

A Study on the Impact of China's Educational Modernization Practices on the Development of Vocational Education in Southeast Asia under the “Belt and Road” Background

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Abstract: In the process of global educational modernization, the systematic accumulation of technological elements and their cross-system mobility have become important variables affecting the development of regional vocational education. The core technological modules, standard encapsulation mechanisms, and industry-education integration organizational models formed during China's educational modernization possess the potential to spill over into the vocational education systems of Southeast Asia. This study focuses on the transferable characteristics of three types of technological elements and their embedding pathways, analyzing the cross-regional calibration logic of the vocational qualification framework, the parametric redesign method of the dual-system teaching operation structure, and the construction method of knowledge transfer carriers and ability mapping relationships in teacher professional development. On this basis, the study explores the evolutionary trends of Southeast Asian vocational education systems after absorbing the above elements, including the distributed adjustment of educational governance rights and responsibilities allocation, the flexible reconstruction of modular curriculum systems, and the emergence of self-organizing characteristics in quality assurance mechanisms. The research suggests that the embedding of elements related to China's educational modernization is not a simple model transplantation; rather, through operations such as calibration, translation, and redesign, it forms an adaptive reorganization with local conditions in Southeast Asia, thereby promoting structural evolution in the regional vocational education systems at the levels of governance structure, curriculum organization, and quality assurance.

Keywords: educational modernization; technological elements; embedding pathways; system evolution; vocational education in Southeast Asia

Introduction

The cross-regional interaction of vocational education systems is an important issue in the field of educational research. Its core concern lies in the flow mechanisms of technologies, methods, and organizational forms among different education systems, as well as the ways in which these mechanisms affect the recipient systems. China's educational modernization process has accumulated a number of technological modules, curriculum resource encapsulation schemes, and industry-education collaborative organizational logics that can operate independently of their original ecological contexts. These elements have potential docking spaces with the vocational education development needs of Southeast Asian countries. Current academic research on the mechanisms through which China's educational elements flow into Southeast Asian vocational education systems remains insufficient. Most discussions stay at the macro-level description of cooperation and lack micro-level analyses of the transferability of technological elements, the specific operational paths of embedding, and the evolutionary logic of the recipient systems. Therefore, it is necessary to start from the identification and characterization of technological elements, systematically examine the conditions and methods of their cross-system transfer, and further track the structural adjustments occurring in the governance, curriculum, and quality assurance dimensions of Southeast Asian vocational education systems after embedding. This study not only helps to understand the internal laws of cross-regional flows of educational elements but also provides a new analytical framework for comparative research on vocational education systems.

1. Technological Elements and Capability Spillovers in the Process of China's Educational Modernization

1.1 Core Technological Modules of the Digital Transformation of Education and Their Transferable Characteristics

The process of digital transformation of education has given rise to a series of core technological modules with independent functions and combination flexibility. These modules include an adaptive recommendation engine based on learning behavior data, an interactive task generator in a virtual simulation training environment, and a cross-terminal collaborative vocational skills training cloud platform. Each module adopts a loosely coupled design in its internal architecture, which allows it to be extracted, replicated, and embedded into different educational environments without relying on the overall logic of the original system. The modules integrate standardized data interfaces and operation protocols, and these features provide a technical foundation for subsequent cross-regional applications.

The transferable characteristics of the above technological modules manifest as three layers of attributes: functional independence, semantic consistency, and environmental adaptability. Functional independence ensures that each module maintains the integrity of its core teaching logic after being detached from the original system. Semantic consistency enables the module to output the same behavioral instructions and evaluation criteria in teaching contexts across different languages and cultural backgrounds through a pre-embedded domain knowledge graph and operational terminology database. Environmental adaptability is reflected in the module's ability to perceive and adjust to local hardware conditions and network bandwidth. These characteristics collectively determine that the technological modules possess the foundational capability to transcend their original ecological context and operate within the vocational education systems of Southeast Asia.

1.2 Standard Encapsulation of Vocational Education Curriculum Resources and Cross-Boundary Adaptation Mechanisms

The standard encapsulation of vocational education curriculum resources refers to the process of packaging teaching content, learning activities, assessment tools, and metadata descriptions into independently exchangeable units according to unified specifications. This encapsulation process adopts a layered architecture: the bottom layer consists of the domain knowledge ontology and the skill point coding system; the middle layer consists of the teaching event sequence and the learning path template; and the surface layer consists of the interactive interface language pack and the media resource index. Each layer follows an open encapsulation protocol, which ensures that the resource units can be identified, parsed, and reorganized across different learning management systems. Standard encapsulation eliminates the technical dependence of curriculum resources on the original development environment, thereby turning these resources into knowledge carriers that can circulate independently of specific institutional contexts^[1].

The cross-boundary adaptation mechanism addresses the contextual differences encountered when encapsulated curriculum resources enter the vocational education systems of Southeast Asia. This mechanism consists of two core operations: semantic mapping and task localization. Semantic mapping performs a comparative conversion between the skill descriptions in the encapsulation unit and the existing vocational qualification levels of various Southeast Asian countries, thereby establishing equivalence relations recognizable by local assessment systems. Task localization adjusts the surface parameters of the case scenarios, tool specifications, and operational procedures embedded in the resources — such as replacing them with locally commonly used equipment models or raw material types — without altering the core skill training objectives. Through the above operations, the standard-encapsulated curriculum resources achieve cross-system migration without losing teaching validity.

1.3 Evaluation of the Systematic Output Potential of the Industry-Education Integration Organizational Model

The industry-education integration organizational model operates in the form of a school-enterprise community. Its core structure includes a joint governance committee, an alternating teaching workshop operation system, and a real order-based curriculum production process. In this model, schools and industry enterprises share teaching spaces, equipment resources, and evaluation authority, thereby forming a closed-loop skill supply-demand regulation mechanism. This model embeds a work

process-oriented curriculum development method, a dual-position teacher rotation mechanism, and a product quality standard-based academic evaluation system, and these components together constitute a complete and self-consistent organizational operation logic.

The evaluation of the potential for outputting this model to the vocational education systems of Southeast Asia needs to be conducted from three dimensions: institutional compatibility, organizational absorption capacity, and technical ecological matching degree. Institutional compatibility measures the degree of friction between this model and the existing educational governance structures of Southeast Asian countries, and it mainly examines the negotiable space for decision-making power allocation and resource flow rules. Organizational absorption capacity assesses whether vocational colleges in Southeast Asia possess the basic conditions—such as management capability, teacher structure, and financial flexibility—to support the operation of this model. Technical ecological matching degree focuses on the difficulty of interfacing the information management tools and equipment interconnection protocols on which this model relies with the existing technical infrastructure in Southeast Asia. A comprehensive analysis shows that, under the conditions of moderate institutional distance and relatively high absorption capacity, a feasible path exists for the systematic output of this model, but parametric adjustments need to be made according to the levels of industrial concentration and institutional autonomy in different countries.

2. Embedding Paths of China's Educational Modernization Elements into the Vocational Education Systems of Southeast Asia

2.1 Cross-Regional Calibration and Localized Translation of the Vocational Qualification Framework

The cross-regional calibration of the vocational qualification framework requires the establishment of comparable correspondences between China's existing qualification system and those of Southeast Asian countries. This process relies on a step-by-step matching operation of level descriptors, which aligns the three dimensions of knowledge requirements, skill complexity, and responsibility autonomy in China's vocational skill level standards with the corresponding levels in the national qualification frameworks of Southeast Asian countries. The calibration adopts a functional mapping method; it does not pursue a one-to-one correspondence of level numbers but focuses on whether the typical types of vocational activities and performance requirements corresponding to each level have equivalent ranges in the target framework. The result of this operation is the formation of a two-way conversion table, which allows a certificate of a certain level from the Chinese system to find its corresponding acceptance range within the Southeast Asian frameworks^[2].

Localized translation is the contextual re-embedding of the content of the qualification framework based on calibration. The translation work involves three levels of adjustment: the localized replacement of industry terminology, the redirection of the legal reference system, and the replacement of the typical case database. At the industry terminology level, job titles and process names that are unique to China's industrial environment need to be converted into commonly used vocational titles in Southeast Asian localities. At the legal reference system level, specific technical standards or safety regulations cited in the original framework need to be removed and replaced with equivalent documents that are currently available and enforceable in Southeast Asian countries. At the typical case database level, the original cases need to be replaced with real work scenarios from local enterprises. After the translation is completed, the revised qualification framework no longer retains the original markings of China's education system; instead, it presents itself as a set of independently operable localized evaluation standards that can be directly invoked by vocational education institutions in Southeast Asia.

2.2 Redesign of the Dual-System Teaching Operation Structure and Its Operational Logic

The redesign of the dual-system teaching operation structure adjusts the parameters according to the organizational conditions of the vocational education systems in Southeast Asia. The alternating cycle between enterprise training and school-based theoretical teaching in the original structure is usually set to a rotation rhythm of two to four weeks, and this rhythm relies on the enterprise's ability to provide stable training positions. Considering that small and medium-sized enterprises account for a relatively high proportion in some regions of Southeast Asia and that labor demand fluctuates significantly, the redesign compresses the alternating cycle to a daily basis or adopts a half-day rotation model, thereby

reducing the pressure on enterprises to commit to long-term training positions. At the same time, the redesign introduces a modular task decomposition strategy, which breaks down a complete vocational activity into several subtasks that can be completed in different enterprises, thus dispersing the concentrated demand for training resources.

The core of this operational logic is to maintain the original closed-loop characteristics of the dual-system teaching — that is, training tasks drive theoretical learning, and theoretical learning provides feedback to guide subsequent training—while adjusting its time scale and resource allocation rules. In the redesigned structure, schools assume more intensive pre-training preparation teaching and post-training review sessions to compensate for possible deficiencies in the teaching guidance capabilities of enterprises. On the enterprise side, they only need to provide standardized task execution scenarios and basic materials, and the responsibility for teaching guidance is shared between the mobile instructors sent by the schools and the regular employees of the enterprises on site. This adjustment changes the original allocation of rights and responsibilities in the dual-system model where enterprises lead the training, and it forms a hybrid operational logic with the school as the dispatch center and the enterprise as the task site. This logic is more aligned with the actual collaboration capacity boundaries between vocational colleges and local enterprises in Southeast Asia^[3].

2.3 Knowledge Transfer Carriers and Competency Mapping Relationships in Teacher Professional Development

The knowledge transfer carriers in teacher professional development include an explicit teaching methodology toolbox, a classroom event video case database, and reusable teaching design templates. The common feature of these carriers is that they transform the teaching experience accumulated during China's educational modernization into forms that can be directly used by teachers in other regions. The teaching methodology toolbox collects classroom organization schemes for different skill types, and each scheme comes with an explanation of applicable conditions and a guide to common problem-solving paths. The video case database selects key teaching events from complete teaching units, and it provides timeline markers and teaching decision annotations. The teaching design templates offer preset structures for course objectives, activity sequences, and evaluation methods; teachers only need to fill in the specific content to generate an executable lesson plan.

The competency mapping relationship is responsible for connecting the teaching behaviors embedded in the above knowledge carriers with the existing competencies of local teachers in Southeast Asia. The mapping operation consists of two steps: first, it identifies the teacher competency items required by the carriers, such as classroom rhythm control ability, real-time feedback generation ability, and differentiated instruction ability; then, it breaks down each competency into observable behavioral indicators and compares these indicators with the behaviors that Southeast Asian teachers have already mastered in their teaching routines. For competency items where gaps exist, the mapping relationship designs supplementary hierarchical training modules, and each module corresponds to a separately learnable behavioral unit. Through this mapping and supplementation mechanism, the knowledge carriers are no longer forced into the local context as complete packages; instead, they are integrated modularly into the existing competency structures of local teachers, thereby achieving a gradual penetration of professional development.

3. Evolutionary Trends of Southeast Asian Vocational Education Systems Influenced by China's Educational Modernization

3.1 Distributed Adjustment of Educational Governance Rights and Responsibilities Allocation and Multi-Actor Collaboration

The distributed governance logic formed during China's educational modernization has exerted a structural influence on the allocation of rights and responsibilities in the vocational education systems of Southeast Asia. The decision-making authority, traditionally concentrated in the hands of educational administrative departments, has begun to disperse to colleges, industry organizations, and regional training consortia, thereby forming a pattern where multiple nodes jointly exercise some governance functions. Specific manifestations of this evolution include the following: vocational colleges have gained expanded autonomy in program selection and curriculum content updates; industry consortia have started to participate in the negotiation process of skill standard development; and cross-institutional resource allocation platforms have obtained a certain degree of decision-making

power over budgets and personnel arrangements. The decentralization of rights and responsibilities does not completely remove central supervision; instead, it establishes a layered authorization mechanism, where strategic frameworks are set at the macro level, while operational decisions are made by nodes close to teaching and employment^[4].

The multi-actor collaboration model has undergone corresponding adjustments accordingly. The inter-actor relationships originally based on administrative directives have gradually shifted toward a collaborative network based on contracts and mutual recognition agreements. Educational institutions form vertical articulation channels through course credit mutual recognition systems, and colleges and employers establish horizontal alignment relationships through jointly developed teaching modules. The functions undertaken by different actors in the collaboration tend to become specialized: industry organizations are responsible for providing real-time signals of skill demands, educational institutions are responsible for converting these signals into teaching content, and third-party evaluation entities are responsible for verifying the degree of match between teaching outputs and demands. This distributed adjustment and collaboration mechanism allows the entire system's response to labor market changes to no longer rely entirely on the step-by-step transmission of central directives; instead, it permits local nodes to autonomously identify problems and initiate adjustment procedures.

3.2 Flexible Restructuring of the Modular Curriculum System and Labor Market Matching Efficiency

Influenced by the transmission of the modular curriculum design concept from China's educational modernization process, the vocational education curriculum system in Southeast Asia is shifting from a sequenced structure of fixed programs to a disassemblable and recombinable building-block structure. The core operation of modular restructuring is to decompose the curriculum content originally organized by grade level into independent teaching units, and each unit corresponds to a vocational competency that can be independently verified. The strict prerequisite dependencies between these units are eliminated, and learners can choose different unit combination paths according to their own starting points and goals. The restructured curriculum system retains complete knowledge coverage, but it abandons the requirement for uniform progress and instead supports the generation of personalized learning trajectories.

The improvement in labor market matching efficiency stems from two characteristics of the modular structure: fine-grained calibration capability and dynamic updating capability. Fine-grained calibration enables vocational colleges to quickly assemble relevant units from the existing module library to form a short-term skill enhancement pathway for a specific job vacancy, without the need to develop an entire set of courses from scratch. Dynamic updating capability allows individual modules to be replaced or added without affecting the operation of the overall system; when the demand for a certain type of vocational skill changes, it is only necessary to adjust the content parameters of the corresponding module or add new modules to achieve synchronization between curriculum supply and market demand. This matching mechanism shortens the time delay from the emergence of a demand signal to the completion of the teaching response, reduces the systematic deviation between the skill structure of graduates and job requirements, and improves the degree of alignment between vocational education outputs and the employment absorption structure^[5].

3.3 Self-Organizing Characteristics of the Quality Assurance Mechanism and Enhancement of Dynamic Adaptability

The self-organizing characteristics of the quality assurance mechanism manifest as a shift in the generation mode of evaluation standards, evaluation subjects, and evaluation procedures from external prescription to internal evolution. Under the indirect influence of elements related to China's educational modernization, a process of quality definition jointly participated in by colleges, employers, and graduate representatives has begun to take shape within the vocational education systems of Southeast Asia. Evaluation standards no longer rely entirely on top-down unified indicators; instead, through repeated negotiations among different stakeholders, they gradually precipitate consensus-based benchmarks applicable to specific regions or specific industries. The evaluation subjects expand from a single educational regulatory agency to a diverse consortium that includes industry certification entities, third-party testing service organizations, and alumni networks^[6].

The enhancement of dynamic adaptability is reflected in the response speed and adjustment range of the quality assurance mechanism to changes in the educational environment. Traditional quality

assurance mechanisms are usually revised at fixed intervals, and the revised content often lags behind changes in teaching practices. In contrast, a mechanism with self-organizing characteristics embeds a continuous feedback loop: formative evaluation data from the teaching process, employer feedback after graduates enter the workforce, and monitoring signals of emerging skill demands within industries are automatically collected and input into the update algorithm of the evaluation system. When cumulative evidence shows that the correlation between a certain evaluation indicator and actual job performance has significantly decreased, the system triggers an indicator correction or weight adjustment procedure. This mechanism ensures that quality assurance is no longer a periodic external review event but becomes an integral part of the daily operation of the vocational education system, thereby maintaining the ability to continuously keep pace with changes in the economic structures and technical conditions of Southeast Asian countries.

Conclusion

This study identifies the transferable characteristics of three core elements in the process of China's educational modernization—digital technology modules, standard-encapsulated curriculum resources, and the industry-education integration organizational model—and examines their embedding paths into the vocational education systems of Southeast Asia. These paths include the cross-regional calibration and localized translation of the vocational qualification framework, the parametric redesign of the dual-system teaching operation structure, and the construction of knowledge transfer carriers and competency mapping relationships in teacher professional development. The study reveals that, after absorbing the above elements, the vocational education systems in Southeast Asia exhibit an adjustment in governance rights and responsibilities from centralized to distributed collaboration, a restructuring of the curriculum system from a fixed sequence to a modular and flexible structure, and an evolution of the quality assurance mechanism from external inspection to an embedded continuous feedback loop. These findings indicate that the embedding of China's educational modernization elements undergoes reorganization operations of calibration, translation, and redesign, thereby generating localized operational logic. Future research may explore the moderating effects of differences in industrial concentration and institutional autonomy across countries on the embedding outcomes, as well as the long-term stability of the evolutionary trends.

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