

Integration of Industry and Education Empowers the Foundation of International Ecology: A Study on the Construction Model of the Internationalization Ecosystem in Vocational Colleges

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Abstract: Against the dual background of economic globalization and vocational education reform, the construction of an internationalization ecosystem in vocational colleges is the key to breaking down cross-border school-enterprise cooperation barriers and cultivating technical and skilled talents with global competence. Supported by educational ecology and industry-education integration theories, this study adopts a mixed research method to sort out relevant research and practices at home and abroad, clarify its core connotation and operational logic, analyze existing problems, draw on mature international experience, and propose core implementation paths and a comprehensive guarantee system. The research shows that the core of the ecosystem construction is to realize the cross-border integration of the industrial chain, education chain and innovation chain and the value co-creation of multiple subjects, which can support the international education of vocational colleges and the transformation of China's vocational education. The research limitations and future directions are also pointed out.

Keywords: Industry-education integration; Vocational colleges; Internationalization ecosystem; Cross-border integration; Talent cultivation

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1. Research origin and value implication

Against the dual background of the in-depth advancement of economic globalization and the deepening reform of the modern vocational education system, the internationalization of vocational education has become the core path to improve the quality of education and connect with the global industrial chain. Constructing an internationalization ecosystem of vocational colleges from the perspective of industry-education integration is an inherent requirement to break through cross-border barriers of school-enterprise cooperation and cultivate

technical and skilled talents with global competence.

The core value of this study is reflected in three dimensions: Theoretically, based on educational ecology and industry-education integration theories, this study clarifies the operational logic of the vocational education ecosystem in cross-border scenarios and fills the theoretical research gap of the internationalized industry-education integration ecology. Practically, it extracts a replicable and promotable ecosystem construction model, providing practical references for vocational colleges to solve problems such as insufficient subject coordination and poor standard alignment in international education. Strategically, it explores the implementation path of vocational education serving the upgrading of the global value chain, supporting the transformation of China's vocational education from "standard input" to "rule output".

This study adopts a mixed research method: systematically sorting out relevant theoretical achievements at home and abroad through literature review, deeply analyzing typical practices through case study, and quantitatively identifying the key influencing factors of ecosystem construction through questionnaire survey and data analysis, so as to ensure the scientificity and practicality of the research conclusions.

2. Core concepts and theoretical connotation

2.1. Connotation evolution and era value of industry-education integration

After more than 40 years of institutional evolution in China, industry-education integration has gradually formed a complete institutional framework of government guidance, industry guidance, enterprise participation and college implementation from 1985 to 2017 ^[1]. First, innovate the talent training model to solve the pain point of disconnection between talent training and market demand ^[2]. Second, improve the quality of vocational education, and force the reform of the curriculum system and teaching mode through industrial technological iteration ^[3]. Third, optimize the talent supply structure and adjust the professional layout closely to the needs of industrial upgrading ^[4]. Fourth, serve the high-quality economic development and promote technological research and development and achievement transformation through school-enterprise collaboration.

2.2. Components and core functions of the internationalization ecosystem

The internationalization ecosystem of vocational colleges is an open educational ecosystem based on the theory of educational ecology, with cross-border industry-education integration as the core, jointly participated by multiple subjects such as governments, colleges, enterprises and international educational institutions, to realize cross-border resource flow and collaborative value creation. Its core components include the subject dimension, resource dimension, technology dimension and cultural dimension.

The core functions of the ecosystem focus on four points: First, promote the cross-border flow of high-quality educational resources and realize the leap of school-running capacity ^[5]. Second, promote cross-border scientific research innovation and technology transfer, and accelerate the industrial application of scientific and technological achievements ^[6]. Third, optimize the international talent supply chain and realize the precise matching between talent training and international industrial needs ^[7]. Fourth, enhance the international competitiveness of vocational colleges and expand the international influence of China's vocational education.

3. Reference to domestic and foreign research and practice

3.1. Domestic research progress and practical exploration

At present, three core research directions have been formed in the domestic academic circle: First, construct a theoretical framework and clarify the ecological structure and operational law of the ternary nested government-industry-education^[8]. Second, clarify the core logic of the internationalization ecosystem and propose a construction path centered on the industrial chain, education chain and innovation chain. Third, complete the typological division of industry-education integration models, forming a gradient cooperation spectrum of loose type, nominal type and independent legal person type^[9].

Existing studies have completed the construction of the basic theoretical framework, but still have obvious limitations: insufficient research on the particularity of cross-border industry-education integration, weak explanatory power for issues such as differences in international rules and cultural cognitive conflicts^[10]; mostly static case analysis, lack of quantitative tracking of the dynamic evolution law of the ecosystem^[11]; insufficient research on the governance model and evaluation system of the new ecosystem under the digital background, which cannot fully meet practical needs^[12].

3.2. International practical models and experience enlightenment

Three types of models have been formed globally: First, the German “Dual System” model, which legislates to clarify the dual-subject status of enterprises and colleges. More than 60% of students’ learning time is spent on practical training in enterprises, forming a school-enterprise collaborative education system with complete institutional guarantee. Second, the American community college model, which is deeply linked with multinational corporations, customizes training programs according to industry needs, and the curriculum system fully fits the pace of industrial technological iteration, forming a highly market-oriented industry-education integration mechanism. Third, the Australian TAFE system, which takes industry organizations as the core link, encourages enterprise participation through policies such as financial subsidies and tax incentives, and builds a flexible and efficient market-oriented school-running system.

The core enlightenment of international practice is that the construction of the internationalization ecosystem of vocational colleges must: Legislate to clarify the rights and responsibilities boundaries of multiple subjects and provide stable institutional guarantee for cross-border cooperation; Adhere to the dominant position of enterprises, design cooperation models closely to the upgrading needs of the global industrial chain, and achieve win-win school-enterprise benefits; Strengthen the government’s guidance and support role, and reduce the institutional costs of cross-border school-enterprise cooperation through policy tools and financial support.

4. Core implementation paths of ecosystem construction

4.1. Build a multi-cooperative international cooperation platform

Multi-subject coordination is the core foundation of internationalization ecosystem construction. On the one hand, deepen in-depth cooperation with multinational corporations, sign long-term cooperation agreements with internationally renowned enterprises, jointly build joint laboratories and cross-border training bases, provide students with overseas internship and employment channels, and realize the precise matching between talent training and international industrial needs. On the other hand, expand the cooperation network with overseas vocational colleges and establish stable inter-school cooperative relations; actively participate in international vocational education alliances and standard formulation, promote the international mutual

recognition of vocational qualification certificates, and break the institutional barriers to cross-border talent mobility ^[13].

4.2. Construct an international standard education and teaching system

Curriculum and teaching reform are the core link of ecosystem construction. First, develop a curriculum system in line with international standards, reverse embed international industry standards into curriculum design, jointly develop professional courses with international enterprises and overseas colleges, and balance technical universality and local adaptation ^[14]. Second, introduce advanced international teaching models, comprehensively promote teaching methods such as project-based learning, flipped classroom and interdisciplinary cooperation, and cultivate students' practical ability, innovation ability and cross-cultural communication ability with real industrial projects as carriers; build cross-border online classrooms relying on digital platforms to realize the real-time sharing of high-quality international educational resources.

4.3. Build an internationalized double-qualified teaching staff

The internationalization of the teaching staff is the key support for ecosystem construction ^[15]. Construct a systematic international training system for local teachers, formulate special training plans, and improve teachers' international vision, professional ability and cross-cultural teaching level; establish a training effect evaluation mechanism, incorporate international exchange experience and teaching achievements into the teacher assessment system, and form a positive incentive. At the same time, increase the introduction of international talents, employ enterprise experts and foreign teachers with overseas working backgrounds to participate in teaching and scientific research, and optimize the structure of the teaching staff.

5. Comprehensive guarantee system for ecosystem construction

5.1. Improve the policy and institutional guarantee system

Policies and institutions are the fundamental guarantee for ecosystem construction. At the national level, continue to release the institutional dividends of policies related to the revision of the "Vocational Education Law" and the reform of the modern vocational education system, improve the top-level design of vocational education internationalization, issue incentive policies for cross-border industry-education integration, and promote the construction of the international mutual recognition system of vocational qualifications. At the local government level, issue supporting measures combined with regional development strategies, set up special funds for vocational education internationalization, coordinate and solve institutional obstacles in cross-border cooperation, and form a top-down linked policy guarantee system.

5.2. Optimize the fund and resource allocation mechanism

Fund and resource allocation are an important foundation for ecosystem construction ^[16]. Construct a diversified fund-raising system, increase financial investment in vocational education internationalization, guide enterprises and social capital to participate in international education projects, and actively apply for international organization education funds and bilateral cooperation project funds to solve the problem of insufficient funding ^[17]. At the same time, establish a scientific resource allocation and use efficiency evaluation mechanism, realize the overall management and precise delivery of school-running resources through digital means, focus on core construction links to optimize resource allocation, avoid resource idleness

and waste, and maximize school-running benefits.

5.3. Strengthen campus culture and brand building

Culture and brand are important supports for the sustainable development of the ecosystem. Shape an open and inclusive campus culture with an international vision, create a strong international school-running atmosphere by holding international cultural festivals, academic forums, foreign expert lectures and other activities, and cultivate teachers' and students' cross-cultural understanding and tolerance. At the same time, build a distinctive international school-running brand, accurately position the school-running orientation combined with the college's advantageous majors and regional industrial characteristics, and enhance the college's international popularity and influence with high-quality cross-border industry-education integration projects and international talent training achievements as the core, promoting the Chinese vocational education brand to go global.

6. Research conclusion and future prospect

This study draws three core conclusions: First, the construction of the internationalization ecosystem of vocational colleges is a systematic project, which must take industry-education integration as the core and build a governance system coordinated by multiple subjects, including governments, colleges, enterprises and international institutions. Second, the core logic of ecosystem construction is to realize the cross-border integration of the industrial chain, education chain and innovation chain, break resource flow barriers and institutional obstacles, and realize the value co-creation of multiple subjects^[18]. Third, ecosystem construction must adhere to problem orientation, focus on core pain points such as cultural differences, standard alignment and subject coordination in cross-border cooperation, improve implementation paths and guarantee systems, and ensure construction effectiveness^[19]. This study still has certain limitations: insufficient research on the role of subjects such as international organizations and non-governmental organizations, insufficient discussion on risk prevention and control in cross-border cooperation, and the sample coverage of empirical research needs to be expanded^[20].

Future research can focus on four directions: First, deepen the systematic research on the cross-border industry-education integration mechanism and solve institutional problems in transnational school-enterprise cooperation. Second, explore new paths for ecosystem construction under the digital background and tap the core empowering role of digital technology^[21]. Third, build a scientific performance evaluation system for the internationalization ecosystem to realize the dynamic monitoring and optimization of construction effectiveness^[22].

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