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# INNOVATION AND EFFECTIVENESS IN THE CULTIVATION MODEL OF SKILLED TALENTS – A CASE STUDY OF SHANGHAI SIPO POLYTECHNIC

Industry-education integration has become strategically vital for bridging educational systems and industrial demands during China's economic transformation. As demographic dividends diminish and technological innovations accelerate, conventional talent cultivation models prove inadequate in supplying the highly skilled workforce required by industrial upgrading. Consequently, the deep integration of vocational education and industry has emerged as a pivotal solution to structural employment challenges. This study examines industry-education integration in vocational education, analyzing persistent challenges in skilled talent cultivation and proposing innovative models and practices, substantiated through a case study of Shanghai Sipo Polytechnic.

**Keywords**: Skilled talents; Vocational education; Cultivation model; Innovation; Practice; Case Study.

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# ИННОВАЦИИ И ЭФФЕКТИВНОСТЬ МОДЕЛИ ПОДГОТОВКИ КВАЛИФИЦИРОВАННЫХ СПЕЦИАЛИСТОВ (на примере Шанхайского профессионально-технического института «Сипо»)

Интеграция образования и производства приобретает стратегически важное значение для соединения образовательных систем и потребностей промышленности в условиях экономической трансформации Китая. По мере сокращения демографических дивидендов и ускорения технологических инноваций традиционные модели подготовки кадров оказываются неспособными удовлетворить потребность в высококвалифицированных специалистах, необходимых для промышленной модернизации. Как следствие, глубокая интеграция профессионального образования и промышленности становится ключевым решением структурных проблем занятости. В данном исследовании анализируются проблемы интеграции образования и производства в системе профессионального образования, выявляются устойчивые вызовы в подготовке квалифицированных специалистов и предлагаются инновационные модели и практики (на примере кейс-стади опыта Шанхайского профессионально-технического института «Сипо»).

**Ключевые слова**: квалифицированные специалисты; профессиональное образование; модель подготовки; инновации; практика; кейс-стади.

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## 1. Emerging Challenges in the Cultivation Model for Skilled Talents

### 1.1 Structural Disconnect Between Conventional Pedagogy and Industry-Education Integration

#### 1.1.1 The Disparity Between Obsolete Instructional Materials and Rapid Technological Advancements

The misalignment between outdated teaching resources and swiftly evolving industrial technologies has emerged as a critical constraint on educational quality and industrial development, particularly within engineering disciplines. Certain tertiary institutions continue to utilize computer science textbooks from the 1990s (e.g., FoxPro programming language), while contemporary technologies such as AI large-scale models and cloud computing constitute less than 5% of curricular content. Industrial practices have comprehensively transitioned to edge computing gateways, whereas standard textbooks like the 5th edition of Power System Automation still emphasize obsolete Remote Terminal Units (RTUs[1]).

The average revision cycle for academic textbooks extends to 5.3 years, contrasting sharply with the 1.8-year technological iteration cycle in advanced manufacturing. This temporal gap results in significant curricular lag relative to industrial practices. For instance, certain vocational institutions persist in using the 2018 edition of Mechanical Drawing textbooks that reference discontinued numerical control machine models.

Three fundamental constraints impede timely textbook updates:

1) Institutional inertia in administrative mechanisms – textbook revision procedures require 5–8 years, substantially exceeding the innovation cycles of power technologies (2.5 years) and artificial intelligence (1.2 years). The approval process for

AI-enhanced teaching systems involves 37 distinct administrative reviews, prolonging implementation to 18 months – threefold longer than corporate technology adoption cycles.

2) Epistemological discontinuity among faculty – 62 % of professorial efforts prioritize SCI-indexed publications, with fewer than 30 % engaging in industry-collaborative projects over the past quinquennium. Robotics instructors frequently demonstrate deficient operational proficiency with Robot Operating Systems (ROS) and TensorFlow frameworks.
3) Systemic distortions in evaluation metrics – academic promotion systems allocate 80 % of assessment weight to research publications, relegating teaching excellence to merely 12 %. This incentive structure perpetuates market inefficiencies wherein publishers prioritize legacy textbooks with pre-packaged pedagogical supplements over updated content.

#### 1.1.2 Instructional Competency Deficits and Systemic Evaluation Failures

Faculty members exhibit limited exposure to frontier technologies, with some persistently employing deprecated technical frameworks. The prevailing research assessment paradigm remains decoupled from industrial requirements, resulting in suboptimal technology transfer rates. Industry-oriented projects rarely receive formal recognition in academic promotion evaluations.

#### 1.1.3 Superficial University-Enterprise Collaboration: Asymmetric Engagement Patterns

Empirical data indicates 62 % of higher education institutions implement outdated practical training modules, with most industry-academy partnerships remaining confined to symbolic agreements. Finance majors, for example, frequently encounter practice-limited internships focused on peripheral tasks such as voucher documentation rather than core financial operations.

### 1.2 Core Imperatives for Industry-Education Integration in Modern Industrial Development

#### 1.2.1 Deepening Multidimensional University-Enterprise Synergy Mechanisms

1) Cooperative institutional development – strengthen corporate governance in educational ecosystems through co-established industry academies and integrated training bases, facilitating vocational education dissemination to county-level regions. Systematically identify core industrial requirements (technological, product-oriented, and talent-driven) to implement targeted human capital development and technical assistance programs.
2) Collaborative talent cultivation – implement comprehensive reforms across five critical dimensions: program structure, curriculum design, pedagogical resources, faculty development, and experiential learning. Establish articulated pathways spanning secondary vocational, tertiary vocational, and undergraduate education to support continuous professional development[2].
3) Integrated employment and career development – develop dynamic program adjustment mechanisms synchronizing industrial evolution, academic offerings, and employment outcomes. Construct skills-based talent marketplaces enhancing graduate employability and regional talent retention.

#### 1.2.2 Constructing Unified Education-Industry Ecosystem Frameworks

1) Policy integration – embed industry-education integration within regional socioeconomic development blueprints, simultaneously optimizing educational resource allocation and industrial structure advancement.
2) Institutional innovation – establish operational metropolitan industry-education consortiums enabling cross-sectoral collaboration among government entities, industry associations, enterprises, and academic institutions. Develop transregional sectoral integration communities responsible for industry standard formulation and technological innovation hubs.
3) Infrastructure development – create open regional practice centers integrating pedagogical functions, production capabilities, and technical service provision.

#### 1.2.3 Optimizing Talent Supply-Demand Alignment

1) Reorient educational objectives toward application-oriented, interdisciplinary, and innovation-capable talent development to support novel productive forces.
2) Resolve structural imbalances between educational output and industrial demand through accelerated skills translation mechanisms.
3) Elevate vocational education's contribution to industrial upgrading, underpinning national strategic initiatives such as "Made in China 2025".

#### 1.2.4 Activating Multi-Stakeholder Collaborative Potential

1) Corporate engagement – to drive technology research & development, process innovation, and workforce training initiatives to overcome innovation barriers.
2) Academic transformation – to accelerate research commercialization, enhance technological skill accumulation, and strengthen industry service capabilities.
3) Governance enhancement – to refine policy frameworks and incentive structures to prevent redundant development in industry-education integration projects.

## 2. Innovative Paradigms in the Talent Cultivation Model through Industry-Education Integration

When a generational gap exists between vocational institutions' training equipment and industry needs, industry-education integration becomes not merely an educational issue but a core engine for industrial upgrading. The integration is undergoing a qualitative transformation from "equipment donation" to "joint standard development." Future breakthroughs are required in three key dimensions: policy sustainability (e. g., evolving tax incentives), digital integration (e. g., virtual simulation training), and international compatibility (e. g., mutual credit recognition), ultimately achieving synergistic interaction among the education chain, talent chain, and industry chain.

### 2.1 University-Enterprise Collaboration: Creating New Frontiers in Vocational Education

#### 2.1.1 Integrated Learning-Doing-Innovating Training Mechanism

Shaanxi Polytechnic Institute focuses on the intelligent transformation of equipment manufacturing and has established an Advanced Manufacturing Industry College in collaboration with leading enterprises. It innovated a talent training model for smart manufacturing craftsmen characterized by "industrial technology leadership and integration of learning, practicing, and innovation." This approach combines theoretical learning, practical training, and innovative application through "building a foundation with knowledge acquisition, honing skills through case studies, and fostering innovation via real-world projects."

#### 2.1.2 Four Co-Construction and Four Integration Mechanism

Shaanxi Polytechnic Institute partnered with Beijing Jingdiao to build an Advanced Manufacturing Industry College, creating an enterprise-situated education platform mechanism based on "co-construction of platforms, resource sharing, personnel exchange, and mutual benefits." This led to an operational mechanism featuring "team integration, technology integration, culture integration, and management integration." The industry-education integration community establishes benefit-sharing mechanisms through a coordination committee to integrate multi-stakeholder needs, sets up special funds to subsidize cooperation projects, and develops talent exchange mechanisms to promote two-way interaction between schools and enterprises.

### 2.2 Policy Incentives: Restructuring Motivation Mechanisms

#### 2.2.1 GPS Navigation Effect of the Whitelist System

When a new energy vehicle enterprise refused interns from a vocational college, the principal discovered an unsettling reality in the workshop: the battery testing equipment students used had been phased out by the enterprise five years prior [3]. This epitomizes the most acute pain point in vocational education – the invisible barrier between the classroom and the workshop. The 2025 policy package of tax incentives and a whitelist system is breaking down this barrier.

University-enterprise cooperation has long suffered from unilateral enthusiasm from schools. A survey by a provincial education department showed that only 17 % of large enterprises made substantive investments in vocational education. The leverage effect of the 2025 policy toolkit is emerging: the tax credit ratio increased to 30 %, equivalent to saving enterprises ¥12,000 per apprentice trained; whitelisted enterprises in pilot provinces qualify for special loans with interest rates 50 % below market rates. A smart manufacturing group in Guangdong, after being whitelisted, received a ¥23 million reduction in land transfer fees for its jointly built "digital twin training base" with a vocational college.

This screening mechanism functions like a GPS for industry-education integration. Evaluation criteria in Zhejiang require enterprises to meet hard indicators such as "skilled positions exceeding 40 %" to qualify for benefits like land use reductions and low-interest loans. An enterprise in Shandong prioritized obtaining 15 mu of industrial land through its industry-education integration credentials, demonstrating how policy levers facilitate two-way resource flow between schools and enterprises.

#### 2.2.2 Credit Revolution: Transfer of Value Assessment Power

The "credit revolution" in vocational education restructures value from the classroom to the workshop. At Zhengzhou Railway Vocational & Technical College, students earning a "Smart High-Speed Rail Maintenance Engineer" certification can exchange it for 32 professional credits. This competency-based evaluation system breaks the monopoly of written exams. The "micro-certificate" system for biopharmaceuticals advocated by National Committee member Su Hua is more forward-looking: students earn modular credits by completing real enterprise projects, resembling "Lego blocks" in vocational education. In a jointly built bioreactor training lab, students conducting cell culture experiments directly contribute to optimizing the production process for a partner pharmaceutical company's monoclonal antibody drug.

### 2.3 Digital Empowerment: Reshaping Teaching Modalities to Replicate Real Professional Scenes

#### 2.3.1 Dynamic Curriculum Data Response Mechanism

The School of Electronic Information at Chongqing Institute of Engineering orientates its curriculum toward enterprise horizontal projects, dynamically updating course content in 5G communications and autonomous driving. Twenty-five percent of students directly participate in actual project development. The School of Business at Kunming Industrial & Commercial Vocational College integrates real-time commodity trade data and logistics status information from Yunnan Province into decrypted training classrooms, holding significant practical value [4].

#### 2.3.2 Closed-Loop Design of a Three-Dimensional Competition-Training System

Given the high costs of equipment updates in rapidly evolving tech industries and the challenges in skill education − sometimes lacking intuitiveness − constructing a practical chain of "basic cognition → simulation verification → real vehicle development" allows competition outcomes to feed back into teaching. Over three years, this approach has supplied over 100 technical core personnel to leading enterprises. This resonates with Suzhou Vocational College's "Dual System International Class," which embeds IHK certification standards. Virtual simulation training excels not only in traditional fields like civil aviation piloting and complex safety management but also in areas developing new quality productive forces. When new technologies emerge, virtual simulation breaks through the "price ceiling" and compresses the "time buffer".

#### 2.3.3 AI Technology Triggers Exponential Adjustments in Vocational Education

Vocational education is based on industry positions, and AI technology is profoundly reshaping the professional landscape, spawning emerging occupations while transforming traditional roles.

Emerging Occupations:

*AI technology layer* – AI Algorithm Engineers (designing and optimizing machine learning models for image recognition, NLP, etc.). AI Hardware Experts (surge in demand for GPU chip design, AI sensor R&D), Data Annotation and Governance Experts (shortage of over 500,000 high-quality data annotators for e-commerce scene labeling, product encyclopedia writing, etc.) [5].

*Industry application layer* – AI Trainers and Ethics Consultants (calibrating model values, preventing algorithmic bias). Prompt Engineers (optimizing AI-generated content through prompt design). Medical AI Engineers (developing intelligent diagnostic systems to improve primary care accuracy). Human-Machine Collaboration Roles (new occupations like autonomous driving safety officers, intelligent customer service trainers).

Transformation of Traditional Positions:

1) Skill Upgrade Demands – teachers transitioning to AI Curriculum Designers (developing personalized learning systems). HR professionals shifting to Talent Data Analysts (using AI to predict employee turnover risks).
2) Job Replacement Risks – repetitive positions like manufacturing assemblers and basic customer service face automation impacts. Roles in finance such as robot-advisors and risk assessment require mastery of AI tools.

## 2.4. Long-Term Mechanisms: Ecosystem Development and Global Perspective

### 2.4.1 Government Role in Building a Balanced Industry-Education Integration Ecosystem

Constructing a four-dimensional educational ecosystem (curriculum, knowledge, practice, evaluation) with deep enterprise involvement requires enhanced government support, strengthened supervision, and clear delineation of rights and responsibilities to avoid superficial cooperation.

1) *Decision-making coordination mechanism* – to establish industry-education integration coordination committees to integrate needs and resources from government, enterprises, schools, and industry associations, regularly discussing key issues like talent training plans, cooperation projects, and benefit distribution.
2) *Benefit compensation mechanism* – government establishes special funds to support early enterprise investments (e.g., teacher training, training base development), providing subsidies per standards. Vocational colleges yield benefits to enterprises through technology transfer and training services, forming a sustainable mutual benefit model.
3) *Talent mobility mechanism* – to build two-way interaction platforms, with government providing subsidies to ensure benefits and career development. Schools and enterprises customize tasks based on individual expertise, supported by evaluation systems to ensure practical effectiveness.
4) *Supply-demand matching mechanism* – government creates platforms publishing enterprise talent needs and school program information, enabling precise talent matching and addressing student employment.
5) *Curriculum development mechanism* – government supports joint course and textbook development, integrating industry standards into vocational education standards. Through directed training and joint research, ensure teaching content aligns seamlessly with job requirements.

### 2.4.2 Internationalizing Vocational Education Industry-Education Integration

1) *Localized implementation of the German Dual System* – it consists from two essential aspects. Firstly, it was necessary to realize curriculum and textbook localization. Restructure courses into modular learning fields; e.g., Baoding Technician College introduced German mechatronics standards, developing localized loose-leaf textbooks updated with enterprise technological advances. Enhanced Practical Training: Increase practical courses to two-thirds, reduce theory to one-third. Deep Enterprise Involvement: Students spend two-thirds of time in enterprise internships with monthly stipends (e. g., up to €2500-3000 for baker trainees). Secondly, it was necessary to make International Certificate Alignment. As a result, we introduced German IHK vocational certificates; e.g., Baoding students can obtain German-recognized qualifications. Teacher Capacity Building: Select and train teachers for practical skill updates; adopt action-oriented teaching with enterprise-developed cases. And finally, Quality Assessment System was implemented. Which was realized in establishing localized standards with dynamic monitoring and dual management by schools and enterprises for industry-aligned training.

2) Leveraging the China-Belarus vocational education industry-education integration community platform – this international organization, co-established by vocational institutions from China and Belarus, was launched at Inner Mongolia Technical College of Construction. Founding members include Inner Mongolia Technical College of Construction, Ordos Ecological Environment Vocational College, and the Belarusian Republican Institute of Vocational Education. The community aims to build an international cooperation platform for vocational education, promoting resource integration in areas like joint development of occupational standards, participation in WorldSkills competitions, and construction of "Chinese + Skills" bases. Ordos Ecological Environment Vocational College serves as the chair unit, with Chinese institutions like Inner Mongolia Technical College of Construction participating. The community is positioned as a model for international exchange and cooperation in vocational education.

## 3. Representative Cases of Industry-Education Integration at Shanghai Sipo Polytechnic

### 3.1 Comprehensive Industrial Investment Model with China State Construction Eighth Engineering Bureau (CSCEC8)

In 2023, Shanghai Sipo Polytechnic collaborated with CSCEC8 Technology Construction Co., Ltd. to establish an "Industrial Field Engineer Training Base." This partnership created a practical training base network that integrates "industry, education, research, innovation, competition, and certification" into a cohesive educational ecosystem.

The institution provided the venue at no cost, while CSCEC8 invested nearly 30 million RMB to develop an intelligent construction training base spanning over 10,000 square meters (4,000+m² indoor; 6,000+m² outdoor). The base demonstrates intelligent functionality, multi-purpose application, and upgrade ability. It focuses on key technologies including construction robotics, intelligent construction equipment, and smart construction site management, addressing the construction industry's transition toward prefabrication, assembly, and intelligent transformation. The facility provides adaptable training scenarios for various construction techniques while allowing for future expansion alongside advancements in intelligent construction and IoT technologies. It serves both technological innovation promotion and ideological education functions encompassing corporate culture, craftsmanship spirit, and model worker recognition.

### 3.2 Comprehensive Talent Development Model with Li Auto

In 2022, Shanghai Sipo Polytechnic established a deep partnership with Li Auto, a leading domestic new energy vehicle manufacturer, creating China's first and Shanghai's exclusive Li Auto Industry College. Through exploring a "dual-subject, whole-process, systematic" industry-education integration mechanism, the collaboration has advanced from "order-based classes" to "training bases" and from "position alignment" to "cultural co-cultivation," effectively addressing the disconnection between professional development and industrial needs while resolving the mismatch between talent supply and position requirements. This has formed a replicable "Sipo Model".

To ensure effective implementation and quality enhancement, both parties innovated an comprehensive operational mechanism featuring "two co-developments, two cultivation approaches, and two planning dimensions".

#### 3.2.1 Co-development of Facilities and Curriculum

Utilizing existing campus resources, Li Auto donated seven new training vehicles and complete testing equipment valued over 3 million RMB, co-establishing a 1,300 m² Li Auto Training Center. The center aligns with actual enterprise environments through integrated “production-education-research-competition-service” standards, creating a high-level digital training platform.

Regarding curriculum development, the institution and enterprise jointly designed a new course system and syllabus, developing specialized courses including “Li Auto Power Battery Technology.” This facilitated curriculum restructuring from “position tasks to occupational standards,” with simultaneous textbook reform toward “project-based, loose-leaf, task-driven” formats.

#### 3.2.2 Joint Cultivation of Faculty and Students

For faculty development, the institution dispatched core instructors to Li Auto’s Changzhou production base for “dual-qualified” training. All teachers must obtain enterprise skill certification before teaching. Meanwhile, the company assigned six engineers as part-time instructors, forming a “dual-mentor team” with six full-time institutional teachers to integrate teaching and practical training.

For student development, the Li Auto “Order Class” implemented a “quasi-employee” management system incorporating corporate culture, standardized service procedures, and technical practical assessments. The company conducts monthly examinations, skill inspections, and on-site evaluations, achieving closed-loop “teaching-learning-practice-assessment” management that ensures precise alignment with enterprise requirements.

#### 3.2.3 Dual-Path Planning for Career and Institutional Development

The enterprise established clear career progression pathways for order class students, ranging from maintenance specialists to store managers and regional general managers, creating transparent and achievable growth trajectories. Incentives include internship opportunities, skill competition bonuses, and employment priority upon graduation.

Based on collaboration outcomes, both parties dynamically optimize program offerings and enrollment plans. The 2026 order class expanded from 25 to 50 students. Notably, the institution's president serves as class advisor, making it China’s only institution where the president directly advises a “Sail Plan” order class. The partnership has developed a talent selection mechanism of “position creation based on demand and excellence selection,” receiving dual recognition from the Ministry of Education’s “Directed Talent Training Project” and “Internship Base Project,” marking a new institutionalized and systematic phase in industry-education collaborative education.

### 3.3 Comprehensive Teaching Integration Model in the Nursing Program

#### 3.3.1 Establishing a “Industry-Education Integration and Collaborative Education” Talent Development Model

Industry-institution cooperation serves as a crucial pathway for achieving industry-education integration. The program actively engages in deep collaboration with healthcare institutions to jointly develop talent development plans, co-establish internship training bases, and create specialized courses, ensuring seamless connection between professional education and clinical practice. Since the 2013 order class agreement with Ruijin Hospital Affiliated to Shanghai Jiao Tong University School of Medicine, 30 nursing students have been admitted annually. The hospital implements dedicated management through a "hiring and instruction" mechanism that strictly controls clinical instructor qualifications. The "one-on-one" mentoring model enables comprehensive understanding of position responsibilities from the internship's commencement, reflecting Ruijin Hospital's "individualized student approach" that enhances instructor-student relevance and ensures "supervised autonomy" throughout the training process. Over 200 graduates have been retained.

#### 3.3.2 Optimized Curriculum System with Emphasis on Practical Teaching

The industry-education integrated nursing curriculum closely aligns with industry needs and professional characteristics. Employment-oriented and competency-based, the restructured curriculum emphasizes practical teaching through courses like "Introduction to International Nursing Humanities," "Innovation Ability Cultivation for Medical Students," and "Multiculturalism and Nursing," alongside specialized courses such as "Nursing Informatics" and "Medical Big Data and Artificial Intelligence" that address position requirements. Combining theory with practice, online with offline learning, and employing case-based teaching, scenario simulation, and role-playing enhances students' practical abilities through multiple approaches. Students obtain relevant vocational skill certifications and demonstrate job readiness upon graduation.

#### 3.3.3 Strengthening the "Dual-Qualified" Teaching Faculty

The program invites industry experts as part-time instructors, building a high-level "dual-qualified" faculty team with strong ethics, medical-educational integration, and alignment with nursing professional development. Regular teaching competitions, salons, and other platforms facilitate instructor exchanges, encouraging engagement in teaching reform and educational research to advance vocational nursing education. The establishment of a Shanghai municipal industry master studio (headed by Zhu Weiyi, Nursing Director at Ruijin Hospital) and an institutional-level international nursing master studio (headed by the Dean of Tampere University School of Nursing) introduces clinical practical experience into classrooms through workshops and training camps, enriching teaching content while enhancing research and innovation capabilities to continuously improve talent development quality.

## 4. Conclusion

### 4.1 Innovation and practice in skilled talent development models require enhanced policy support. Current national initiatives include:

"Skills Illuminate the Future" Training Initiative (2025–2027): Focusing on key sectors including healthcare and advanced manufacturing, implementing an integrated project-based training model combining "position requirements + skill training + skill evaluation + employment services" (MHRSS and MOF Notice No. 10 [2025]). High-Skilled Leadership Talent Development Plan: Aiming to cultivate over 15,000 new leading talents nationally within three years, driving the addition of approximately 5 million high-skilled personnel (MHRSS and Six Departments Notice No. 29 [2024]).

### 4.2 Innovation and practice in skilled talent development models necessitate scientific effectiveness evaluation.

Evaluation Dimensions:

1) Participant reaction assessment – using questionnaires or observation to evaluate course usefulness, materials, instructor quality, management issues, and facilities.

2) Learning outcomes assessment – employing closed-book exams, questionnaires, and practical operations to assess content mastery.
3) Behavioral performance assessment – through on-site observation and follow-up questionnaires evaluating sustained workplace application of knowledge/skills, typically conducted 3–12 months post-training.

Evaluation Practices:

1) Order-based training model evaluation – systematic framework covering industry demand analysis, model value assessment, and domestic-international comparisons throughout the talent development process.
2) Vocational undergraduate learning outcomes evaluation – for example, a mechanical manufacturing engineering program identified students' strong practical skills but theoretical deficiencies, leading to adjusted teaching strategies and significant improvement.
3) Industry-education integration policy evaluation – assessment framework including policy implementation progress, model innovation, support systems, and existing issues, with regular performance reporting.

### 4.3 Innovation and practice in skilled talent development models must continuously adapt to technological, economic, and social developments.

Digital Transformation: Developing smart campuses using VR/AR technologies for immersive learning environments and creating online learning platforms for personalized needs. Regional Collaborative Development: Enhancing resource sharing, cooperative education, and faculty exchanges among eastern, central, and western regions to reduce regional disparities. International Expansion: For instance, Beijing's plan to establish vocational universities overseas promotes vocational education's "going global" strategy.

Founding:

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## REFERENCES

1. *Wang, Y., Zhang, J., & Zhang, S.* (2025). Generative AI technology empowers the construction of digital textbooks: Scenario depiction, hidden concerns, and pathway exploration. China Adult Education, (09), 49–56.

2. *Ma, J., Yang, S., & Huang, D.* (2025). Research on the pathway of synergistic development between vocational colleges and regional industries. Journal of Guangxi College of Education, 40(5), 1–9. https://doi.org/10.20208/j.cnki.1006-9410.2025.05.001.

3. *He, R., & Wu, Q.* (2025). Research on the talent cultivation model of "school-enterprise-government-institute collaboration and industry-education-research integration": A case study of the crop production technology program at Cangxi Vocational High School in Sichuan Province. Western China Quality Education, 11 (17), 67–71+82. https://doi.org/10.16681/j.cnki.wcqe.202517015.

4. *Guo, L., Zhang, W., & Liu, L.* (2023). Exploration and practice of a synergistic innovation talent cultivation model for emerging engineering education based on SWOT analysis. Theory and Practice of Innovation and Entrepreneurship, 6(11), 131–134.

5. *Zhang Q, Xu L, Huang J, et al*. Distributed satellite information networks: architecture, enabling technologies, and trends[J/OL].Science China(Information Sciences):1-73[2025-09-09].http://kns.cnki.net/kcms/detail/11.5847.TP.20250825.0928.002.html.