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The Path and Practice of Empowering Urban Industrial Upgrading with Domestic CAD/CAM Technology Industry Education Integration Base

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Abstract: Against the dual background of deepening the strategy of building a strong manufacturing country and promoting the "one body, two wings" reform of vocational education, the integration of industry and education in the city has become a key lever to solve the mismatch between regional industrial upgrading and the supply of technical and skilled talents. This article takes the domestic CAD/CAM technology "learning, training, research, creation, and application" industry education integration base jointly built by Wenzhou Polytechnic, Zhongwang Software, Ruili Group and other enterprises as the object. Based on the industry focus advantages of Rui'an City Industry Education Alliance and Rui'an Automotive Industry College, this article systematically explores a new model of industry education integration in the city from five dimensions: strategic background, construction foundation, core implementation path, guarantee mechanism and practical effectiveness, which includes "government guidance, school enterprise leadership, platform support, and industry empowerment". It provides theoretical reference and practical paradigm for vocational colleges to accurately serve regional industrial digital transformation and help domestic industrial software breakthrough.

Keywords: City Wide Alliance, CAD/CAM Technology, Practical Training Base, Talent Cultivation.

1. Introduction

As the foundation of a country and a strong nation, the high-quality development of the manufacturing industry is directly related to national economic security and industrial competitiveness[1]. In 2024, the added value of China's manufacturing industry will be about 33.6 trillion yuan, accounting for 24.8% of GDP, and its scale will remain the world's largest for 15 consecutive years. As a strong manufacturing city in the Yangtze River Delta and one of the top 100 industrial counties (cities) in China, Rui'an City's total industrial output value above designated size will reach 150.95 billion yuan in 2024, with the four leading industries of automobiles, motorcycles, and parts accounting for over 87.8%. Investment in industrial technological transformation and high-tech industries continues to grow, and the momentum of industrial transformation and upgrading is strong.

At present, China's manufacturing industry is facing problems such as weakened competitiveness in traditional industries and "bottlenecks" in domestic industrial software. Key technology fields such as CAD/CAE/CAM have a high degree of external dependence, and there is a structural contradiction between the supply of technical and skilled talents and industrial demand[2]. In this context, relevant national policies have clearly defined the development layout of vocational education as "one body, two wings", and proposed the creation of new carriers such as the integration of industry and education in the city[3-4]. At the same time, the construction of industry education integration training bases is a mutually beneficial development requirement for vocational colleges and industry enterprises[5]. The domestically produced CAD/CAM technology "learning, training, research, innovation, and application" industry education integration base jointly established by Wenzhou Polytechnic is based on the innovative practice of the Rui'an City Industry Education Alliance and Rui'an Automotive Industry College, with the core of breaking through industrial technology bottlenecks and cultivating suitable talents. Based on the experience of the base construction, this article outlines the implementation path of the city's industry education integration, providing reference for the coordinated development of similar colleges and regional industries.

2. Strategic Background of the Construction of Urban Industry Education Integration Base

(1) Transformation demands of the automotive industry

China's manufacturing industry is transitioning from "scale expansion" to "quality improvement", with digitization and intelligence becoming core directions. But key industrial software has long been monopolized by foreign countries, and it is urgent for domestic industrial software to break through[6]. As a gathering place for the automotive and motorcycle parts industry, Rui'an City will rank third in the province in terms of the growth rate of industrial output value on the "Ten Thousand Acres, One Hundred Billion" new industry platform in 2024, attracting 115 key intelligent automotive component enterprises to gather. The industry's demand for the application of domestic digital design and manufacturing technology is becoming increasingly urgent, and vocational education is urgently needed to cultivate technical and skilled talents with domestic CAD/CAM technology application capabilities to support industrial transformation and upgrading.

(2) Policy orientation for the reform and development of vocational education

In 2022, the "Opinions on Deepening the Reform of Modern Vocational Education System Construction" clarified the development layout of "one body, two wings", and in 2023, the "Implementation Plan for Enhancing the Integration and

Empowerment of Vocational Education Industry and Education (2023-2025)" proposed the creation of new carriers such as the municipal industry education integration consortium, which provides direction for vocational education to meet industry needs and deepen industry education integration. Vocational education should be decentralized to the city, focus on industries, and establish a sound mechanism of "promoting production through education and providing teaching assistants through production"[7]. The Rui'an City Industry Education Alliance and Rui'an Automotive Industry College provide institutional guarantees and industry focus carriers for the construction of the base, which are in line with policy guidance.

(3) Practical development needs for the integration of urban industrial and educational resources

The depth and effectiveness of industry education integration depend on the efficiency of regional resource integration. Rui'an City has a complete automotive and motorcycle parts industry chain, high-quality vocational education resources, and leading enterprise clusters, which provide the innate conditions for building an integrated base of "learning, training, research, innovation, and application". Through the construction of the base, the resource coordination function of the industry education alliance in Rui'an City can be activated, the professional focus advantage of Rui'an Automotive Industry College can be strengthened, the barriers between schools and enterprises, industries and resources can be broken down, and the deep connection between the education chain, talent chain and industry chain, and innovation chain can be achieved.

3. The Construction Foundation of the City's Industry Education Integration Base is Solid

(1) Platform Support for Urban Industry Education Joint Venture

The Rui'an City Industry Education Joint Venture is based on the Rui'an High tech Industrial Park, led by Wenzhou Polytechnic and Ruili Group. It integrates resources from more than 20 colleges, more than 30 leading enterprises, and industry associations, forming an operational mechanism of "government guidance, school enterprise leadership, diversified participation, and coordinated development". It establishes an operational mechanism for coordinating core resources such as venues, faculty, projects, and funds, providing a cross subject and cross domain resource transfer platform for the base and maximizing resource allocation efficiency.

(2) Practical accumulation of integrating industry and education in cultivating talents

Wenzhou Polytechnic has a solid foundation in cooperation with relevant leading enterprises: it co built an industrial college with Ruili Group and was awarded the title of "One County, One Industry College" in Wenzhou City; Collaborated with Zhongwang Software to establish an intermediate exam center for 3D model design of 1+X mechanical products, with over 200 people receiving training and certification, and a certification rate far exceeding the national average; Jointly build domestic industrial software innovation workstations and carry out the Ministry of Education's supply and demand docking employment and education project - Wenzhou Polytechnic Digital Design and Manufacturing Targeted Talent Training Project; We have established characteristic classes with enterprises such as Zhengbo Machinery, achieved mutual recruitment of teachers and platform sharing, jointly completed more than 10 horizontal projects, and accumulated rich experience in school enterprise cooperation and industry education integration in education.

(3) Professional Focus Advantages of Industrial Colleges

Rui'an Automotive Industry College focuses on the digital transformation needs of the automotive parts industry and offers characteristic majors such as mechanical design and manufacturing (automotive and motorcycle parts manufacturing) and new energy vehicle technology. The college has jointly established four training bases with enterprises such as Ruili Group and Tongli Group, developed more than 10 integrated courses between industry and education, introduced more than 10 real production projects from enterprises, and formed distinct professional advantages in the fields of digital design of automotive parts and CAD/CAM technology application, providing precise support for the bases.

4. The Core Implementation Path of the Urban Industry Education Integration Base

(1) Building a talent cultivation system that is suitable for the industry

Collaborate with the College of Enterprise and Industry to form a professional research team, analyze the technical skill requirements of core positions in the automotive parts industry, sort out core skill points, and form a three-dimensional mapping map of "position skills curriculum". Integrating vocational skills competition standards, 1+X certificate standards, and industrial production standards into the curriculum system, developing three professional courses, writing supporting loose leaf textbooks and practical training guides, and constructing a tiered curriculum structure. Promote the model of "mixed teaching team+real project enrollment+three-level practical system", integrate ideological and political elements into the curriculum, and enhance students' professional ethics and patriotism.

(2) Creating a Regional Shared Technology Service Platform

Integrate school enterprise resources to establish a domestic CAD/CAM technology service center, providing closed-loop services such as software installation and debugging, technical consulting, drawing conversion, and secondary development to regional enterprises and universities. The school provides over 100 square meters of office space, including the Zhongwang 1+X training center (51 machine positions) worth 2 million yuan and a metalworking workshop worth 6.5 million yuan; Zhongwang Software donated professional software with a total value of 2.5506 million yuan, providing more than 1000 online and offline teaching resources, realizing resource co construction and sharing, and helping to build a public training base for high skilled talents in automobile parts manufacturing in Wenzhou. We provide technical training for enterprise employees, college teachers, and social learners, with an average of over 300 participants per year. We have successfully hosted various skill competitions such as the Zhejiang Province Industrial Design Vocational Skills Competition for Lighting Designers and the National Equipment Manufacturing Industry New Technology

Application Skills Competition for Cartographers (CAD Mechanical Design), to promote training and improve regional technical application levels.

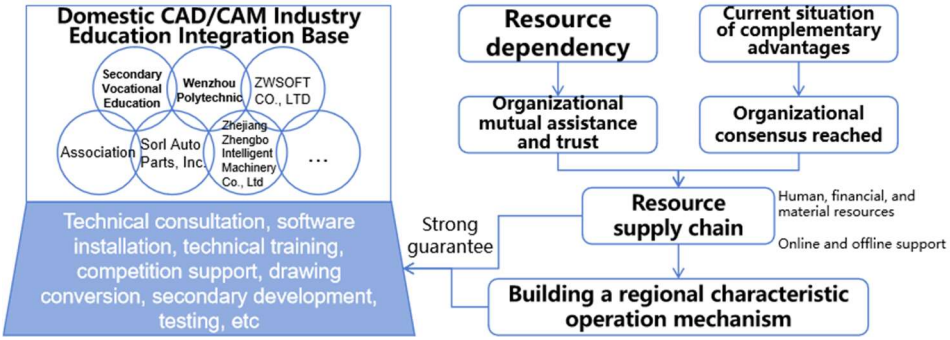

Figure 1. Domestic CAD/CAM Industry Education Integration Base

(3) Building a research and innovation carrier for industry education collaboration

Relying on industry association resources to sort out industrial technology needs, establish a technical service team for teachers, students, and enterprises, undertake R&D projects such as reverse engineering and structural optimization of automotive parts, improvement of mechanical processing technology, etc., and solve technical problems for enterprises. Establish a mechanism for the transformation of research and development achievements into teaching, converting new technologies and processes into virtual simulation teaching resources and integrating them into core courses. Establishing a student innovation studio, conducting practical activities such as component innovation design and skill competition training, aligning with innovation and entrepreneurship support policies, cultivating multiple student innovation projects in the past three years, and winning over 10 awards in provincial-level and above competitions.

5. Guarantee Mechanism and Practical Effectiveness

(1) Guarantee mechanism for diversified collaboration

Establish a management committee composed of vice deans in charge of the college and enterprise leaders to coordinate the construction and operation of the base. The school has invested more than 10 teachers in research teams and practical training facilities. Zhongwang Software has donated software and equipped specialized enterprise personnel for coordination and management. Ruili Group and Zhengbo Machinery provide internship positions, insurance, accommodation, and corresponding internship subsidies, forming a resource guarantee system of "co construction, sharing, and responsibility sharing", clarifying the rights and obligations of schools and enterprises and various work norms, and ensuring the orderly operation of the base.

(2) Multidimensional Construction Achievements

The base annually cultivates more than 200 domestic CAD/CAM technical skilled talents, with a graduate employment rate of over 98% and an average employment rate of over 60% in Switzerland, providing stable talent for the region. The Technical Service Center has completed more than 10 technical service projects to assist enterprises in digital transformation and the popularization of domestic industrial software. Forming a new model of city wide consortium coordination, industry college focus, deep participation of enterprises, and integration of "learning, training, research, innovation, and application", providing replicable and promotable practical experience for solving the "two skin" problem of industry education integration.

6. Conclusion

The construction of a domestic CAD/CAM technology "learning, training, research, and application" industry education integration base is an innovative practice that deeply integrates the functions of the city's industry education consortium platform, the characteristics of industrial colleges, and the advantages of school enterprise resources. Through the implementation path of integrating job, course, competition, and certification, coordinating school enterprise resources, and integrating science and education, the base has effectively resolved the structural contradiction between industrial upgrading and talent supply, and achieved integrated development of talent cultivation, technical services, and research and development innovation.

In the future, the base will further deepen its collaboration with the city's industry education alliance, expand the professional coverage of industrial colleges, strengthen cooperation with domestic industrial software enterprises and automotive industry clusters, improve the full chain integration mechanism of "learning, training, research, innovation and application", optimize talent training programs and technical service systems, enhance the ability to serve the high-quality development of regional industries, and contribute more vocational education strength to the construction of a manufacturing powerhouse.

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