A Study on the Practices and Pathways for Enhancing Students' Vocational Competence in Regional Secondary Vocational Schools from the Perspective of Industry-Education Integration

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Abstract: *With the acceleration of industrial upgrading and technological iteration, the deep integration of vocational education and industrial development has become a key factor in enhancing the quality of human resources. Against this backdrop, regional secondary vocational schools, as important carriers for cultivating skilled talents, see their students' level of vocational competence directly impacting the structure and effectiveness of the regional labor market. Based on the theoretical perspective of industry-education integration, this study first examines the conceptual evolution of industry-education integration and the multidimensional connotations of vocational competence, clarifying its theoretical foundation and evaluation criteria. It then analyzes the current state of vocational competence among students in regional secondary vocational schools, identifying the imbalance in their competency structure and systemic obstacles in the process of industry-education integration. Finally, it proposes integrated pathways for enhancing vocational competence from aspects such as school-enterprise cooperation mechanisms, curriculum system restructuring, and competency support systems. The study aims to provide theoretical basis and practical references for the systematic development of vocational competence among students in regional secondary vocational schools through the structural coupling of educational ecology and industrial demands.*

Keywords: *industry-education integration; vocational competence; secondary vocational schools; school-enterprise cooperation; curriculum restructuring; competency certification*

Introduction

Under the dual drivers of industrial technological transformation and the evolution of vocational education, industry-education integration has gradually emerged as a core mechanism for promoting the substantive development of regional secondary vocational education. Vocational competence, serving as a key indicator for measuring the quality of talent cultivation in secondary vocational education, not only relates to the career development of individual students but also closely connects with the enhancement of regional industrial competitiveness and the construction of an innovation ecosystem. Currently, although a consensus on industry-education integration has been reached at the conceptual level, its implementation still faces challenges such as the disconnection between educational logic and industrial logic, misalignment between curriculum content and technological advancements, and mismatch between students' competency structures and job requirements. These issues constrain the effectiveness of vocational competence cultivation. Therefore, systematically exploring the theoretical connotation, practical dilemmas, and enhancement pathways of vocational competence from the perspective of industry-education integration holds significant theoretical value and practical necessity. By integrating multidisciplinary theoretical perspectives, this study constructs an analytical framework of "theoretical interpretation – current situation analysis – pathway construction," aiming to develop a holistic solution that is logically coherent and offers practical guidance.

1. Theoretical Perspective of Industry-Education Integration and the Connotation of Vocational Competence

1.1 Conceptual Evolution and Theoretical Foundation of Industry-Education Integration

Industry-education integration, as a composite concept, has evolved from simple inter-institutional cooperation in its early stages to the deep coupling of the education system and the industrial system in terms of structure and function. This evolutionary process reflects the intrinsic demands of the transformation in knowledge production modes — specifically, the shift from linear knowledge transmission centered on disciplines to the co-creation and sharing of knowledge within applied contexts. Its theoretical foundation is primarily anchored in the relationship capital construction emphasized by social network theory, as well as the dynamic processes of knowledge flow and innovation diffusion. Human capital theory provides a microeconomic explanation, stressing the enhancement of returns on human capital through the precise alignment of educational investment and industrial demands[1].

The ecosystem perspective further regards industry-education integration as an organic whole co-evolving through multiple actors. Its healthy development depends on the virtuous cycle of information, resources, and talent within the system. From the viewpoints of Mode 2 knowledge production and the Triple Helix innovation theory, industry-education integration places greater emphasis on the interactive synergy among universities, industry, and government, thereby forming a new paradigm for innovation-driven development. This multi-dimensional theoretical support collectively constitutes an analytical framework for understanding the complexity of industry-education integration. It transcends the superficial interactions of traditional school-enterprise cooperation and provides a theoretical basis for constructing a modern vocational education system.

1.2 The Multidimensional Composition and Evaluation Criteria of Vocational Competence

Vocational competence is an integrative competency construct. Its composition extends beyond the scope of singular operational skills, encompassing three fundamental dimensions: cognitive, behavioral, and attitudinal. Within the cognitive dimension, it requires individuals to master structured professional theoretical knowledge and possess the ability to identify, analyze, and solve complex problems within authentic work scenarios. The behavioral dimension focuses on observable professional behavioral capabilities, including technical operation proficiency for specific positions, the standardized execution of work processes, and collaborative skills for cross-domain tasks. The attitudinal dimension involves intrinsic psychological traits such as professional identity, work ethics, quality awareness, and adaptability.

From a competency-based perspective, vocational competence must also incorporate metacognitive abilities and career development capabilities to adapt to rapidly changing professional environments. The evaluation of vocational competence requires a comprehensive methodology that integrates process-oriented assessment with outcome-oriented assessment. For example, behavioral anchored rating scales can be used to assess behavioral performance, situational judgment tests can be employed to examine cognitive processes, and vocational value scales can be introduced to measure attitudinal inclinations. Simultaneously, evidence-based evaluation models and authentic assessment methods can more accurately capture students' competence performance in real-world work situations, thereby forming a holistic judgment of their multidimensional structure.

1.3 Educational Characteristics and Role Definition of Regional Secondary Vocational Schools

Regional secondary vocational schools occupy a specific structural position within the educational ecosystem. Their core characteristic is manifested in a strong regional dependency in their operational orientation and a direct service-oriented nature in their educational function. This regional dependency necessitates that their program offerings, curriculum content, and training standards be closely aligned with the dynamic demands of the region's dominant industries, distinctive economic structure, and labor market.

In terms of role definition, such schools serve not only as the primary suppliers of skilled personnel but also as pivotal hubs for the accumulation and diffusion of industrial technologies and skills within the region. By integrating local industrial resources with educational elements, they transform the latest advancements in sector-specific technologies into standardized teaching resources, thereby facilitating

the transmission and iterative development of technical skills. From the perspective of educational ecology, regional secondary vocational schools also bear the crucial responsibility of coordinating the structural equilibrium between the supply side of education and the demand side of industry. This requires them to find an optimal balance between standardization and differentiation in talent cultivation.The key to the successful fulfillment of this role lies in whether these schools can establish an organizational mechanism capable of sensitively responding to external changes in industrial technology while continuously adapting internal teaching elements. The level of their educational effectiveness directly influences the optimization of the regional human capital structure and the enhancement of industrial competitiveness. It also determines their value positioning and developmental space within the regional innovation system[2].

2. Analysis of the Current State of Vocational Competence among Students in Regional Secondary Vocational Schools

2.1 Assessment of the Current Level of Students' Vocational Competence

Evaluating the current level of vocational competence among students in regional secondary vocational schools requires a systematic depiction based on objective data of their competency performance. In the cognitive dimension, students generally demonstrate the ability to memorize and understand standardized professional knowledge. However, significant gradient differences emerge in their analytical thinking and strategic problem-solving capabilities when transferring theoretical knowledge to atypical, complex working condition scenarios.On the behavioral dimension, students exhibit a high degree of operational proficiency in closed-skill tasks. Yet, their comprehensive task execution ability, particularly in open-ended situations requiring interdisciplinary knowledge integration, team collaboration, and responses to unexpected technical failures, shows insufficient adaptability.At the attitudinal dimension level, students' professional value identification displays context dependency, with its stability easily influenced by external variables such as internship environments and organizational culture. The assessment of the current level reveals a structural imbalance, characterized by a tension between the mastery of foundational skills and the development of higher-order vocational competence. This tension constitutes the logical starting point for enhancing competence.

2.2 Obstacles in the Process of Industry-Education Integration

The deepening of industry-education integration is constrained by multiple obstacles. The core obstacle stems from the inherent differences in the operational logic and objective functions between the education system and the industrial system. Schools follow an educational logic based on disciplinary systems and teaching cycles, whereas the industry adheres to a production logic centered on market efficiency and technological iteration. This results in a systematic misalignment in their pace, standards, and value propositions. This logical divergence materializes into information barriers, manifesting as the failure to promptly and effectively feed back and embed the dynamics of industrial technological evolution and changes in talent demand specifications into the curriculum system and teaching content.Another key obstacle is resource heterogeneity. A generational gap exists between the teaching resources in schools, such as laboratory equipment and simulation platforms, and the actual technological equipment applied in enterprise production lines. This gap leads to a partial disconnect between the skills students acquire and the authentic demands of job positions. Furthermore, misalignment in the cognitive frameworks of the collaborating parties—specifically, an insufficient understanding of each other's core demands and constraints—constitutes an implicit boundary that further hinders knowledge sharing and collaborative innovation.

2.3 The Influencing Mechanisms in the Formation of Vocational Competence

The formation of students' vocational competence is a dynamic process influenced by the interaction of multi-level variables. At the micro-individual level, the construction of students' cognitive schemas and their professional identity formation constitute the key psychological mechanisms. By participating in challenging authentic or simulated work tasks, individuals continuously assimilate and accommodate external information, reconstruct their mental models regarding professional activities, and gradually develop stable professional value orientations in this process.At the meso-organizational level, the internal teaching organization methods and curriculum

structure design within the school form the core arena for competence cultivation. The implementation of project-based and modular curricula can create learning contexts that approximate professional practice, effectively promoting the integrated development of theoretical knowledge, operational skills, and professional attitudes. The interactive interface constructed through school-enterprise cooperation, such as jointly established technology learning platforms, provides students with crucial opportunities to observe, imitate, and internalize the tacit knowledge of industry experts.At the macro-environmental level, the characteristics of the regional industrial technology culture, such as the emphasis on striving for excellence and collaborative innovation, subtly shape students' professional spirit and ethical concepts. The formation of vocational competence is, therefore, the result of continuous mutual construction among individual agency, organizational guidance, and environmental influence.

3. Design of Pathways for Enhancing Vocational Competence Guided by Industry-Education Integration

3.1 Mechanism Innovation for Deep Integration of School-Enterprise Cooperation

3.1.1 Establishing a Strategic Collaborative Governance Framework

Deep integration between schools and enterprises necessitates the establishment of a collaborative governance framework with strategic foresight. This framework transcends traditional simple cooperation models. It involves forming a professional development committee composed of academic representatives from the school and technical experts from the enterprise to jointly discuss and determine talent cultivation specifications. The core functions of this framework include researching and judging industrial technology development trends, evaluating the feasibility of program establishment, reviewing and approving talent cultivation plans, and assessing the quality of education and teaching.Within this framework, both parties jointly invest resources to establish technology and skill innovation platforms. These platforms integrate authentic enterprise research and development projects with the school's teaching resources, thereby fostering an effective ecosystem of mutual promotion between teaching and production. The establishment of such a governance framework provides institutionalized channels for dialogue and decision-making mechanisms for both schools and enterprises, ensuring the stability and sustainability of the cooperative relationship[3].

3.1.2 Establishing a Reciprocal Resource-Sharing Model

Resource sharing serves as the material foundation for deep school-enterprise integration, necessitating the establishment of a two-way, open resource circulation mechanism. Schools should open their teaching and research facilities, such as libraries, laboratories, and R&D centers, to enterprises, providing support for employee training and technological research and development. In turn, enterprises should provide authentic workplaces and advanced equipment for student internships and teacher practical training, and dispatch experienced technical backbone personnel to participate in teaching activities. This resource sharing should not remain limited to the physical level but should extend into the realm of intellectual resources. Initiatives such as co-establishing "Technical Expert Mobile Stations" and "Industry Professor Studios" should be implemented to promote flexible exchange of talent between both parties. The depth and breadth of resource sharing directly determine the quality and effectiveness of school-enterprise cooperation and serve as a crucial indicator for measuring the degree of industry-education integration.

3.1.3 Refining the Operational Mechanism for Collaborative Talent Cultivation

The refinement of the operational mechanism for collaborative talent cultivation requires breaking through traditional teaching organization methods based solely on semester systems and class-based instruction. By implementing a "semester-phased, competency-progressive" training model, the production rhythms of enterprises can be organically integrated with the teaching schedules of schools, enabling the alternation of theoretical learning and practical training. In specific implementation, flexible and diverse teaching organizational forms such as "project-based workshops" and "technical boot camps" can be adopted. These forms involve joint guidance by enterprise mentors and school teachers to assist students in completing authentic work tasks.Simultaneously, a two-way evaluation and feedback mechanism should be established. Enterprises evaluate students' practical abilities, while schools assess the quality of guidance provided by enterprises, thereby forming a closed-loop management system. The establishment of this operational mechanism facilitates the transformation of school-enterprise cooperation from a loose, ad-hoc model to a close-knit, normalized mode of development.

3.2 Integration Approaches for Curriculum Systems and Industrial Technology

3.2.1 Reconstructing Curriculum Logic Based on Work Processes

The deep integration of curriculum systems and industrial technology fundamentally requires a reconstruction of curriculum development logic. Traditional discipline-based curricula should shift towards a work-process-based curriculum system centered on typical work tasks. This reconstruction demands an in-depth analysis of the work content, processes, and requirements of professional positions. Representative work tasks must be extracted and transformed into learning scenarios. The organization of course content no longer follows the logical sequence of knowledge but is arranged according to the chronological order of the work process. This approach enables students to naturally master the necessary knowledge and skills while completing work tasks. The reconstruction of this curriculum logic breaks down the boundary between theory and practice, achieving a high degree of unity between learning content and work content[4].

3.2.2 Establishing the Content Organization of Modular Curricula

A modular curriculum organization is an effective way to achieve dynamic alignment between course content and industrial technology. Course content is divided into several relatively independent yet interconnected competency modules based on professional competency requirements. Each module corresponds to a complete work task or technical unit. This organizational method offers high flexibility, allowing specific modules to be adjusted or updated in a timely manner according to the needs of industrial technological development without restructuring the entire curriculum system. A clear logical relationship and competency progression is formed between the various competency modules, ensuring the systematic development of students' professional competencies. Modular curricula also support the design of personalized learning pathways. Students can select different combinations of competency modules based on their individual interests and career plans, thereby achieving differentiated development.

3.2.3 Constructing a Dynamic Mechanism for Continuous Updates

Establishing a dynamic mechanism for the synchronized updating of course content and industrial technology is key to maintaining curriculum relevance. This mechanism comprises three components: industrial technology monitoring, course content updating, and teaching resource development. Industrial technology trends are captured in a timely manner through regular surveys of enterprise technology applications, participation in industry technical exchanges, and analysis of technological development trends. A regular revision system for course content is established to ensure that new technologies, processes, and standards can be quickly translated into teaching content. Concurrently, supporting teaching resources that reflect the level of technological development are created, including workbooks, manuals, and digital resources, providing strong support for curriculum implementation. This dynamic updating mechanism ensures that course content remains synchronized with industrial development.

3.3 Safeguarding Measures for the Continuous Enhancement of Students' Vocational Competence

3.3.1 Establishing a Whole-Process Competency Certification System

Establishing a competency certification system covering the entire talent cultivation process is a fundamental measure to ensure the continuous enhancement of students' vocational competence. This system should span the entire learning cycle from enrollment to graduation. It involves creating personal competency portfolios to record students' competency development at each learning stage. Competency certification not only focuses on final learning outcomes but also emphasizes the process of competency formation, employing diversified assessment methods including project assignments, practical operations, portfolio displays, and more. The certification results serve both as the basis for evaluating student academic performance and as a reference for enterprise recruitment. The establishment of a whole-process competency certification system makes students' competency development visible and traceable, providing data support for personalized guidance and precision cultivation.

3.3.2 Constructing a Specialized Teacher Collaboration Mechanism

The professional level of the teaching faculty directly determines the quality of vocational competence cultivation. Constructing a school-enterprise teacher collaboration mechanism requires breaking down the identity barriers between school teachers and enterprise technical personnel and

establishing a management system for two-way mobility and mutual employment. By creating positions such as "industry professors" and "technical mentors," outstanding technical talents from enterprises are attracted to participate in teaching. Implementing "teacher enterprise practice programs" enhances the practical abilities of school teachers. Concurrently, a joint teaching research mechanism between school and enterprise faculty is established, involving regular teaching seminars and technical exchanges to promote the integration of educational philosophies and industrial thinking. The formation of this teacher collaboration mechanism provides strong faculty support for cultivating students' vocational competence[5].

3.3.3 Perfecting the Intelligent Support Service System

An intelligent support service system is a crucial technical safeguard for promoting the continuous development of students' vocational competence. This system comprises three components: a learning resource platform, career guidance services, and a growth monitoring mechanism. The learning resource platform integrates high-quality teaching resources from schools and enterprises, providing students with round-the-clock, open learning support. Career guidance services help students clarify their professional development directions and formulate competence enhancement plans through personalized counseling and tutoring. The growth monitoring mechanism utilizes big data analysis to track students' competency development in real-time, promptly identifying issues and enabling timely intervention. The refinement of the intelligent support service system creates favorable conditions for the autonomous development and continuous improvement of students' vocational competence[6].

Conclusion

This study, through theoretical analysis and pathway construction, systematically elucidates the mechanisms and pathways for enhancing the vocational competence of students in regional secondary vocational schools from the perspective of industry-education integration. The research indicates that the cultivation of vocational competence is a multidimensional, synergistic, and dynamically evolving process. Its enhancement relies on institutional innovation in school-enterprise cooperation, structural reconstruction of the curriculum system, and continuous optimization of the support system. At the level of school-enterprise cooperation, constructing a strategically collaborative governance framework, a reciprocal resource-sharing model, and an operational mechanism for collaborative talent cultivation is key to achieving organic integration of the education chain and the industry chain. Regarding curriculum development, reconstructing curriculum logic based on work processes, establishing a modular curriculum organization, and forming a dynamic updating mechanism help bridge the gap between knowledge and practice. In terms of competency assurance, a whole-process competency certification system, a specialized teacher collaboration mechanism, and an intelligent support service system collectively form the foundational support for the sustained development of students' vocational competence. Future research could further focus on the evolution of industry-education integration models in the context of digitalization, the adaptability of pathways from a cross-regional comparative perspective, and long-term tracking mechanisms for student vocational competence development, thereby continuously enriching theoretical exploration and practical innovation in this field.

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