At the same time, we select professional backbone teachers to participate in enterprise practice during holidays to improve their professional and technical abilities, so as to optimize the teacher team and build an excellent "dual-teacher" teacher team.

*4.5.2. Participate in Huawei official teacher certification*

Huawei Institute of Information and Network Technology provides official teacher training services for authorized courses during the summer and winter, i.e., Huawei Certified College Instructor, which is based on



professional certification and focuses on examining teachers' engineering practice ability.

**4.6. Evaluation and assessment mechanism**

**4.6.1. Process assessment and evaluation**

In the process of cultivating talents in big data technology, the assessment and evaluation of the course, breaking the traditional assessment and evaluation method, taking the "vocational ability" demand as the core, and adopting the process assessment method for reform practice. According to the characteristics and nature of the course, the course teaching team jointly draws up the assessment content, adopts the practical-oriented assessment content, and designs the "N+1" process assessment and evaluation method, in which "N" is the number of assessments in the teaching process, and "1" is the final examination. "1" is the final examination. "The number of assessments in the "N+1" mode is set to  $3 \leq N \leq 5$  according to the credit and credit hour arrangement of the course to examine the students' hands-on practical ability. The results of "N" process examinations in the course, in appropriate proportion with other contents such as class tests and attendance rate, constitute the "ordinary grade" part, and the results of "1" final examination constitute the "final grade" part, and appropriately increase the percentage of the stage examinations in the overall final evaluation grade. The percentage of the examinations in the overall final evaluation grade is appropriately increased, generally set at 50%-60%, and can be increased up to 70% if the number of hours arranged for the course is large.

**4.6.2. Credit recognition and replacement**

In the professional curriculum system, the certification syllabus related to Huawei Professional Certification (Big Data) is integrated, HCIA mainly focuses on theoretical assessment, HCIP takes into account both theoretical and practical assessment, and the certification of HCIE includes written test, experiment and interview. According to the school-level "Credit Recognition and Replacement Management Measures" and other institutional documents, in the process of talent cultivation, the "certificate" and the corresponding course learning results can be recognized and converted. At the end of the courses related to the examination syllabus, if students have already obtained the corresponding certificates, they can apply for exemptions from part of the assessment content of the corresponding courses. According to the aforementioned curriculum system and the content of professional certification, the recognition of substitution table is shown in Table 2.

**Table 2.** Credit Recognition Replacement Form

Certification	Associated Courses	Theoretical Assessment Requirements	Practical assessment requirements
HCIA-Big Data	Big Data Technology Fundamentals	Exemption from examination	Big Data System Deployment Training
HCIP-Big Data Developer	Big Data Development Technologies	Exemption from examination	Big Data Development Training
HCIP-Big Data Developer	Real-time data processing techniques	Exemption from examination	None
HCIP-Big Data-Data Mining	Python Crawler Application Development	Exemption from examination	Crawler Application Development Training
HCIP-Big Data-Data Mining	Data Mining	Exemption from examination	None

**5. REFORM AND PRACTICE**

In 2015, the Information Engineering Institute carried out the construction of school-enterprise studios and actively explored the practical application of the "studio system" teaching mode in the teaching of core courses of computer-related majors. We have built 7 studios, including Science and Innovation Development Center of School of Information Engineering, Animation Film and Television Center of School of Information Engineering (Project R&D and Production Training Center of Comic-Con), School-Enterprise Student Creative Space (Yueqian Company), Innovation Studio of Tengke Company and CDIO Studio of Xinyingda. Under the guidance of the school-enterprise mentors, they have completed various practical projects and trained more than 800 students, including "Tengke's primary and secondary school campus network cloud computing solution design", "Lakeview The total number of social service projects completed is 48, and the total amount of funds obtained from social service projects and horizontal projects of enterprises is RMB 782,300. We make use of the good atmosphere of the studio to cultivate students' professional skills, and actively organize outstanding students to participate in "Computer Network Application", "Cloud Computing Technology and Application", "Web Front-end

Development", "Software Testing", and "Software Testing". "In the past 5 years, we have won 32 awards in provincial competitions.

In 2017, the Information Engineering Institute started to launch the construction related to big data majors, introduce and train big data teachers, and carry out the construction of Hadoop and other curriculum resources. 2019 was approved by the Guangdong Provincial Department of Education to establish a big data technology major, and actively carry out construction tasks in professional construction, teaching reform and curriculum resources through the completed studio nurturing platform. In the past three years, the teaching team of big data majors has made full use of the nurturing platform to jointly declare the natural science research topics of Guangdong Provincial Department of Education and Guangdong Provincial Education Science Planning Topics, and has been approved a total of 11 research topics in cloud computing, data mining, microservices, software-defined storage, software-defined networking and talent training research, among which the cooperative enterprises have provided research grants of 235,000 yuan. Through joint efforts, teachers and students have made good achievements in textbook research, including publishing 32 textbook research papers on related topics, including 5 EI retrievals and 1 SCI retrieval, declaring and obtaining 9 software copyrights and 4 utility model patents authorized. The teaching team has developed 11 project-based teaching materials through the studio education platform, such as "Java Programming Tutorial", "Cloud Computing Technology and Application", "Linux Application Foundation Project-based Tutorial", etc. The total number of printed copies is 53,710, and the teaching materials have been adopted by many institutions such as Nanjing Vocational University of Industry Technology and Fuzhou Polytechnic.

## 6. CONCLUSION

In the talent training process of big data technology based on studio system, by taking students' "vocational ability" cultivation as the breakthrough, using the vocational teaching environment built by the studio, adopting excellent teaching resources transformed by enterprise projects and cases, and under the joint guidance of school-enterprise dual tutors, students can get better skills training and vocational ability cultivation, so as to improve graduates' employability. Under the joint guidance of school-enterprise instructors, students can get better skills training and vocational training, and achieve the purpose of improving the employment competitiveness of graduates. In terms of faculty construction, instructors improve their personal education and teaching level or professional and technical ability by participating in enterprise projects and corresponding professional and curriculum reform

practices. In terms of professional construction, majors carry out in-depth cooperation with enterprises, absorb and introduce excellent enterprise teachers according to the trend of industry and new technology development, jointly carry out teaching resource construction, train more excellent students and enhance the ability of professional service industry. On the enterprise side, enterprises can participate in the whole process of talent training through the education platform and get more excellent talents. In terms of school construction, they can make full use of the nurturing platform to introduce excellent enterprises and industrial associations to create school highlights, form their own characteristics, and further enhance the image and influence of the school. Therefore, the nurturing model based on studio system has good application value and promotion significance, which can provide reference for other similar institutions' reform and practice.

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