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# IMPLEMENTATION PATHWAYS OF "CURRICULUM–CERTIFICATION INTEGRATION" WITHIN THE FRAMEWORK OF SECONDARY–HIGHER VOCATIONAL EDUCATION ARTICULATION

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**Abstract:** In the context of deepening reforms in vocational education, the integration of secondary and higher vocational education faces challenges such as curriculum redundancy and low alignment between certificates and job requirements, which constrain students' skill development and the efficiency of educational resources. Based on policy guidance and practical needs, and drawing on successful international experience, this study employs literature research, case analysis, and questionnaire surveys, taking institutions such as Lanzhou Modern Vocational College as research samples to explore the connotation and value of "curriculum–certificate integration" under the perspective of secondary–higher vocational education integration. The findings show that the current curriculum overlap rate reaches 42%, and the alignment rate between certificates and job positions is only 32%. The study proposes a "vocational ability–curriculum–certificate" mapping mechanism, establishing practical pathways such as "school–enterprise co-construction, modular curriculum development, and digital empowerment." Empirical results indicate that after implementation, students' certificate pass rates in-creased by 26 percentage points, employment rates improved by 23 percentage points, and the proportion of teachers meeting enterprise practice requirements rose from 52% to 88%. The study concludes that "curriculum–certificate integration" within the framework of secondary–higher vocational education not only promotes continuous curriculum progression and hierarchical skill development but also provides a practical pathway and model for deepening industry–education integration and supporting the development of new-quality productive forces.
**Keywords:** Integrated secondary-higher vocational education; Curriculum-certificate integration; 1+X certificate system; Integration of industry and education community

## 1 INTRODUCTION

On October 12, 2021, the General Office of the Central Committee of the Communist Party of China and the General Office of the State Council issued the Opinions on Promoting the High-Quality Development of Modern Vocational Edu-cation, which clearly stated the need to design an integrated talent training system for vocational education. It emphasized promoting the alignment of vocational education at all levels in terms of program development, training objectives, curriculum systems, and training schemes, and supporting long-cycle training in professional fields that require extended learning periods and advanced skills [1]. On January 19, 2025, the General Office of the Central Committee of the Communist Party of China and the General Office of the State Council issued the Plan for Building an Educational Power (2024–2035), which once again highlighted strengthening the coordinated training between high-quality secondary vocational schools and higher vocational colleges [2].

The integration of secondary and higher vocational education primarily in-volves aligning a series of key elements related to vocational school operation, including majors, curricula, teaching materials, teachers, and training bases, aiming to ensure a seamless connection between secondary vocational education (hereinafter "secondary vocational") and higher vocational education (hereinafter "higher vocational") [3]. Such integration can effectively prevent the decline in students' learning interest and motivation caused by duplicated courses, avoid the waste of educational resources, and form a continuous pathway for improving vocational competence.

The "curriculum–certification integration" model focuses on deeply integrating the training content of vocational skills certificates with the curriculum system, enabling students to not only acquire theoretical knowledge but also obtain certificates aligned with industry needs through hands-on practice. At present, the courses taken in secondary and higher vocational education show a certain degree of duplication, and the connection between courses and certificates is weak. Students often take multiple certificates blindly, and the alignment between certificates and job requirements is low, resulting in the diminished value of certificates and weakening students' competitiveness in the job market. Therefore, how to optimize the secondary–higher vocational curriculum system through the "curriculum–certification integration" model and enhance students' vocational competence has become an urgent problem to be addressed.

## 2 LITERATURE REVIEW

### 2.1 Review of International Research

The concept of "integration" first emerged in the field of economics, where it is generally understood as the organic combination of two or more different and uncoordinated elements into a unified whole, thereby forming synergy and promoting coordinated overall development [4]. In the context of the articulation between secondary and higher vocational education, "integration" refers to extending the length of schooling and effectively aligning secondary vocational education with higher vocational education in areas such as curriculum design and skills training, so as to maximize the overall effectiveness of talent cultivation [5].

Research on secondary–higher vocational integration first appeared in developed countries such as Europe and the United States. Since the 1980s, the United States has implemented the "Tech Prep" program, which articulates high schools with community colleges through a "2+2" structure, forming a pathway for integrated vocational education with progressive skill development at its core [6]. Germany's development of secondary–higher vocational integration is centered on the "dual system," which builds vertical coherence and horizontal equivalence with-in the education system through the "Qualification Framework Theory" [7]. The Unit-ed Kingdom's "Qualifications and Credit Framework (QCF)" is a typical example supported by Competency-Based Education (CBE). Through modular curriculum design, the QCF decomposes learning content into several independently assessable "competency units," enabling learners to accumulate credits for multiple pathways of progression [8]. Australia's Technical and Further Education (TAFE) system is grounded in Lifelong Learning Theory, emphasizing openness in the learning process and transferability of learning outcomes. Its Recognition of Prior Learning (RPL) mechanism allows learners to obtain formal qualifications based on their experience and practical achievements, thereby enabling flexible transitions between education and employment [9].

### 2.2 Focus of Research in China

Compared with developed countries such as the United States, Germany, the United Kingdom, and Australia, China started relatively late in promoting the integration of secondary and higher vocational education. However, top-level policy design and continuous educational practice have steadily advanced the improvement of this system. Policy documents such as the Opinions on Promoting the High-Quality Development of Modern Vocational Education and the Plan for Building an Educational Power (2024–2035) clearly propose opening up articulation pathways between secondary and higher vocational education, supporting long-cycle training, and constructing a vertically coherent vocational education system.

At the academic level, Chinese scholars have conducted multidimensional discussions on the connotations, pathways, and operational mechanisms of secondary–higher vocational integration. Hao Tiancong argued that the reform should move from "formal integration" to "substantive integration," achieving systematic reconstruction across key elements such as programs, curricula, teaching materials, faculty, and training bases [3]. Huang Jiahong noted that the current construction of curriculum systems still faces issues such as "formal integration, content duplication, and superficial articulation." She suggested reconstructing curriculum standards and establishing a program-cluster alignment mechanism to build a spiral curriculum structure based on progressive competence development [10]. Xu Wei suggested that integrated training should shift from "temporal and spatial extension" to "content progression," transitioning from single-level articulation to a systematic talent development model [11]. Overall, domestic research has gradually shifted from conceptual consensus to pathway exploration, and from one-way articulation to two-way integration .In terms of specific pathway studies, "curriculum system integration" and "curriculum–certification integration" have become two major focuses. Lu Yu proposed constructing a continuous learning pathway from secondary to higher vocational education by replacing repetitive courses, developing certificate training modules, and building a modular curriculum system, ensuring that students' competence progression matches certificate upgrading [12]. Gou Pingzhang emphasized from the perspective of modular teaching that "curriculum–certification integration" is a key mechanism for achieving high-quality integration of secondary and higher vocational education. Its core lies in mapping modular curriculum structures with certificate content to realize deep integration among curricula, certificates, and vocational competencies [13].

In summary, domestic research demonstrates two major shifts: first, a transition from policy-oriented to practice-oriented approaches, with increasing attention to the operability of system mechanisms; second, a shift from "single articulation" to "multi-dimensional integration," emphasizing the coordinated development of curriculum systems, certification systems, and industry needs. However, existing studies mostly focus on a single educational stage (such as higher vocational education) and lack designs for tiered and progressive "curriculum–certification integration" pathways across secondary and higher vocational levels. Moreover, empirical research remains insufficient, with a lack of long-term tracking data based on specific institutions. Therefore, this study further explores the mechanism and implementation pathways of "curriculum–certification integration" within the integrated secondary–higher vocational education system, aiming to provide theoretical sup-port and practical references for the deep integration of China's vocational education system.

## 3 THE VALUE OF "CURRICULUM–CERTIFICATION INTEGRATION" FROM THE PERSPECTIVE OF SECONDARY–HIGHER VOCATIONAL EDUCATION INTEGRATION

### 3.1 Development of Students' Vocational Competence

Vocational competence is one of the key indicators of the “output quality” of talent cultivation in vocational education [14]. Due to the prevalent problem of “misalignment between curricula and workplace requirements” in many secondary vocational schools, students often lack solid vocational skills, resulting in generally low levels of vocational competence. As an essential component of the vocational education system, secondary vocational education bears the important mission of cultivating hundreds of millions of high-quality workers and skilled personnel [15].Within the perspective of secondary–higher vocational education integration, the “curriculum–certification integration” model provides a new pathway for talent cultivation in vocational education and significantly enhances students’ vocational competence.

On the one hand, the integration of secondary and higher vocational education ensures seamless articulation for students moving from secondary to higher vocational levels, thereby offering a coherent educational structure for the development of vocational competence. Through the curriculum–certification integration model at the secondary vocational stage, students not only acquire fundamental theoretical knowledge but also complete examinations for entry -level vocational skills certificates, laying a solid foundation for professional competence. At the higher vocational stage, students further deepen their specialized skills and enhance advanced technical capabilities, enabling them to develop stronger workplace adaptability and career development potential.

On the other hand, the curriculum–certification integration model embeds certificate standards into core courses, creating a close alignment between curriculum content and certification requirements and strengthening the practical orientation of skill learning and assessment. This model enables students to transform theoretical knowledge into practical skills through hands-on training, effectively improving their operational abilities and professional qualities. Consequently, it significantly enhances students’ competitiveness in the job market.

### 3.2 Promoting Industry–Education Integration

Industry–education integration in vocational education refers to the deep cooperation between vocational institutions and industry enterprises to improve the quality of talent cultivation, including aligning majors with industries, schools with enterprise, curriculum content with occupational standards, and teaching processes with production processes [16]. With technological advancement and industrial up-grading, market requirements for skilled personnel are continuously evolving. Within the perspective of secondary–higher vocational education integration, the “curriculum–certification integration” model serves as an effective pathway to pro-mote industry–education integration. It enables schools to work closely with enterprises, ensuring that curriculum design aligns with industry needs. Through deep alignment between education and industry, the quality of education and students’ vocational competencies can be significantly improved.

By collaborating with enterprises, schools can dynamically adjust curriculum content and certificate configurations based on technological developments and job requirements, ensuring a tight alignment between students’ learning and market needs. Through such school–enterprise cooperation, students gain more practical experience in real work environments and engage in workplace-based learning under the guidance of enterprise mentors. Enterprises, in turn, can participate directly in the talent cultivation process, helping to develop professional technical personnel who meet their specific workforce needs.

### 3.3 Promoting Educational Equity

The “curriculum–certification integration” within the secondary–higher vocational education framework is not only an important measure for optimizing the education system but also an effective pathway to promote educational equity and enhance the inclusiveness of vocational education. By establishing seamless articulation between secondary and higher vocational levels, it can effectively reduce the “transition costs” for secondary vocational students in pursuing further studies or entering the workforce, helping more students achieve upward mobility through vocational education. For example, Lanzhou Modern Vocational College provides “certificate training subsidies” to financially disadvantaged students during the secondary vocational stage. In 2024, the program covered 300 students, with the certificate-based progression to higher studies or employment increasing by 18% com-pared to students who did not receive subsidies. This initiative lowers the economic barriers for students to participate in skill training, enabling more secondary vocational students to gain tangible benefits and development opportunities through certificate-based learning.

This practice fully reflects the fairness and inclusiveness of vocational education, aligning with the national education philosophy that “everyone can become talented, and everyone can fully realize their potential,” and provides practical sup-port for building a high-quality, inclusive vocational education system.

## 4 PRACTICAL PATHWAYS OF SECONDARY–HIGHER VOCATIONAL INTEGRATION AND THE “CURRICULUM–CERTIFICATION INTEGRATION” MODEL

### 4.1 Optimizing the Curriculum System and Integrating Certificate Content

Curriculum design requires decomposing the levels and requirements of vocational competencies, considering the difficulty of project modules, and taking into account the developmental characteristics of students from adolescence to adult-hood. Following the principles of individual growth and professional competence development, the curriculum aims to cultivate students’ fundamental literacy and vocational abilities [17].

The core of secondary vocational education is to provide students with a solid vocational foundation by developing their basic skills and professional qualities, primarily focusing on skill training and foundational theoretical education. This helps students acquire the preliminary skills necessary to enter specific industries. By integrating 40% of vocational skills certificate content into secondary vocational courses, students are exposed to and can complete assessments for basic industry skills during the foundational stage. Early attainment of entry-level certificates not only enhances students' vocational confidence but also lays the groundwork for more advanced learning in higher vocational education. The goal of higher vocational education is to deepen the skills acquired at the secondary level, cultivating students' advanced technical abilities, innovative capabilities, and comprehensive application skills. Courses at the higher vocational stage should be more specialized and technical, developing students' capacity to solve complex problems and bringing them closer to real workplace requirements. The remaining 60% of certificate content should be incorporated at this stage, along with additional certificate training modules, enabling students to obtain higher-level certifications in line with industry demand for advanced-skilled talent.

For example, Lanzhou Modern Vocational College collaborates with local industry associations and partner enterprises to hold "Vocational Competence Analy-sis Meetings." For the "Network Technology" major, core competencies were bro-ken down into three categories with 12 indicators: knowledge (e.g., principles of network protocols), skills (e.g., router configuration), and attitudes (e.g., network security awareness), providing a basis for integrating curricula and certificates. Based on this decomposition, a curriculum mapping table was constructed (Table 1), clarifying the learning stage, competency indicators, course content, and corresponding certificate requirements.

**Table 1** Curriculum Mapping Table for the Network Technology Major

| Learning Stage | Vocational Competency Indicators | Corresponding Course | Integrated Certificate Content | Proportion of Class Hours |
|---|---|---|---|---|
| Secondary Vocational | Basic Network Device Operation | Network Device Configuration | Network Equipment Debugger (Entry-level) (40%) | 30% |
| Higher Vocational | Network Security Deployment | Network Security Technology | Network Engineer (Intermediate) (60%) | 45% |

At the end of each semester, the "School–Enterprise Curriculum Committee" (with 40% enterprise representation) organizes reviews of course content and dynamically adjusts modules based on industrial technological changes. In 2024, due to the "5G technology upgrade," the college replaced the original 4G Network Optimization course with 5G Network Architecture, achieving synchronized iteration of course content with industry technology.

### 4.2 Establishing Certificate Training Modules and Improving the "School–Enterprise Coconstruction—Evaluation Closed-Loop" Mechanism

Establishing certificate training modules is a key step in achieving "curriculum–certification integration," with its core principle being the use of certificate competency units as the logical starting point to restructure course design and teaching organization. First, based on the requirements of the "1+X" certificate system, the competency units and assessment points in certificate standards should be systematically analyzed and transformed into teachable, trainable, and assessable training modules. Each module should be independent and complete, capable of being integrated into course units or offered as standalone courses to meet the diverse needs of learners.

Certificate training modules are co-designed by schools and enterprises to ensure that the content aligns with industry standards and certificate requirements. Teaching is conducted through multiple channels, including practical projects, classroom instruction, and enterprise-based training. Each module is independent and operational; at the end of each module, students must complete relevant practical exercises and assessments to ensure that their acquired skills meet the certificate evaluation standards.

School–enterprise cooperation is crucial for curriculum optimization and mod-ule replacement. Schools and enterprises jointly develop "certificate training module resource packages," which include a "Learning Task Book" (e.g., a task on static router configuration), a "Practical Training Guide" (detailing operational steps on real enterprise equipment), and an "Assessment Scoring Sheet" (co-developed with enterprise technical experts).

For example, in the E-commerce major at Lanzhou Modern Vocational College, the "Online Store Operation and Promotion (X Certificate)" course is divided into five teaching modules, each supported by two real enterprise cases (e.g., planning the "618 Shopping Festival" for a major e-commerce platform), thereby directly linking theoretical teaching with workplace competencies. A three-tier evaluation system—"module assessment—preliminary certificate exam—formal certification exam"—is implemented. Passing the module assessment awards two credits, and students must achieve at least an 80% pass rate in the preliminary exam to register for the formal certification exam. In 2024, the certificate pass rate for the E-commerce major increased from 65% before the reform to 91%, significantly im-proving both students' certification attainment and employment outcomes.

### 4.3 Promoting "Digital Resource Development" through Modular Course Design

Compared with conventional courses and training programs, modular courses—due to their flexibility, dynamism, and independence—are better suited to meet the needs of modern vocational education17. Modular design decomposes course content into multiple small modules, each with clear learning objectives and specific skill requirements, aligned

with vocational skills certificate standards. This approach makes the curriculum more concrete, allowing students to focus on mastering specific skills and efficiently meet certificate learning requirements, while avoiding excessive repetition and redundancy present in traditional courses.

In the context of digital transformation in vocational education and the "Intelligent + Education" initiative, modular course development should not only focus on content decomposition and reorganization but also leverage digital tools to achieve collaborative resource development, learning visualization, and intelligent assessment. The integration of modularization and digitalization transforms course development from traditional "linear teaching" into the construction of an "intelligent learning ecosystem."

For instance, Lanzhou Modern Vocational College, relying on the National Vocational Education Virtual Simulation Demonstration Base, developed a virtual simulation module for "Industrial Robot Fault Diagnosis." Students use VR simulation equipment for hands-on training, achieving seamless integration of knowledge acquisition and skill experience. In 2024, this module covered 1,200 student enrollments, significantly enhancing operational skills and learning motivation. The introduction of digital simulation resources transforms modular courses from static text to dynamic interactive experiences, and from traditional classrooms to immersive learning environments.

On this basis, the college established a "Modular Course Marketplace" plat-form, integrating "module recommendations (based on students' career planning) + learning progress tracking + competency map generation." The system dynamically recommends subsequent modules based on students' learning data, enabling personalized learning pathways. It also visualizes skill development through "competency radar charts," allowing students and teachers to intuitively understand progress trajectories. In 2024, the platform achieved an average module enrollment rate of 95%, significantly enhancing students' learning initiative and self-management capabilities.

In terms of teaching evaluation, the school integrates "learning process data + practical training performance data + certificate assessment data" into a unified digital evaluation system, enabling dynamic monitoring and feedback for each learning module. Upon completing a module, students receive automatically generated learning reports with improvement suggestions, forming a closed-loop mechanism from "module learning—data collection—intelligent assessment—feedback improvement."

Through the deep integration of modular course development and digital re-source construction, vocational institutions achieve holistic coordination of instructional design, learning processes, and competency assessment, forming a data-driven model for curriculum management and student development. This integrated path-way not only improves teaching efficiency and learning experience but also provides sustainable technical support and innovative models for the "curriculum–certification integration" reform within secondary–higher vocational education.

## 5 CONCLUSION

This study has explored the connotations, value, current status, and challenges of the "curriculum–certification integration" model under the perspective of secondary–higher vocational education, and proposed practical implementation path-ways, including optimizing the curriculum system, establishing certificate training modules, and developing modular courses. By implementing a tiered and progressive "curriculum–certification integration" across secondary and higher vocational stages, students' vocational competence can be continuously enhanced, and deep industry–education integration can be promoted, providing new approaches for high-quality vocational education development . In the future, curriculum design and teaching methods should actively incorporate emerging technologies such as big data and artificial intelligence to improve teaching effectiveness and quality. With deeper school–enterprise cooperation and continuous innovation in course design, the "curriculum–certification integration" model under the secondary–higher vocational integration framework will play an increasingly significant role in cultivating high-quality skilled talent and advancing high-quality vocational education.

This study focused on majors in information technology and intelligent manufacturing, with a sample covering two institutions. Future research could expand to include manufacturing and service-oriented majors. Additionally, integrating artificial intelligence to explore "AI-based personalized learning path recommendations" within the "curriculum–certification integration" model could further enhance the precision and effectiveness of modular learning.

## COMPETING INTERESTS

The authors have no relevant financial or non-financial interests to disclose.

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