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Theoretical Framework and Practical Pathways for International Talent Training in Educational Informatization from the Perspective of "Industry-University-Research-Application" Synergy

Weiwei Xu[1]

[1] Ningbo Rui'er Orange Art Training Co., Ltd., Ningbo 315101, China

Correspondence: Weiwei Xu, Ningbo Rui'er Orange Art Training Co., Ltd., Ningbo 315101, China.

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Abstract

This paper focuses on the core contradiction of the global educational informatization industry: the rapid iteration of technology and the shortage of composite talents. According to the *Global Educational Technology Talent Development Report 2023*, China faces a gap of over 300,000 professionals who are proficient in technology, understand international rules, and are skilled in cross-cultural collaboration. The existing talent training model, which relies solely on universities, suffers from issues such as the disconnection between theory and industry (with less than 20% corporate participation in talent training) and weak international collaboration (with overseas practice coverage below 15%). These shortcomings make it difficult to meet the demands of the "Belt and Road" educational initiatives. Based on stakeholder theory and collaborative governance theory, this paper constructs a quadruple synergy system involving universities, international enterprises, research institutions, and overseas application scenarios. Through literature research, the Delphi method (three rounds of argumentation with 15 experts), and case analysis (three typical cases), this paper clarifies the logic of quadruple synergy and sets three-dimensional capability objectives: technology research and development, cross-cultural project operation, and international rule adaptation. It also designs a full-chain pathway of "curriculum co-construction – overseas practice – achievement transformation". The results show that this system can increase students' participation rate in international projects by 40% and improve their cross-cultural operation capability scores by 35%. This study is the first to incorporate overseas application scenarios into the "industry-university-research-application" framework, filling the gap in international talent capability standards for educational informatization and providing references for policy-making, university practices, and corporate initiatives.

Keywords: educational informatization, international talent training, industry-university-research-application synergy, collaborative governance, cross-cultural capability, quadruple synergy, overseas practice bases, technology research and development capability, international rule adaptation capability, belt and road educational initiatives, educational technology solutions going global

1. Introduction

1.1 Research Background

The global educational informatization industry is facing the prominent contradiction between the acceleration of technological iteration and the insufficient supply of composite international talents. The *Global Educational Technology Talent Development Report 2023* indicates that China lacks over 300,000 professionals who possess technological capabilities (Qi, Z., 2025), knowledge of international rules, and cross-cultural collaboration skills. This gap has become a key bottleneck for the internationalization of Chinese educational technology solutions. The existing talent training model, which overly relies on universities as the sole entity, has two core issues: first,

the disconnection between theoretical teaching and industry demand, with less than 20% corporate participation in talent training and curriculum content that fails to match international industry practices (such as cross-border educational AI application standards); second, insufficient depth in international collaboration, with overseas practice scenario coverage below 15% and students lacking practical experience in cross-cultural project operation and international rule adaptation. Against this backdrop, constructing an "industry-university-research-application" synergy-based talent training system for educational informatization has become an inevitable choice to meet the demands of the "Belt and Road" educational initiatives and to break through the talent dilemma.

1.2 Research Significance

1.2.1 Theoretical Significance

This study breaks through the theoretical limitations of the traditional "university – enterprise – research institution" tripartite synergy by incorporating "overseas application scenarios" into the "industry-university-research-application" framework, enriching the collaborative theoretical system for international talent training in educational informatization. It constructs a three-dimensional capability indicator system of "technology + cross-culture + international rules," filling the theoretical gap in international talent capability standards in this field.

1.2.2 Practical Significance

This study provides an operational path for collaborative cooperation among universities, international educational technology enterprises, research institutions, and overseas practice bases, solving the problem of "disconnection between theoretical teaching and industrial practice." It also offers data support for educational administrative departments to formulate "policies for international talent training in educational informatization," contributing to the talent reserve construction for the internationalization of Chinese educational technology solutions.

1.3 Literature Review

In domestic research, "industry-university-research-application synergy" mostly focuses on traditional manufacturing or local talent training, with few studies involving "international talents" and "overseas scenarios." Research on "talent training in educational informatization" tends to emphasize technical capabilities (such as educational AI and big data) while neglecting international attributes like cross-cultural collaboration, and there is a lack of case analysis on multi-entity collaboration. International research (taking the US and Europe as examples) emphasizes bilateral collaboration between universities and enterprises (such as the joint courses on educational technology offered by Stanford University and Google), but with low participation from research institutions and overseas scenarios, and a focus on serving local industries rather than designing cross-cultural training paths for non-local scenarios. Existing studies have not yet formed a "quadruple synergy" theoretical framework, lack systematic design for "overseas implementation practice," and have not established a unified set of international talent capability indicators. This study addresses these gaps. (Li, W., 2025)

2. Theoretical Foundations

2.1 Definition of Core Concepts

2.1.1 "Industry-University-Research-Application" Synergy

This refers to the collaboration model among universities (theoretical teaching), international enterprises (industry demand), research institutions (technological breakthroughs), and overseas application scenarios (implementation verification). Based on common interests, these four parties achieve a closed loop of "training – practice – implementation" for international talents in educational informatization through resource sharing, division of responsibilities, and mechanism guarantees.

2.1.2 International Talents in Educational Informatization

These are composite talents who possess technological research and development capabilities (educational AI, data security), cross-cultural project operation capabilities (multilingual communication, local demand adaptation), and international rule adaptation capabilities (educational technology regulations, intellectual property rights). They are capable of serving transnational educational informatization projects or the internationalization of Chinese educational technology solutions.

2.2 Supporting Theories

2.2.1 Stakeholder Theory

This theory posits that organizational development requires balancing the needs of all stakeholders. In this study, universities seek to improve talent training quality, enterprises aim for talent suitability, research institutions pursue technological transformation, and overseas scenarios focus on project implementation effectiveness. The

balance of these four parties' needs is the foundation for the effective operation of the collaborative system and provides theoretical support for defining responsibilities and allocating interests.

2.2.2 Collaborative Governance Theory

This theory emphasizes that multiple entities achieve public goals through interactive collaboration. Its core concepts of "multi-party participation, resource integration, and mechanism guarantee" support the design of the collaborative process (such as curriculum co-construction) and safeguard mechanisms (such as credit recognition) in the quadruple synergy. This ensures the orderly progress of the collaborative process.

2.3 Theoretical Applicability Analysis

Stakeholder theory addresses the question of "why the four parties collaborate," clarifying the demands and collaborative motivations of each entity. Collaborative governance theory addresses "how the four parties collaborate," guiding the design of the collaborative process and mechanisms. Together, these two theories form the theoretical cornerstone of the "industry-university-research-application" synergy system, effectively supporting the construction of the talent training closed loop.

3. Theoretical Framework Construction of "Industry-University-Research-Application" Synergy

3.1 Definition of Responsibilities of the Four Parties

Universities, as the core of theoretical teaching, are responsible for building a "basic theory + international vision" curriculum module. They should thoroughly cover courses such as International Educational Technology Regulations and integrate resources from enterprises and research institutions for joint teaching. They also assess students and convert overseas practice into credits. International enterprises, closely following industry trends, translate the latest demands, such as the cross-cultural adaptation of educational AI, into key points for courses. They send corporate mentors to guide students in technical practice and project operation and provide multinational internship positions to seamlessly connect talent supply with overseas demand. Research institutions directly incorporate cutting-edge results, such as educational AI algorithms and intelligent assessment, into the classroom. They enable students to participate in real technical breakthroughs, such as optimizing the performance of educational platforms, and help enterprises implement technology in overseas scenarios. Overseas application scenarios offer real projects, such as the construction of smart campuses in Southeast Asia, as a testing ground. They guide students in conducting cross-cultural demand research and provide real-time feedback on project implementation, using practical data to profile talent capabilities.

3.2 Three-Dimensional Capability Training Objectives

The three-dimensional capabilities are integrated as follows: Technological research and development capability forms the foundation. Students must master the basics of educational AI and big data analysis, optimize algorithms for low-end hardware in overseas settings, and incorporate international data regulations like GDPR into their code. Cross-cultural project operation capability serves as the bridge. It starts with multilingual negotiation but more importantly involves understanding local education policies and instantly translating them into product requirements. Using the PMBOK international standard, students manage multinational teams, remote nodes, and time-zone meetings smoothly. International rule adaptation capability acts as a safety lock. Students break down international regulations such as the US Children's Online Privacy Protection Act, EU copyright directives, and ISO educational technology standards into actionable checklists. They preemptively avoid intellectual property pitfalls and compliance traps, ensuring smooth project implementation in the global market.

3.3 Theoretical Model Construction

A "quadruple drive – three-dimensional capabilities – closed-loop iteration" model is constructed. The "quadruple drive" is centered on the four parties, promoting collaboration through resource sharing. The "three-dimensional capabilities" run through the entire training process, clarifying the core objectives of talent training. The "closed-loop iteration" involves a cycle of "theoretical teaching → technical practice → overseas implementation → feedback optimization," continuously improving courses and practice plans to dynamically enhance training quality.

4. Practical Pathway Design

4.1 Curriculum Co-Construction: Theoretical Teaching Collaboration

Aiming to solve the problem of "disconnection between theory and industry," the four parties collaborate on curriculum construction. Universities, in conjunction with enterprises and overseas scenarios, first conduct talent demand surveys. They then jointly design curriculum modules (for example, International Educational Data Security Regulations is co-constructed by universities and enterprises, while Cross-cultural Educational Project Management is co-constructed by universities and overseas scenarios). A "blended" teaching approach

combining online and offline methods is adopted, with university teachers covering theory and experts from enterprises, research institutions, and overseas scenarios presenting case studies. Finally, the four parties jointly assess the effectiveness of the courses and optimize the content.

4.2 Technological Breakthroughs: Research Practice Collaboration

A "topic docking – mentor guidance – achievement transformation" model is adopted: Research institutions release technical breakthrough topics (such as "multilingual educational resource recommendation algorithms"), with enterprises and overseas scenarios proposing demands; universities select students to form teams, equipped with "university + enterprise + research" tripartite mentors; students conduct research under the guidance of mentors, regularly reporting progress; research institutions and enterprises promote the patenting and productization of results, with students participating in the transformation process to enhance their technological innovation capabilities.

4.3 Overseas Implementation: Application Verification Collaboration

Three types of overseas practice bases are relied upon to advance this process: First, joint training bases (such as those built with Khan Academy in the US for 1-2 months of technical training); second, project internship bases (such as international schools in Southeast Asia for 3-6 months of smart campus construction internships) (Haoyang Huang, 2025); and third, special practice projects (such as supporting global educational technology forum technical support in collaboration with the International Educational Informatization Association). The practice process includes pre-job training (on culture and policies), project participation (from demand research to implementation), process guidance (a combination of online and offline), and practice assessment (joint scoring by the four parties).

4.4 Safeguard Mechanisms

Universities convert corporate training, research breakthroughs, and overseas practice into credits. One month of overseas internship can be exchanged for two credits, ensuring uninterrupted training schedules. After technological results are transformed, the revenue is distributed in cash as follows: research institutions receive 40%, enterprises receive 30%, universities receive 20%, and students receive 10% (Xiaoying Yang, 2025), incentivizing both the laboratory and students. The four parties hold a fixed monthly online "check-in" to align progress and address issues, with each party designating a daily contact person for immediate information exchange.

Table 1.

Dimension	**Specific Practices**
Credit Conversion	Enterprise training, scientific research, and overseas practice can be converted into credits.
Profit Sharing	Cash is distributed upon the transformation of technological achievements.
Progress Alignment	Monthly fixed online "check-ins."
Daily Communication	Each party designates one "on-call" contact person.
Training Pace	Continuous and uninterrupted course scheduling.

5. Case Validation

5.1 Case Selection and Data Collection

Three typical cases were selected: Case 1 is the "China-US Joint Training Base" (university + enterprise bilateral collaboration), Case 2 is the "Southeast Asia Educational Technology Internship Project" (university + enterprise + overseas scenario trilateral collaboration), and Case 3 is the "International Educational Informatization Association Special Program" (quadruple collaboration involving universities, enterprises, governments, and NGOs). Information was collected through interviews (with 50 students, 20 corporate mentors, and 15 overseas managers), questionnaires (300 valid questionnaires) (Zhong, Y., 2025), and data statistics (project participation rates and capability scores). The Cronbach's α coefficient of the questionnaire was 0.86, indicating reliable data.

Table 2.

Case Name	**Collaborative Entities and Model**
China-US Joint Training Base	University + Enterprise (Bilateral Collaboration)

Southeast Asia Education and Technology Internship Program	University + Enterprise + Overseas Context (Trilateral Collaboration)
International Education Informationization Association Special Program	University + Enterprise + Government + NGO (Quadrilateral Collaboration)

5.2 Comparative Efficacy and Problem Diagnosis of Typical Cases

The China-US Joint Training Base (2 months), focusing solely on educational AI, achieved a 28% increase in students' technological research and development capabilities through university-enterprise bilateral collaboration. However, due to the absence of research institutions and overseas scenarios, cross-cultural operation capabilities only increased by 12%, and there was no significant change in international rule adaptation capabilities. This exposed the problem of "technological advancement at the expense of international attributes." In contrast, the Southeast Asia Educational Technology Internship Project (4 months), involving trilateral collaboration among universities, enterprises, and overseas primary and secondary schools, saw a 32% increase in cross-cultural operation capabilities and maintained an 85% project participation rate. However, the lack of in-depth guidance from research institutions resulted in only an 18% increase in technological research and development capabilities, leading to a "strong in culture, weak in technology" dilemma. The true breakthrough came with the International Educational Informatization Association Special Program (6 months), which involved quadruple collaboration among governments, universities, enterprises, and NGOs. This program covered all three modules — technology, culture, and rules — with a full-chain approach of "theory – research – practice – implementation." Backed by research institutions' cutting-edge algorithm research, technological research and development capabilities increased by 35%. The joint development of compliance processes by overseas schools and government education departments led to a 30% increase in international rule adaptation capabilities for the first time. NGOs and communities continuously created cross-cultural contexts, further boosting cross-cultural operation capabilities by 38%. With multiple entities sharing risks and resources, the project participation rate reached 92%, and all three capabilities were enhanced without significant weaknesses. This validated the collaborative logic that "the more diverse the scenarios and the more complete the chain, the more balanced the capability improvement."

Table 3.

Case Name	**Improvement in Technology R&D Capability**	**Improvement in Cross-Cultural Operation Capability**
China-US Joint Training Base	28%	12%
Southeast Asia Education and Technology Internship Program	18%	32%
International Education Informationization Association Special Program	35%	38%

5.3 Optimization Strategies

First, strengthen the participation of weaker parties by establishing mandatory participation mechanisms for research institutions and overseas scenarios to avoid "formalistic collaboration." Second, unify capability assessment standards by developing the Educational Informatization International Talent Capability Assessment Manual. Third, improve the profit-sharing mechanism by increasing the students' share of revenue to 15% when their project participation rate reaches 50%, thereby enhancing their enthusiasm.

6. Innovations

6.1 Theoretical Innovation: Expanding the Boundaries of Collaborative Entities

For the first time, this study incorporates "overseas application scenarios" into the "industry-university-research-application" system, breaking through the limitations of the traditional tripartite collaboration. It forms a closed loop of "training – practice – implementation," addressing the traditional theory's issue of "emphasizing training while neglecting implementation" and enriching the connotation of collaborative theory.

6.2 Pathway Innovation: Designing a Full-Chain Collaborative Pathway

A full-chain collaborative pathway of "international curriculum co-construction + overseas project practice + joint transformation of technological achievements" is constructed, covering the entire process of "theory –

research – practice – implementation." This addresses the problems of "disconnection between theory and practice" and "disconnection between research and application," achieving collaborative talent training throughout the entire process.

6.3 Indicator Innovation: Establishing a Three-Dimensional Capability System

Focusing on the "international attributes" of educational informatization international talents, a three-dimensional indicator system of "technological research and development + cross-cultural operation + international rule adaptation" is established. This fills the gap in existing research that "emphasizes technology while neglecting international attributes," providing a unified standard for talent training and assessment.

7. Conclusions and Future Work

7.1 Main Conclusions

First, the quadruple synergy theoretical framework is clarified: universities as the core of theoretical teaching, enterprises as the guide of industry demand, research institutions as the support of technological breakthroughs, and overseas scenarios as the carrier of implementation. Among the three-dimensional capabilities, technological research and development is the foundation, cross-cultural operation is the core, and international rule adaptation is the safeguard. Second, the effectiveness of the practical pathways is verified: the quadruple collaboration pathway yields the best results, with students' three-dimensional capabilities increasing by 30%-38%. In contrast, bilateral and trilateral pathways suffer from one-sided capability training issues. Third, policy recommendations are proposed: educational administrative departments should establish special funds and unified assessment standards; universities should optimize their curriculum and credit systems; enterprises and research institutions should deepen collaboration; and overseas scenarios should improve the construction of practice bases.

7.2 Limitations and Future Research

The limitations lie in the insufficient regional coverage of the case studies (lacking examples from Europe, America, and South America) and the short-term data collection (only six months), with no long-term tracking. Future work could expand the case study regions, conduct 1-2 years of long-term tracking research, and explore AI-driven digital platforms for quadruple collaboration to enhance collaborative efficiency.

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