Research and Practice on the Engineering Skills Training Pattern in College-Enterprise Cooperative Studios

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Abstract. The development of vocational education is of great significance to the problem of difficult employment in enterprises. The cornerstone of sustainable development for skill studios are solving technical challenges and imparting technology. This will be beneficial for promoting and inheriting the IoT and artificial intelligence hardware technologies that enterprises need. The "Three-Mentor-Mechanism" proposed by the College-Enterprise Cooperative Studios help students personalized and rapid growth. General basic projects, professional skills projects, ability expansion projects, and on-the-job internship projects will be set up and run through the "four stages" of professional talent cultivation. College enterprise collaboration, college park co-education, project penetration finally construct a professional talent training model.

Keywords: "five integrations, three mentors" pattern; College-Enterprise Cooperative Studios; Gradual path of education.

1. Background

At present, deepening the integration of industry and education, promoting domestic organic connection between the education chain, talents chain, industry chain is an important way to promote the supply side structural reform of human resources. It is of great significance to comprehensively improve the quality of vocational education, expand employment and entrepreneurship,, and cultivate new drivers of economic development in the new situation[1].

Amidst the accelerated construction of the “Guangdong Hong Kong Macao Greater Bay Area”, Zhongshan City has accelerated its interaction and cooperation with Hong Kong, Macao and other places. The implementation of the "5321" project in the "14th Five Year Plan" has continuously strengthened the strategic emerging industries and modern service industries, and a large number of technology integration positions such as the IOT and AI technology have emerged[2].

Based on regional industries, taking advantage of local industrial transformation and upgrading, and relying on the local industrial pattern of "one town, one industry", Zhongshan Polytechnic College established the IoT Application Technology major in 2013[3]. During the more than ten years of construction, this major has been awarded the titles of National Backbone Major, the first batch of pilot construction majors for industry education integration by the Ministry of Industry and Information Technology, and the core professional group of artificial intelligence in Zhongshan City.

The construction of the industry-education-integration studio is an important measure to deepen the college-enterprise cooperative studio in colleges, explore the construction of innovative mechanisms for talent cultivation, and promote the cultivation of applied, compound, and innovative talents in universities. At present, this major has collaborated with "specialized, refined, and innovative" enterprises and key leading enterprises in the key industry chain, relying on the advantages and characteristics of universities to build 6 college-enterprise cooperative studios, especially the "Sun Jing Intelligent Hardware Skill Master Studio in Zhongshan City", "Jiang Wuzhi IOT Application Skill Master Studio in Zhongshan City", and has been awarded the "Municipal Skill Master Studio" by the Zhongshan Human Resources and Social Security Bureau.

The cornerstone of the sustainable development of the studio is "technological breakthroughs" and "passing on skills with apprentices". The establishment of the municipal studio platform will be conducive to the promotion and inheritance of the IOT and AI hardware technology; It also provides reliable guarantees for technological breakthroughs and industry wide technological exchange

activities; Provide more opportunities for students' subsequent development and solve the dilemma of "difficult employment" in enterprises; Provide more ecological foundations for the team to establish broader cooperative relationships.

At the same time, as the electronic information technology industry in the region continues to move towards the mid to high end, the issue of disconnection between various aspects of talent cultivation and industry enterprises has become increasingly prominent, such as insufficient depth and breadth of cooperation between college and enterprises, and low matching between the supply side of talent cultivation and the industry demand side [4]. In response to the above issues, this paper provides several problem-solving ideas.

2. Main approaches

Since its establishment, the IoT application technology major has continuously explored a close enterprise cooperation and education mechanism of "five integrations, three mentors" in the direction of industry education integration: forming a deep school enterprise cooperation in five aspects of "teaching, research and development, entrepreneurship and innovation, training, and competition" (five integrations); Through the collaborative guidance of professional mentors, entrepreneurial mentors, and industry mentors (three mentors), with the main line of "cultivation cooperation employment".

"Four Classrooms" follow the principle of "similar post clusters, interlinked technical fields, identical service fields, and shared teaching resources", as shown in Figure 1. With the goal of building the service industry chain and professional clusters, they meet the needs of general skills, professional skills, and comprehensive skills training within the professional clusters, give consideration to both software and hardware construction, maintain the progressiveness nature of learning content and projects, and achieve industry university research innovation collaboration, project iteration The progressive improvement of technical skills has achieved the goal of high-quality education through multi-level and multi category talent division and cooperation, and individualized teaching. Specifically, it is:

1) By deepening cooperation with major IoT industry chain enterprises, as well as with provincial IoT associations and Harbin Institute of Technology (Zhongshan) Research Institute, we jointly built an information technology industry education integration park platform.

2) Established a "training" platform consisting of "1+X" certification training courses and "intelligent hardware innovation and entrepreneurship system courses".

3) Jointly built the "Intelligent Hardware Innovation Joint Laboratory", the first batch of "Arm China Vocational College Embedded Artificial Intelligence Application Technology Demonstration Base", and the Intelligent Internet of Things Engineering Center to form the "research" platform.

4) A creative platform that empowers local mainstream traditional industry technology through technical services.

5) In terms of selecting and allocating resources outside of school, the college introduces advantageous resources representing new technologies, standards, and processes outside of school to test, optimize, and upgrade the training within the school.

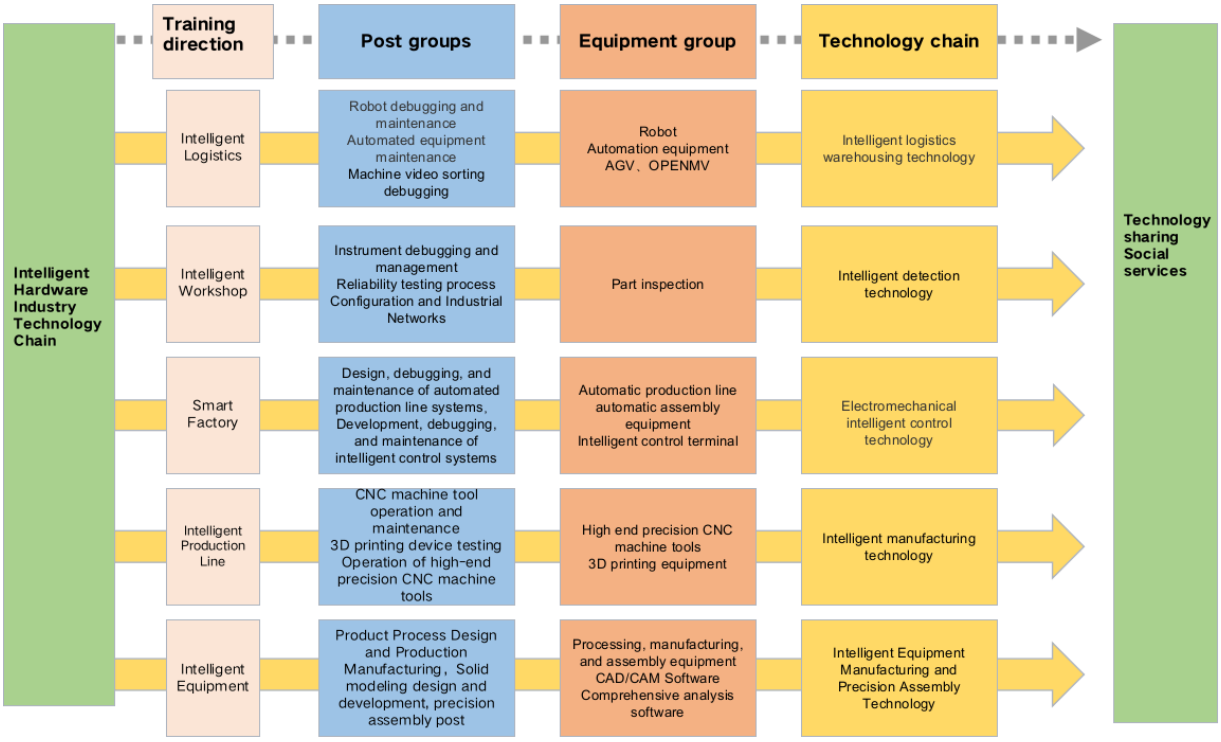


Figure 1. Organizational structure of skills training pattern in College-Enterprise Cooperative Studios

3. Problems and Solutions

(1) Weak cross practical ability of professional talents and insufficient motivation for enterprises to participate in school enterprise cooperation

Explore the construction of an integrated school enterprise collaborative education model based on full enterprise participation, from training to employment, to balance the costs, benefits, and risks of enterprise education. Specifically, ① In the process of talent cultivation, industry talent cultivation standards are introduced, and talent cultivation plans and teaching modules are jointly developed with enterprises. Courses such as "IoT Enterprise Project Practice", "Python Machine Vision Technology", and "1+X Sensor Network Evaluation" are successively offered, and 5 project-based teaching materials are jointly published. ② In terms of teaching mode, studios and enterprises collaborate to develop tutorials, teach together, cultivate together, and recruit students based on their strengths In terms of cooperation, the projects that students participate in come from the actual production problems of the enterprise, and the results are evaluated by the enterprise.

In this dual subject and full process model, enterprises always stand on the perspective of self education and collaborate with vocational colleges to cultivate talents. The skilled talents cultivated are "useful and sustainable", which not only reduces the risks of enterprise education, but also increases the expected returns of the enterprise, and can further stimulate the enthusiasm of enterprise collaborative education.

(2) Lacking a collaborative environment and real enterprise projects in the cultivation of skilled talents

Relying on two Zhongshan Skills Master Studios, national backbone professional group equipment resources, and donated equipment from enterprises, studios have collaborated deeply with industry enterprises to integrate advantageous resources from multiple enterprises according to the environmental requirements for real product research and development. Studios have jointly invested and built an enterprise level research and development space of 890 square meters and a 1500 square meter studio main base, creating an integrated platform for collaborative product research and education.

Establish a "three mentor system" for the management of integrated production and education studios, with performance assessment requirements. Professional mentors, entrepreneurial mentors, and industrial mentors must sign a "work contract" and "apprenticeship transfer agreement" in the studio, and follow the training strategy of "one person, three mentors, one person, one plan, and one person, one expertise" to guide team members to grow independently and develop personalized. Lead students to complete tasks according to the annual work plan and implement the concept of "teaching apprentices to pass on skills".

Studio students participate in mentor projects or real enterprise orders, understand the latest industry developments, technical information, and mainstream work methods, learn the entire process of project design to project acceptance, and participate in project analysis, management, operation, and marketing.

(3) Professional talent's creativity cultivation not meeting the development of the new generation of information technology

Combine entrepreneurship and innovation education with "Challenge Cup", "Internet plus" competition and other events, guide students to design competition projects according to professional characteristics, and establish interdisciplinary cooperation teams and expert guidance teams with complementary advantages. The goal of talent cultivation is to have a product-based mindset, promoting students' deep understanding and applied thinking of professional knowledge. The "micro science and innovation" teams constructed in this way, based on disciplinary and professional backgrounds, not only effectively solve professional knowledge application problems, but also cultivate adaptability, team collaboration ability, and resource integration ability. Students learn how to operate projects, master important innovation and entrepreneurship skills, and promote the transformation of scientific research achievements into practical productivity.

4. Innovation points

(1) Innovate the mechanism of integrating multiple schools, enterprises, and businesses to provide examples for the construction of vocational education studios

Collaborating with mainstream enterprises in the industry to establish a platform for connecting banks, enterprises, and schools, outputting core competitiveness of professional standard positions, and key elements of industry talent cultivation, relying on skill master studios to integrate multiple resources, studios carry out deep integration of industry and education in the five aspects of "teaching, training, competition, research and development, and entrepreneurship and innovation", implement "integration of job courses, competitions, and certificates", and achieve a talent cultivation ecology of "symbiosis between banks, enterprises, and schools". The cultivation direction resonates with the new industry ecology, This provides an example for the construction of a vocational education industry integration studio.

(2) Establish a complete studio management system and form a collaborative teaching team consisting of "professional teachers, entrepreneurial mentors, and enterprise engineers" to cultivate talents

Starting from the needs of the "jobs", all mentors have a clear division of labor and deeply participate in routine work such as studio cultivation course development, skill training, order project guidance, innovation and entrepreneurship guidance. Using studio management and performance evaluation systems as driving forces, clarify the division of labor among mentors, specific requirements for mentoring and passing skills, and performance evaluation indicators to ensure that mentors are not "absent" and provide protection for students' growth.

(3) Taking "cultivation cooperation employment" as the main line, achieving a gradual and precise path of education

Accurately connecting with the demand for talent cultivation in new positions in the information technology industry, driven by application research and development tasks, guided by students' interests and driven by enterprise product research and development, and driven by intelligent

hardware product research and development, studios aim to complete the entire process from "professional training" to "precise employment" and enhance employment competitiveness. Organize students to participate in real projects or orders, master the latest technical information, mainstream work methods, and achieve precise education.

(4) Transforming cross disciplinary and cross-border training into innovation and entrepreneurship service capabilities

In response to the technical barriers between majors and the incomplete knowledge lineage of students, a detailed cross disciplinary group joint training plan is formulated to integrate the school's professional teaching resources and innovative achievements of teachers and students into the research and development and production of real projects and enterprise products, guide students to convert intellectual property rights into social services and entrepreneurial projects, promote the transformation of scientific research achievements into real productivity, and enhance their technical service capabilities.

5. Achievements

Improve service quality and efficiency, and achieve significant scientific research results in schools and enterprises. The studio supervisor team focuses on enterprise technological innovation and provides precise services that are "uninterrupted, comprehensive, and efficient". Through the feedback of scientific research achievements, talent cultivation is continuously strengthened, and the technical skills foundation for service talent cultivation and industrial development is continuously consolidated. A development system that integrates the accumulation, innovation, and transformation of IOT application technology is constructed. For many years, the mentor team members have consistently led students to delve deeper into the traditional manufacturing industry that urgently needs to be upgraded in the local area, focusing on solving problems such as the shortage of technical and skilled talents, scientific research and technological challenges, and the development of new technologies. By empowering enterprises with technology, college studios aim to enhance their value.

Studios continuously shift the focus of scientific research towards the direction of national strategy and social needs, actively uniting multiple talents from professional groups to carry out cross professional technology integration around the cutting-edge foundation of AI, as well as computer vision and pattern recognition, visual big data intelligent processing and other fields. After unremitting efforts, studies have developed intelligent and digital application achievements that support industry and people's livelihoods, such as the "Machine Vision Chip Quality Automation Testing System" and the "Efficient and Energy Saving Battery Electric Tools". Studios has cultivated more than 20 innovation and entrepreneurship projects for college students. Students directly participated in 35 municipal level projects, 39 patents, 18 software copyrights, and 52 horizontal projects, directly cultivated 3 startup companies, directly led to 29 employment opportunities, and indirectly led to 497 people.

6. Conclusion

(1) Demands oriented, promoting talent supply side reform

Industrial development requires talents first, and the development of intelligent hardware cannot be developed without high-quality and practical skilled talents. As China's economic development has entered the New era, the economic structure and development momentum have undergone profound transformation, and the new driving force with new industries, new formats and new models as the core has been constantly strengthened, which has put forward new demands for the supply of high-quality applied talents and innovative services.

Building an industry education integration studio, guiding the mentor team to establish a talent cultivation model that aligns with industry needs, promoting collaborative education between industry and education, strengthening the construction of teaching staff, empowering social skill

talent training, and assisting regional industrial technology services are important means to promote talent supply side reform.

The IoT professional industry education integration studio actively provides new technology training and skill enhancement services for practitioners in society and industry enterprises, and shares technical resources; Provide diversified and accurate all-in-one technology services for small and medium-sized enterprises in “Guangdong Hong Kong Macao Greater Bay Area”, including technology product research and development, intelligent upgrading, achievement transformation, and entrepreneurship and innovation incubation, to meet the pain point of the temporary shortage of high-tech talents for enterprises, and help them quickly achieve intelligent product research and application.

(2) Continuously deepening, multi-party collaborative management and operation

Relying on the collaborative education platform, we aim to create a real project carrier library suitable for the integration of industry and education, closely integrating regional industrial characteristics, industry technological innovation, and enterprise job requirements. General basic projects, professional skills projects, ability expansion projects, and on-the-job internship projects will be set up and run through the "four stages" of professional talent cultivation. College enterprise collaboration, college park co education, project penetration, and ability progression construct a professional talent training model.

The "three-mentor-mechanism" jointly established by both parties for management and operation aims to achieve the sharing of information, talent, technology, and equipment resources between industries, schools, and enterprises, forming a lasting community with a shared future for schools and enterprises, radiating the transformation and upgrading of regional industries, serving the enhancement and cultivation of high skilled talents in the region, and establishing a comprehensive cooperation mechanism from teaching, scientific research, teacher training to student internship and practical training, promoting the continuous deepening of school enterprise cooperation.

(3) Orderly promotion drives harmonious regional economic development

Actively participate in national conferences, high-level forums, and university robot challenge competitions, promote the integration of cooperative projects and scientific research achievements to go global, and promote the development of regional industries towards digitization, specialization, and standardization. Introducing internationally leading IoT&AI technologies, combined with the foundation of cooperation with excellent overseas universities such as Longhua University of Science and Technology in Taiwan, drawing on the international cooperation experience of Hong Kong, Macao, and Taiwan, conducting in-depth basic research, while participating in international cooperation, striving to achieve technological research with independent intellectual property rights, and cultivating high-quality technical and skilled talents with international perspectives.

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