

Empirical Study on the Integration of Industry and Education in Suzhou Optoelectronic Industry

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Abstract: Based on the case analysis of the integration of industry and education in Suzhou optoelectronic industry, the implementation approach, operation mode and practical effect of the integration of industry and education are analyzed and studied. The results show that the Optoelectronic industry in Suzhou has combined with the professional (group) construction of vocational colleges and actively developed the new mode of multi-agent, multi-form and diversified vocational education through the establishment of industry-education integration service organization, improved the quality of skilled personnel training and the precision of service for the optical communication industry, and promoted the coordinated development of the industry and vocational education.

Keywords: School enterprise cooperation, integration of industries and education, professional (group), skilled talents training.

1. Introduction

Up date, China have built the world's largest vocational education system. In 2021, vocational schools will recruit 5.57 million students, 1.8 times as many as ten years ago; Secondary vocational schools (excluding technical schools) recruited 4.89 million students. The secondary and higher vocational schools cultivate about 10 million high-quality technical and skilled talents every year, providing a steady stream of talent dividends for the industrial economy. According to statistics, in the fields of modern manufacturing, strategic emerging industries and modern service industries, more than 70% of the new front-line employees in China come from vocational school graduates.

In the face of the new situation of the development of the digital economy, China's vocational education actively explores new ways to integrate vocational education, talent training and industries[1], realizes the organic connection of education chain, talent chain, industry chain and innovation chain [2]. The new mode of innovative integration of industry and education is the focus for academic research, and it is also the new trend of industrial practice in various regions [3].

Suzhou, where high-tech industries are clustered, gives full play to the guidance role of the government, relies on industry associations and chambers of commerce, actively supports the industry to establish a diversified industry education integration service organization entity, explores diversified vocational education, and forms a new mode of industry education integration with characteristics. Taking the practice of industry education integration in Suzhou optoelectronic industries as a case, this paper conducts an empirical study on the implementation approach, governance operation mode and practical effect of industries education integration, providing referential experience for building a new model of high-quality vocational education.

2. Practices of The Integration of Industry and Education for Suzhou Optoelectronic Industries

As a major industrial city in China, Suzhou has a good foundation for the development of optical communication industry. It has established a complete optical communication industry chain and has gradually expanded to optoelectronic display, optical equipment, etc. The optoelectronic

industries has become one of Suzhou's top ten emerging industrial clusters with major support of more than 100 billion yuan.

In order to enhance the competitiveness and influence of Suzhou optoelectronic industry in China and even in the world, the Suzhou Chamber of Commerce for optoelectronic Industry was established in 2011 under the leadership of leading enterprises. At present, the Chamber has 300 members and serves more than 2000 optoelectronic enterprises in Suzhou, with an industrial scale of more than 300 billion. With the Chamber of Commerce as the platform, several collaborative innovation carriers have been established to actively promote talent training, research cooperation between industry and university.

2.1 The path for the integration of industry and education: cultivating industry education integration service organization

As an entity organization, the industry education integration service organization includes loose, nominal or independent legal entity forms [4] [5]. Suzhou optoelectronic industries has established a variety of forms of industry education integration service organizations to provide all-round services to vocational colleges and industries in the optoelectronic industry, and explore a talent training model of predominantly vocational skills training and comprehensive education.

The vast majority of private enterprises support the development of Suzhou's optoelectronic industry. With the acceleration of global ICT iteration and upgrading, the lack of talents, technologies and other innovative elements has become the biggest problem to hinder the rapid development of the industry. In 2016, leading enterprises, together with universities and institutions, enterprises, industry chambers of commerce and other units related to the optical communication industry chain, established an organization named "The Education Integration Consortium of Regional Optical Communication Industries" (hereinafter referred to as the consortium). The consortium adopts the governance operation mode of "multi agent coordination, joint consulting and management, joint construction and sharing" [6], and carries out innovative cooperation in professional (group) construction, talent training, vocational training, social services, factories practice, enrollment and employment, scientific research innovation, etc.

Focusing on the innovation needs of Suzhou optoelectronic enterprises and the training needs of skilled talents in the industry, the main enterprises in the consortium signed strategic cooperation agreements with a number of excellent vocational colleges such as Suzhou vocational university and Suzhou industrial vocational and technical college, formed the alliance of Suzhou modern optoelectronic vocational education group (hereinafter referred to as the education alliance), reformed the talent training mode, and integrated enterprise vocational training with school vocational education. The education alliance has set up the university of Suzhou optoelectronic industry, fusion and penetration the vocational education of schools with skills training of enterprises with the help of high-quality production practice bases and scientific research resources in the optoelectronic industry. Those practices accelerate the professional construction, greatly raise the breadth, applicability and industry matching for the skilled personnel training, and the overall quality of vocational education has also been improved.

In order to continuously innovate the training mode of highly skilled talents, Suzhou optoelectronic industry took the lead in establishing a joint workstation for skilled masters in the China in 2017. The workstation was located in Suzhou vocational university. National skilled masters were employed in the workstation. Through the platform of skill master workstation, it can gather highly skilled talents in the optoelectronic industry into the corresponding skill master workstation, spread the spirit of craftsmanship and professionalism, strengthen the vocational skill training channels for vocational college students and in-service employees, cultivate more highly skilled talents, This contributed to achieve the coordinated education between schools and enterprises and promote the cross-border and coordinated development of regional economic industries chain and professional talent value chain.

2.2 Management mode of the integration of industry and education: explore integration platform of the multi-agent, multi-form and diversification of vocational education

The Suzhou optoelectronic industry makes full use of the platform of "Suzhou university of optoelectronic industry" under the education alliance to set up vocational training branches in relevant enterprises and schools, giving full play to the advantages of vocational education of schools and skills training of enterprises. The platform has carried out talent training covering academic education and non-academic education, innovatively set up industrial comprehensive classes, enterprise naming classes, professional characteristic classes, and school enterprise cooperative education projects such as Pre-service training for enterprise employees, on-the-job skills training, certification training for industrial application-oriented talents, and overseas project training. At the same time, to solve the shortage of skilled personnel in the optoelectronic industry, the platform also set up the research innovation alliance of optoelectronic industry and university on the basis of industrial universities, jointly carry out scientific research projects, technical R&D, standard formulation, patent application, achievement transformation, jointly build a cross professional comprehensive training center for industrial talents, and explore the construction of industry exhibition halls, industry joint laboratories and other high-quality platforms for industry, university and researching; jointly set up a team of double qualified teachers and build an industry expert pool; jointly develop training materials and online digital resources, set up special scholarships for student and teacher, and promote high-quality training and R&D resource sharing.

The form of "school in factory" and "factory in school" is another integration platform, that is, to establish a high skilled talent training community led by enterprises and participated by schools in enterprises, and to establish practice training base led by schools and participated by enterprises in schools. For example, as one of leading enterprise of suzhou optoelectronic industries, Hengtong Group has opened up some production line resources to build a practice teaching space in the factory, selected some excellent teachers and skilled masters for on-site skill training. On the other hand, through the mode of equipment donation and joint construction of schools and enterprises, a "factory in school" was established on the campus of Suzhou Vocational University to carry out the training of new apprenticeship talents. A variety of vocational education cooperation modes complement each other to support jointly staff training, student practice, technology research and development, achievement transfer, and lay a foundation for enterprises to cultivate and reserve more highly skilled talents.

Under the framework of industry education integration service organization, it has formed a new mode of multi-agent, multi-form and diversified vocational education by continuously deepening the development mechanism of industry education integration, and carried out in-depth industry education integration work in a diversified operation mode [7].

3. Integrating Achievements of industry and education in the Suzhou optoelectronic industry

In the integrating practice of industries and education, leading enterprises in the Optoelectronic industry played a guiding and driving role. For example, to solve needs of innovation and skilled personnel training, Hengtong Group has opened relevant technology centers and laboratories to vocational colleges, actively cooperated to apply scientific research projects for national, provincial and municipal, promoted the construction technological innovation consortia of school-enterprise, technology appraisal centers and technical training bases, as well as double-master-type teacher training bases, promoted drifting and employing mutually of teachers and technical experts of the enterprise in two-way, cultivated high-level optoelectronic majors (groups). Hengtong Group has also made great achievements in talent introduction, resource construction, vocational training, skill innovation, scientific research and development, and the industrial scale of the Group grew from more than 20 billion in 2011 to more than 130 billion in 2021.

The practice case of integrating of industry and education led by Hengtong Group has distinctive industrial characteristics with deep integration of schools-enterprises and outstanding exemplary role. In June 2021, the National Development and Reform Commission and the Ministry of Education jointly awarded Hengtong Group the honorary title of national enterprise of integration of industry-education. It also fully proves that enterprises can gain real benefits during the integrating practice of industry and education, truly realize the common destiny and development of schools-enterprises.

The vocational schools in Suzhou also actively explore the modern apprenticeship training mode, that is, students enter enterprises for professional training in the form of apprentices. The apprentices have both the identity of enterprise staff and student [8]. This mode effectively integrates school vocational education and enterprise vocational training, which not only ensures the quality of talent training, creates a good channel for students and employees to improve their professional skills, but can also be trained according to needs, realize the unity of high-quality training and high-quality employment.

Follow the spirit of the "Double High Plan" issued by the state, Suzhou vocational university changed the talent training conventional mode, actively promoted the mutual employment of enterprises and vocational colleges, and built a team of compound double qualified teachers, which greatly promoted the construction of optoelectronic specialty (group), to enable enterprise masters and famous teachers in vocational colleges to transform the technical skills and high-tech required by the optoelectronic industry into teaching contents, evaluation standards, and vocational education resources. In combination with the needs of Suzhou's industrial development, from 2019 to 2021, the university also has established respectively the industrial colleges with enterprises and industry organizations, and 80 internship and training bases with 17 new courses targeted. 560 people were trained for enterprises every year in the form of order classes and apprenticeships, At the same time, make full use of the enterprise resources. Every year, 30 people from difference enterprise are recruited as a teacher to participate in the school's teaching activities. The cooperative enterprise provides the school with at least 615 internship posts every year, 613 students have successfully achieved employment, and the skilled talents jointly trained with the enterprise have won 8 Awards in the skill contests above the provincial level.

The Suzhou government has introduced new support policies to encourage professors from colleges to take up a temporary position required by difference enterprises, so as to provide strong scientific, technological and talent support for enterprises to accelerate their development. Professors' temporary positions generally include deputy chief engineer, technical consultant, assistant general manager, assistant director of technology (R&D) center, assistant project manager, etc. These professors and doctors give full play to their professional advantages to help enterprises solve technical problems, give full play to the role of bridge and link, promote the cooperation between school and enterprise science and technology projects, guide scientific and technological talents to gather in enterprises, and promote the "vice presidents of science and technology" to bring new "vitality factors" to the development of enterprises.

At the same time, temporary professors participate in daily business activities such as enterprise production, research and development, management and market support, and accurately meet the needs of enterprises through immersive experience and personal work experience, which further opens up a new mode of integration of production and teaching, and provides an efficient channel for the school to improve students' vocational skills training program and promote the in-depth integration of production, teaching and researching.

Up to now, only Wujiang National Development Zone of Suzhou has carried out temporary projects with 11 colleges and universities, and a total of 71 professors and doctors have come to enterprises in the zone to take temporary jobs, providing guidance in production, R&D, management and other aspects for enterprises, which has strongly supported the sustainable development of Wujiang optoelectronic industries.

4. Conclusion

Suzhou Municipal Government gives full play to its role of guidance, support, guides enterprises and schools to actively participate, explores new development modes of vocational education, creates characteristic vocational education, matches talent supply with industrial development, promotes high-quality development of vocational education and the development of optoelectronic industry, and contributes practical experience to the development of high-tech and the formation of a skilled society in Suzhou by cultivating a number of industry education integration service organizations. It also confirms that cultivating industry education integration service organizations is an important way to achieve the integration of industry education.

The practical enlightenment of the integration of industry and education in Suzhou optoelectronic industry mainly includes the following aspects: First, cultivate industry education integration service organizations to match the supply and demand of talent supply and industrial development; The second is to carry out diversified vocational education, change the talent training model, create new apprenticeship, order class and other characteristic vocational education models, and achieve high-quality employment; The third is to promote the construction of specialties (groups) in combination with the "Double High Plan" to achieve the integrated development of industry-university-research; Fourth, the optoelectronic industry and vocational education enjoy common prosperity, and realize the organic connection of education chain, talent chain, industry chain and innovation chain.

The integration of industry and education is a continuous work, which requires interaction between schools and enterprises, dynamic innovation and expansion of new models and paths. At the same time, government must increase the support in policy and funding dynamics unceasingly, promote the integration of industry and education to be more efficient.

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