Study of the Construction Method of Industrial Institute Based on "3+1" University-Enterprise Cooperation Mode

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Abstract. At present, China's policy requirements, economic development status, industry status and university education situation all put forward requirements for high-quality application-oriented, composite and innovative talents. Industrial institute construction is an important way for local application-oriented universities to grasp the strategic opportunity period of national development and provide support for high-quality economic development. On the basis of the above status quo, the concepts of "Education as the foundation", "Close integration as the path", "The combination of multi-angle construction method" and "Insisting on innovation and development" reflect the rationality. Industrial institute construction method based on the "3+1" university-enterprise cooperation mode and supplemented by multi-angle construction measures follows the concepts. Through the case of industrial institute construction between Kunming University and Beijing Zhongguancun Industrial Park in computer science, this method is a highly innovative, feasible and effective development direction of industrial institute construction in computer science subject.

Keywords: Industrial Institute · "3+1" University-enterprise Cooperation Mode · Multi-angle Industrial Institute Construction Measures · Computer Education · Local Application-oriented University

1 Introduction

At present, China's domestic and external situation is facing drastic changes, so crisis and opportunity coexist. Higher education in today's era should firmly grasp the opportunity period of national development strategy and provide support for high-quality economic development. Therefore, Local Application-oriented Colleges and universities need to recognize the important role of enterprises in education and cultivate a large number of high-quality application-oriented, compound and innovative talents to adapt to the industry. Constructing an industrial institute is an effective way to achieve this goal [1–3]. University-enterprise cooperation can cultivate high-quality talents [4–6], and promote

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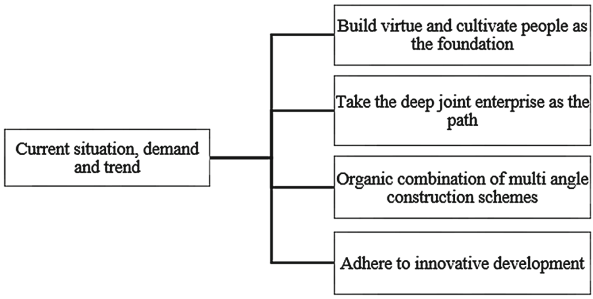

Fig. 1. Industrial Institute Construction Concept Architecture Diagram

the mutual promotion and improvement between universities and enterprises [7–9]. It is an important way to build an industrial institute. This paper discusses the concept of the construction of the industrial institute, based on the "3+1" university-enterprise cooperation mode and supplemented by multi-angle industrial institute construction measures, this paper puts forward the construction method of industrial institute, and takes the construction of Kunming college and Zhongguancun Software Park Industrial Institute as cases to test and confirm, and then puts forward conclusions and countermeasure suggestions.

2 Construction Concept of Industrial Institute

Grasping the concept of the construction of industrial institutes in colleges and universities is the top priority to establish and improve the talent cultivation ability of colleges and universities. For this reason, combined with policy requirements [10], economic development [11], industry status [12] and education and teaching experience [13], this paper uses the following concepts as the guidance for the construction of industrial institutes. Our conceptual framework for the construction of industrial colleges is shown in Fig. 1.

(1) *Build virtue and cultivate people as the foundation*

With talent training as the core, clarify the supply-side position of talent training and the demand-side position of the industry, achieve an organic balance between the depth and breadth of the curriculum in practice, consolidate the foundation, progressive progression, strict assessment, cultivate an innovation and entrepreneurship education atmosphere, and cultivate high-quality talents.

(2) *Take the deep joint enterprise as the path*

Focusing on industry and enterprises, while deeply combining higher education with industrial chain and innovation chain, give full play to the advantageous disciplines and resources of colleges and universities, scientifically position the training objectives, and achieve a goal oriented university-enterprise cooperation mode in the direction of promoting industrial and economic development, so as to achieve in-depth integration and open up the "last mile" of the construction of industrial institute.

(3) *Organic combination of multi-angle construction schemes*

Adhere to the integration of production and education, while paying attention to talent training, combined with the training of double qualified teachers, the construction of laboratories and teaching platforms, scientific research cooperation, resource sharing and other measures, adhere to the integration of production, learning, research, transfer, innovation and application, and realize the platform construction of talent training.

(4) *Adhere to innovative development*

Adhere to the innovation of teaching mode, build a new talent training mode under the background of application-oriented transformation, and build a unique curriculum system. Adhere to the innovation of management mode, gather the strength of the government, associations, enterprises and other parties, and coordinate the resources of industry, education, scientific research and other parties. Explore a sustainable, connotative and diversified pathway for the cultivation of innovative talents.

3 Explanation on the Construction Method

Based on the above concepts. This paper proposes a construction method for the industrial institute of computer science based on the "3+1" university-enterprise cooperation mode and supplemented by multi-angle industrial institute construction measures. This method covers the education and teaching of students in the four-year university system in breadth, and then extends to enrollment, teacher training, scientific research cooperation, etc. In terms of depth, it is different from the traditional university-enterprise cooperation and the construction of industrial institutes, which often only stay in some lectures or short-term internships for senior students, it is difficult to achieve in-depth integration of the status quo. We strive to achieve in-depth cooperation and open up the "last mile" of the construction of Industrial Institute. The specific contents are as follows, and the structure is shown in Fig. 2.

3.1 "3+1" University-Enterprise Cooperation Mode

"3+1" university-enterprise cooperation mode, that is, during the four-year undergraduate education period, the first three years are jointly cultivated by the university and the enterprise to educate in the university, and the fourth year's engineering practice education is carried out in the enterprise. This mode is highly innovative and aims to solve the disadvantages of the traditional university-enterprise cooperation mode of short time and shallow degree. Its specific measures are as follows.

(1) *University-enterprise jointly complete the development of training programs*

Both the university and the enterprise jointly determine the professional curriculum, introduce enterprise courses and embed them into the curriculum system of relevant majors. Jointly determine the professional training plan, jointly formulate the education and teaching plan, cooperate to establish the internship training plan, identify relevant measures for career guidance and services.

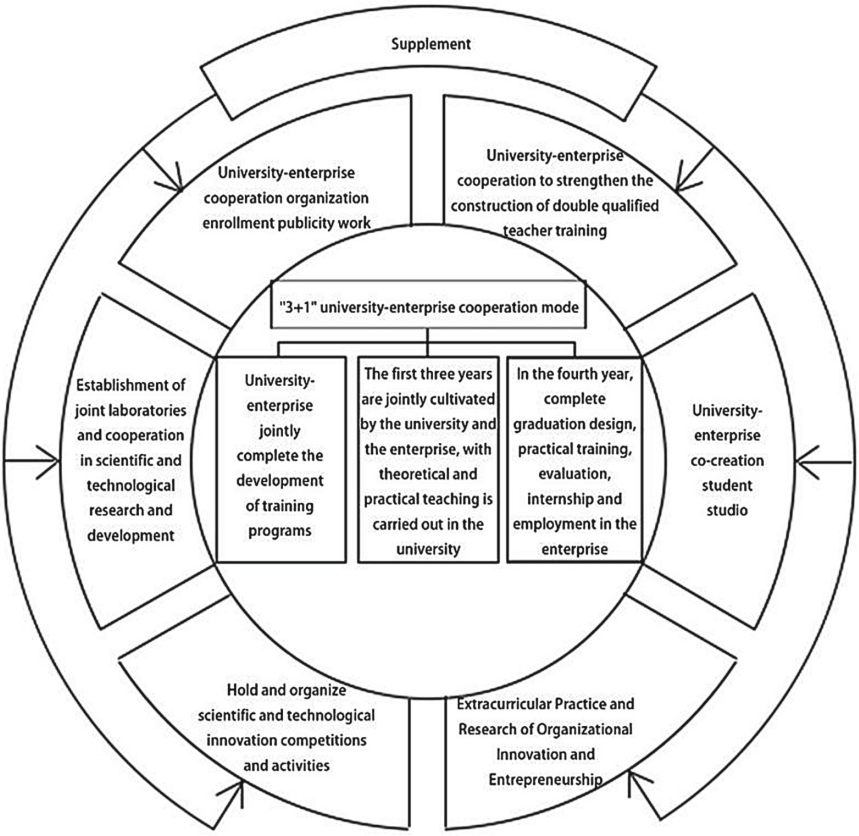

Fig. 2. Structure diagram of construction method of Industrial Institute

(2) *The first three years are jointly cultivated by the university and the enterprise, with theoretical and practical teaching is carried out in the university*

Students begin to accept the corporate culture and pay attention to the development of the industry since the first semester. Both the university and the enterprise cooperate to complete the course teaching. Among them, the enterprise is responsible for practical training courses, workplace training courses and professional courses related to the enterprise. The university is responsible for basic courses and professional courses with shallow relationship with enterprises, and integrates enterprise engineering practice courses and vocational quality education into theoretical teaching.

Both parties jointly plan the training bases inside and outside the university, adopt the enterprise mode management, through learning and practice in the training base, let students understand the development prospects of the industry, let students understand the development prospects of the industry, experience the learning and living environment of the industry up close, and stimulate their enthusiasm for learning.

Adhere to both classroom and extracurricular teaching, strengthen extracurricular self-study and training, and strictly carry out semester course examinations; Insist on paying equal attention to theory and practice, on the basis of reasonably constructing the core knowledge structure for students, start from standardized experimental operation and transition to comprehensive design. Pay special attention to the analysis, design, implementation and expansion of the software and hardware large-scale system in key courses. Strictly carry out the experimental inspection, acceptance and defense to ensure the teaching quality.

(3) *In the fourth year, complete graduation design, practical training, evaluation, internship and employment in the enterprise*

In the fourth year, students complete their graduation projects in enterprises and complete practical training according to the internal and external conditions that meet the requirements of universities and enterprises. After assessment, enterprises shall issue professional ability test reports, and then provide internship recommendations. Finally, enterprises complete employment education and services. Make students feel the corporate culture and workplace experience, enhance their sense of identity to work in enterprises, improve their professional ability, and promote students' smooth employment.

The "3+1" university-enterprise cooperation mode adheres to the concept of building morality and cultivating people as the foundation, it has realized the in-depth combination with the enterprise, so that the foundation is to build virtue and cultivate people, and the deep integration of enterprises is the path, which is more in line with the above four concepts and has a solid theoretical foundation and high innovation.

3.2 Multi-angle Industrial Institute Construction Measures

In order to establish a sound and perfect construction method of industrial institutes, in addition to the "3+1" model, it is also necessary to carry out multi-angle construction measures as a supplement to enhance the breadth, depth and integrity of the construction of industrial institutes. The specific measures are as follows:

(1) *University-enterprise cooperation to strengthen the construction of double qualified teacher training*

The university has developed a dual qualification teacher training system, issued policies on Teachers' participation in training, further education and study visits, encouraged teachers to participate in teacher training courses organized by the university and enterprises, enterprises regularly carry out collective training in professional skills, focusing on the essential knowledge of innovation and entrepreneurship, core general ability and special job ability, and arrange teachers with cooperative professional direction to enter the enterprise for practice.

(2) *University-enterprise co-creation student studio*

Based on the diversified industrial institute, making full use of the university-enterprise cooperation projects, enterprise teachers and advanced ideas, the university teachers and enterprise engineers jointly set up student studios, so that students can participate in project development, practical training and team cooperation

according to their interests in the university. Students can choose their own studio, participate in real project training according to project and task. They are not limited to majors and break professional barriers.

(3) *Extracurricular practice and research on organizational innovation and entrepreneurship*

In order to speed up the construction of application-oriented transformation development, improve students' practical innovation ability. Through scientific and technological innovation activities such as scientific research project establishment, discipline competition, patent application, achievement transfer, project incubation, etc. students' interest in learning, research, innovation and entrepreneurship is stimulated, and students' spirit of independent thinking, independent development, free exploration and innovation is cultivated.

(4) *Hold and organize scientific and technological innovation competitions and activities*

Hold, organize and guide students to participate in various competitions, take competitions as a platform, integrate with practical teaching, actively explore new ways to improve students' innovation and application ability, and carry out innovative practical teaching reform. In this way, the principle of "student-centered" should be implemented to realize the individualization of innovation and practical teaching.

(5) *Establishment of joint laboratories and cooperation in scientific and technological research and development*

The University and the enterprise shall establish joint laboratories, build teaching and research centers for cutting-edge technical talents, adopt the enterprise management mode to organize teachers and students to carry out engineering project practice and technology research and development. The two sides will carry out various forms of cooperative research work in the fields of enterprise scientific and technological innovation, technological breakthroughs, so as to promote the scientific and technological innovation strength of both sides to reach a higher level.

(6) *University-enterprise cooperation organization enrollment publicity work*

Send teachers and experts to potential student source areas and actively carry out enrollment publicity for major potential student source units. University-enterprise shall coordinate and cooperate with each other in the enrollment publicity work and actively cooperate with each other.

The multi-angle industrial institute construction measures, while taking into account the concept of cultivating talents by virtue and the concept of in-depth cooperation, are organically combined with the university-enterprise cooperation plan to form a unified whole, striving to achieve the integration of production, learning, research, transfer, innovation and application, and paying attention to the cultivation of students' innovation ability. They are a powerful supplement to the construction method of industrial institutes, fully mobilizing the complementarity of University-enterprise resources, and improving the integrity of the method.

4 A Case Study on the Industrial Institute Construction

The construction method of the industrial institute proposed in this paper is guided by four concepts, with the "3+1" university-enterprise cooperation mode and multi-angle construction measures as the specific content, and finally settled in the construction practice of the industrial institute between Kunming University and Beijing Zhongguancun Industrial Park. Now this case will be analyzed to discuss and verify the method of constructing the industrial institute in this paper.

(1) *Establishment of cooperation and formulation of training plans*

In response to the August 2010 "Outline of National Medium- and Long-Term Education Development and Reform", the "Decision on Accelerating the Development of Modern Vocational Education" in May 2014, and the Yunnan Provincial Department of Education's "Notice on the Evaluation of the Transformation and Development of Applied Undergraduate Transformation Pilot Universities" in the spirit of other documents, based on the background that Kunming University was listed as one of the first batch of Pilot Universities for overall transformation and development in 2014, Kunming University actively explored the development idea of application-oriented transformation in the transformation attempt, and carried out the construction of computer industry college with Zhongguancun Software Park, signed a series of agreements from 2015 to 2016, formally reaching cooperation.

The two parties jointly formulate the software engineering professional talent training plan, introduce enterprise courses and embed them into the software engineering professional curriculum system. Zhongguancun Software Park provides a curriculum system for big data and software development, and undertakes courses such as entrance education, innovation and entrepreneurship courses, professional course training, enterprise induction training, employment training. It also undertakes software engineering professional enterprise courses: website construction and design, Java Object-oriented programming, JavaWeb programming and so on; Enterprise courses in software development direction: Java advanced development, RIA application, Spring advanced development; Big data oriented enterprise courses: Shell programming technology, Hadoop big data processing technology, SQL and Oracle business development, etc.

(2) *Collaborate to carry out admissions promotion work*

In June 2016, teachers from Kunming College and industry experts from Zhongguancun went deep into Dali, Qujing and other places to carry out university-enterprise cooperation software engineering co-construction professional enrollment publicity. All student source units showed great interest in its development prospects and employment orientation, while played a positive role in completing the enrollment. In 2016, they began to recruit the first batch of students majoring in software engineering co-construction.

(3) *Launch of the "3+1" university-enterprise cooperation mode*

During the period of student training, Zhongguancun Industrial Park is responsible for introducing the engineering practice education system, and jointly launching the "3+1" university-enterprise cooperation mode with Kunming University. In the first three years, it has completed the on campus training, with no less than 24 class

hours in the first year, no less than 240 class hours in the second year, and no less than 240 class hours in the third year. In the fourth year, the students started practical training in the engineering practice education center established by the two sides. Zhongguancun guides students to complete the graduation design, and conducts pre-job training of no less than 424 h. After that, a professional ability test report is given to the students who pass the assessment. Zhongguancun conducts corporate internship recommendation to ensure that the company provides students with various benefits equivalent to interns, and then completes employment guidance and employment recommendation to provide assistance for students' employment.

(4) *Continuously deepening the construction of multi-angle industrial institute*

Since 2016, the two sides have cooperated in various fields: the university and enterprise jointly built 22 student studios; Build joint laboratories, on campus and off campus training bases and teaching and research centers, and organize teachers and students to carry out engineering project practice and technology research and development; Cooperate in scientific and technological research and development, and carry out various forms of research in the fields of scientific and technological innovation and technological breakthrough; Zhongguancun Software Park regularly organizes enterprise engineers and industry experts to evaluate teaching effects, and Kunming University arranges teachers to go to Zhongguancun Software Park to conduct IT enterprise practice; At the same time, the college has formulated a dual-qualified teacher training system, and introduced policies for teachers to participate in training, further education, and visiting studies. Encourage teachers to participate in teacher training courses organized by the college and enterprises in Zhongguancun Software Park, and cultivate teaching teams that adapt to the application-oriented teaching reform as soon as possible.

For non-university-enterprise cooperation students, the university also adheres to the concept of close cooperation with enterprises and actively carries out joint teaching. In July 2016, the university selected 21 outstanding students of all grades to carry out experiential internships in Beijing Zhongguancun Software Park. In February 2017, 17 of the 2017 graduates went to Zhongguancun Software Park for a one-month internship. For teachers and industry experts, the two sides have actively carried out mutual guidance, exchange and learning. For example, in November 2016, Kunming University selected teachers to participate in the innovation and entrepreneurship education training held in Zhongguancun Software Park. Zhaoquanli, director of Zhongguancun Software Park Engineering Practice Education Development Center, conducted entrance education for software engineering freshmen. At the end of the semester, he assigned three enterprise teachers to carry out a week-long professional comprehensive training. In order to accelerate the application-oriented transformation and development and improve the construction of students' practical innovation ability, the college has successively established student innovation and entrepreneurship platforms such as zhishuo Bonnie, ToStart, the Internet of things, intelligent agriculture, smart cars, Oracle club, etc. In October 2016, the Institute of information technology held a work exchange meeting on the innovation and entrepreneurship platform. In March 2017, the university joint

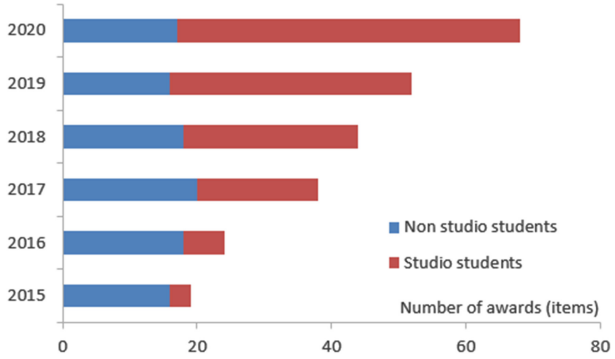

Fig. 3. Trend chart of the number of students winning national, provincial and ministerial awards

current education center, held the "zhishuo" maintenance service launch conference of the university of information technology to create an upgraded version of information system maintenance for the whole university.

For various disciplines and professional competitions, the institute of industry has achieved good results. The university-enterprise co-construction of 22 student studios has achieved more significant results. Students participated in competitions such as the "Internet + Innovation and Entrepreneurship Competition" and won a total of 239 national, provincial and ministerial awards, and the number of awards has increased year by year. A total of 1,289 students participated in the studio. Students won the first place in intellectual property rights and published 98 papers. 98% of students graduate with a relevant vocational qualification or level certificate. According to statistics, from 2015 to 2020, the number and proportion of awards obtained by student studios has increased rapidly, reflecting the good results achieved by student studios. Figure 3 shows the trend of students' winning awards from 2015 to 2020.

(5) *"3+1" university-enterprise cooperation mode and other construction modes have achieved phased results*

The first batch of students majoring in software engineering and university-enterprise cooperation in Beijing Zhongguancun Software Park will study in Beijing in September 2019. Students are engaged in internship and pre-employment as test engineer, development engineer, operation and maintenance engineer, crawler engineer and Implementation Engineer in AsiaInfo Technology Co., Ltd., UFIDA Network Technology Co., Ltd., Beijing Baidu Netcom Technology Co., Ltd., digital China Group Co., Ltd., Beijing Sohu New Media Information Technology Co., Ltd., etc. In the end, good phased results have been achieved in employment.

5 Conclusions

This paper combines the current policy requirements, economic situation, industry status and education and teaching experience. With the concepts of "Education as the foundation", "Deep joint enterprise as the path", "The combination of multi-angle construction method" and "Insisting on innovation and development", this paper puts forward a method of constructing an industrial institute based on the "3+1" university-enterprise cooperation mode, supplemented by multi-angle measures for the construction of an industrial institute. The "3+1" university-enterprise cooperation mode is the innovation and breakthrough of this method. It strives to realize the deep integration of university-enterprise cooperation, and colleges and universities give full play to the strength of both sides. The construction measures of multi-angle industrial institutes are a powerful supplement to this method. It implements the concept of integration of production, learning, research, transfer, innovation and application, and consolidates and promotes the integrity, unity and developability of the construction method of industrial institutes. Furthermore, this paper takes the construction work of Kunming University and Beijing Zhongguancun Industrial Park Industrial Institute as an example to explain, verify and practice the method. To sum up, the theory of this method has high rationality, and at the same time, the theory is well implemented. It has shown high feasibility and effectiveness in practice, and has achieved relatively successful phased results.

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