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Research on Training Mode of Industrial Internet Application Professionals in Higher Vocational Colleges from the Perspective of Integration of Production and Education

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Abstract: Currently, the shortage of personnel for upgrading and follow-up operation and maintenance has emerged as a critical issue hindering industrial internet companies from achieving digital transformation. This indicates that, at this stage, higher vocational colleges' industrial internet programs are lagging in talent cultivation compared to the rapid advancements within the industry, making it challenging to fully satisfy the demands of industries and enterprises. Consequently, based on the integration of industry and education, it is highly significant to investigate innovative approaches for training industrial internet professionals in higher vocational colleges. This can promote collaborative education between higher vocational colleges and enterprises, fostering skilled artisans who strive for excellence and dare to innovate, thereby supporting the modernization and digital transformation of industrial internet enterprises. In this study, considering the current development context of the industrial internet sector and combining it with the existing state of talent training for industrial internet application majors in higher vocational colleges, the study focuses on optimizing their talent training model through the integration of production and education.

Keywords: Integration of industry and education; Higher vocational colleges; Industrial internet application major; Talent training

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1. Introduction

The industrial internet represents an emerging paradigm that integrates next-generation information technology with industrial systems across multiple domains and dimensions. This deep fusion has revolutionized the organizational and production models of the traditional industrial era, aligning closely with the defining characteristics of the intelligent age. Its operational processes and talent structures exhibit clear trends of specialized division of labor and de-stratification, becoming a central driving force for promoting high-quality

development in industrial manufacturing [1]. By aligning with the demands of the industrial internet sector and refining the training approaches for industrial internet application specialists in higher vocational colleges, it is possible to effectively address the practical requirements of industry and enterprise digital and intelligent transformations, while enhancing the professional adaptability of graduates in their careers [2].

2. Industrial background

As China's industrial internet core industry continues to develop vigorously and expand in scale, the range of industries it encompasses has surpassed 85%, significantly enhancing value-added services for sectors such as construction and agriculture. Guided by policy initiatives, China has leveraged modern information technology to pave the way for the digital and intelligent transformation of its manufacturing sector. As institutions that provide talent support for regional economic growth, higher vocational colleges should proactively align with the digital and intelligent reforms within the industrial internet sector. By doing so, they can continuously supply high-caliber applied technical talents to meet the demands of a modern industrial system and bridge the needs of local industries [3]. During the application and transformation process involving the industrial internet, industrial enterprises have created numerous emerging technical roles. These positions urgently require a substantial number of advanced talents in the manufacturing domain—individuals who possess core knowledge, specialized skills, digital literacy, and technological proficiency—to actively engage in scientific and technological research and development. For instance, the Talent Exchange Center under China's Ministry of Industry and Information Technology issued the "Industrial Internet Industry Talent Job Competency Requirements," which explicitly outlines the talent demands for key positions within the sector. Given the continuous emergence of related roles and the widening talent gap, there is a pressing need for higher vocational colleges to focus on the latest trends and advantages in digital economy development. By innovating the training model for industrial internet application professionals, these institutions can address the critical issue of talent supply-demand mismatch. Furthermore, by cultivating high-quality interdisciplinary and composite technical-skilled talents, they can support the high-quality development of modern industries and foster new economic growth drivers [4].

3. The current situation of talent cultivation for the industrial internet application major in higher vocational colleges at the present stage

3.1. The curriculum system does not meet the needs of the industry

As an emerging field within the context of the digital economy, the industrial internet application major faces a relative scarcity of teaching resources [5]. Some higher vocational colleges have developed their curriculum systems by referencing similar disciplines, yet they often overlook the critical alignment between professional development and industry demands. Consequently, this makes it challenging to fulfill the urgent need for high-caliber talent in the industrial internet sector. Since initiating the cultivation of industrial internet professionals, vocational colleges have aimed to leverage the integration of industry and education mechanisms. They strive to promote synchronized advancements in professional development, teaching reforms, talent training, and industrial growth through deepened school-enterprise collaboration [6]. Nevertheless, due to the absence of well-established experience in constructing industrial internet application programs, higher vocational colleges remain in the exploratory phase. This limits their ability to refine course system designs according to the current occupational competency standards utilized in the industrial internet domain. Additionally, integrating industrial

requirements into curriculum development proves difficult, thereby hindering innovative guidance for students during the talent cultivation process [7].

3.2. The talent cultivation is out of line with the industrial demands

Ensuring precise alignment between course content and professional standards, along with the smooth integration of teaching processes with production processes, is essential for improving talent development quality in industrial internet programs at higher vocational colleges. The intelligent and digital transformation of industrial internet companies involve a multitude of core technologies and critical data. As a result, to protect data security, few business owners provide authentic engineering case resources to higher vocational colleges, and the collaboration mechanism between schools and enterprises needs further enhancement. In this context, it becomes difficult for students to interact with various data and management technologies in scenarios that are closely linked to actual enterprise production processes. There is still insufficient deep integration between personnel training at higher vocational colleges and real-world enterprise roles, resulting in a notable disconnect between "production" and "teaching" [8].

4. Training paths for industrial internet application professionals in higher vocational colleges from the perspective of integration of production and education

4.1. Optimize the talent training program

By leveraging the integration of industry and education to drive innovation in the training model for industrial internet professionals, higher vocational colleges must closely monitor shifts in objectives due to the rapid advancement of the industrial internet sector. Subsequently, by aligning with enterprise requirements, they should collaborate both internally and externally to revise their professional talent development plans [9], ensuring alignment with the current trends of the digital economy and the industrial internet. In this context, higher vocational colleges need to further identify changes in job demands and the precise number of talents required during the intelligent and digital transformation of the industrial internet industry. They should establish a theory-practice integrated talent cultivation framework guided by enterprise job requirements. This approach will help address the imbalance and mismatch between the supply and demand of industrial internet professionals while enhancing the quality of talent training. Specifically, higher vocational colleges can form a professional construction steering committee, inviting enterprise experts to participate in evaluations and conduct in-depth visits and research.

Currently, the industrial internet sector faces a notable shortage of two key types of talent: providers and users of industrial internet solutions. This scarcity poses significant challenges for the advancement of the industrial internet [10]. To address this issue, it is crucial to focus on the practical requirements of industrial internet enterprises regarding talent utilization, maintenance, and management. By broadening professional development pathways and continuously enhancing the quality of training for complex and innovative talents, we can effectively promote the in-depth construction and sustainable growth of industrial internet application majors [11,12]. During field visits and research conducted by the professional construction steering committee, it was discovered that the talent gap in the industrial internet primarily exists within operational technology, information technology, and management domains, spanning various roles such as integration engineers and technical personnel specializing in industrial internet identification analysis systems. In response to these specific needs, higher vocational colleges and departments can strengthen the integration of industry and education

through school-enterprise collaboration. For instance, establishing modern industrial colleges can facilitate the transformation of enterprise resources, thereby seamlessly incorporating industrial internet companies into the talent cultivation framework.

4.2. Deepen the reform of the curriculum system

The main concept for higher vocational colleges to deepen the reform of the industrial internet application major curriculum system under new circumstances is the integration of post-competition certification. This involves embedding the vocational skill level certificate corresponding to a specific occupational position into the industrial internet application professional curriculum system, aligning it with occupational post competencies. A modular curriculum system [13] is then established to match these occupational abilities. For the industrial internet application major in higher vocational colleges, the relevant vocational skill level certificate is "Industrial Internet System Debugging and Operation Maintenance," which encompasses specific occupational competencies such as management, debugging, and operation maintenance. In this context, higher vocational colleges can develop general course modules, specialized course modules, advanced course modules, and others.

First, the general courses module. This component encompasses foundational modules for the industrial internet application major in higher vocational colleges, with an emphasis on developing students' fundamental information technology literacy and reinforcing their ideological and political education. In line with China's ongoing transformation and upgrading of social energy consumption and industrial structures, higher vocational colleges may introduce courses related to new energy and ecological civilization within the general courses module. This aims to guide students in gaining a comprehensive understanding of China's economic and social development trends, as well as the country's clean energy reserves. Furthermore, it assists students in establishing an awareness of energy conservation and emission reduction during their professional studies and curriculum practices, encouraging them to live and learn guided by the concept of green development. Second, the professional course module. Instructors in vocational education can provide hands-on courses related to Internet of Things (IoT) system integration and IoT engineering. These courses aim to assist students in acquiring knowledge and skills such as testing and installing IoT devices, constructing and optimizing hardware and software systems, and helping them achieve relevant skill certifications. Third, the advanced course module. This section emphasizes professional growth and focuses on enhancing students' overall competence. To achieve this, vocational educators can leverage skills competitions, innovation and entrepreneurship initiatives, and incorporate real-world work situations aligned with professional traits. This approach encourages students to continuously refine their professional practical skills and foster their innovative and entrepreneurial capabilities through healthy competition. As professional education progresses, higher vocational institutions can guide students to deepen their understanding of corporate management principles and develop pertinent occupational skills by familiarizing themselves with business operations and competency requirements. This preparation aims to equip students both mentally and attitudinally for future employment and entrepreneurial endeavors [14].

4.3. Construction of practice and training bases

The employment-oriented approach in higher vocational education emphasizes the combination of scientific and practical teaching. Consequently, by establishing industrial internet laboratories, we can facilitate the seamless integration of theoretical and practical instruction. Through school-enterprise collaboration mechanisms, real-world projects can be introduced to enhance students' skills based on job requirements. This guides students to gain a thorough understanding of the technical standards and work environment within the industrial internet

sector. Such an approach not only significantly reduces graduates' pre-employment adaptation time but also boosts their professional competitiveness while effectively aligning talent supply with industry demands [15]. Nevertheless, at present, the development of industrial internet training facilities in higher vocational colleges encounters numerous challenges, including insufficient training resources, inadequate hardware infrastructure, incomplete software ecosystems, and difficulties in procuring comprehensive equipment packages. In response, this paper explores strategies to enhance the quality of industrial internet training facility construction, aiming to create favorable conditions for cultivating industrial internet talents with robust practical capabilities.

First, an analysis of training conditions and hardware equipment construction is necessary. Practical training in industrial internet applications spans various domains, including industrial network communication technology, industrial robots, intelligent sensors, PLC control, and more. Consequently, higher vocational colleges should prioritize the development of students' vocational skills by introducing advanced equipment, establishing practical training platforms, and simulating real-world practice environments to address previous limitations in practical training resources. For instance, instructors can integrate virtual reality technology with actual production processes to create a virtual laboratory in cyberspace, enabling students to simulate real working scenarios.

Second, an examination of the software environment and practical project construction is crucial. The quality of software environment development significantly influences the effectiveness of talent cultivation for industrial internet applications in higher vocational colleges. In this context, higher vocational colleges should enhance collaboration with enterprises in the research and development of technology, actively engage in experience-sharing activities with other institutions, and align these efforts with the specific requirements for training professionals in industrial internet applications. Furthermore, they should identify and incorporate relevant application software tools from the current market that meet teaching objectives while designing practical projects tailored to student needs.

Additionally, the selection and evaluation of integrated equipment systems play a crucial role. Procuring such equipment is a pivotal aspect of establishing training facilities for the industrial internet specialty within higher vocational colleges. To achieve this effectively, colleges must conduct thorough market analyses, consider students' financial constraints, and strategically plan long-term purchases of equipment sets. By integrating industry and education, colleges can also minimize costs associated with acquiring complete equipment packages, thereby optimizing resource efficiency.

4.4. Strengthen the construction of teaching staff

The field of industrial internet application is characterized by multidisciplinary integration, focusing on the development of talents with compound knowledge and skills. This demands enhanced teaching capabilities from educators in this discipline, requiring them to possess relevant practical experience within the industry. To address this, higher vocational colleges should continuously reinforce the development of their faculty in industrial internet applications, striving to establish a high-caliber team of both full-time and part-time instructors. More specifically, these institutions can refine mechanisms for self-study, training, and advanced studies to promote the professional growth of teachers. Additionally, they should ensure, at a systemic level, that professionals engage in temporary training sessions within industrial internet enterprises. This approach allows educators to gain a deeper understanding of the current industry's evolving requirements for talent cultivation through hands-on exposure to real-world industrial internet application scenarios.

5. Conclusion

To enhance the training quality of industrial internet application professionals in higher vocational colleges, it is essential for both the "industry" and "education" sectors to reach a value consensus. This means that higher vocational colleges must thoroughly comprehend current industrial requirements. By refining the talent development plan, advancing the reform of the curriculum structure, establishing practical training platforms, and reinforcing faculty development, these institutions can ensure the delivery of high-caliber talents to meet the needs of the industrial internet sector.

Disclosure statement

The author declares no conflict of interest.

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