

A Discussion on the Construction and Operation of Industry-Education Integration Training Bases in the Construction Industry

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Abstract

Against the dual backdrop of the nationwide advancement of modern vocational education system reform and the accelerated transformation of the construction industry toward intelligent construction and prefabricated building, industry-education integration training bases serve as the core vehicle bridging institutional talent cultivation and industry job requirements. They represent a key lever for addressing persistent challenges in construction-related vocational education, including the overemphasis on theory at the expense of practical training, superficial school-enterprise cooperation, and mismatches between talent supply and industrial demand. Grounded in national vocational education policies and the practical demands of the construction industry's industrial upgrading, this paper identifies common issues in the current construction and operation of industry-education integration training bases. It breaks away from the conventional thinking of "building bases according to academic disciplines" and proposes a new construction logic centered on job tasks. Using the Modern Building Technology Vocational Skills Public Training Center at Guangzhou City Construction College as a representative case study, the paper systematically analyzes the construction pathways encompassing base planning and layout, functional zoning, hardware provisioning, and faculty coordination, as well as the sustainable operation model characterized by marketization, open sharing, and diversified services. The study concludes with four core operational principles—employment orientation, school-enterprise symbiosis, industry empowerment, and training feedback—providing replicable and scalable practical references for the high-quality construction and long-term operation of construction-related vocational institutions and regional public training bases in China.

Keywords: Vocational education; Construction industry; Industry-education integration; Training base; Dual-qualified teachers; School-enterprise cooperation; Public training center

1. Introduction

1.1 Research Background

(1) The continuous deepening of national vocational education reform has elevated industry-education integration to an institutional top-level design.

Since the promulgation of the National Implementation Plan for Vocational Education Reform, the General Office of the CPC Central Committee and the General Office of the State Council have issued the Opinions on Deepening the Reform of the Modern Vocational

Education System, explicitly proposing the creation of a number of open, shared, and industry-integrated internship and training bases to promote deep collaborative education between vocational institutions and industry enterprises. In 2026, the Ministry of Education's Opinions on Deepening the Reform of Key Elements of Vocational Education Teaching further refined the pathways for training base construction, encouraging school-enterprise joint construction, cluster-based collaborative construction, and mixed-ownership co-construction of training facilities. The opinions require that training scenarios benchmark against real enterprise production environments, achieving integrated education of "learning by doing and doing by learning." Multiple departments—including the National Development and Reform Commission, the Ministry of Human Resources and Social Security, and the Ministry of Housing and Urban-Rural Development—have introduced supporting policies encompassing central budget investment, special bonds, and tax incentives for industry-education integration, providing comprehensive guarantees in terms of funding, land, and standards. Industry-education integration training bases have thus become a mandatory assessment indicator for improving vocational education quality.

(2) The transformation and upgrading of the construction industry compel innovation in skilled talent cultivation models.

As a pillar industry of the national economy, the construction sector is comprehensively advancing the adoption of green building, prefabricated construction, full-lifecycle Building Information Modeling (BIM) application, smart construction sites, and construction robotics. The nature of industry positions has undergone fundamental changes. Traditional construction roles have differentiated into new technical positions such as digital modeling, prefabricated component grouting, intelligent equipment operation and maintenance, and engineering digital management. Enterprises now impose higher standards on practitioners' hands-on capabilities, digital application skills, and comprehensive project management abilities. The traditional teaching model, which relies solely on classroom theoretical instruction and simple simulation training rooms, can no longer match industrial employment demands. School-enterprise cooperation and industry-education integration-based real-scenario training have become the necessary pathway for talent cultivation.

(3) Training bases and dual-qualified faculty are core supporting conditions for vocational education.

The defining characteristic that distinguishes vocational education from general higher education is its practical orientation. Training bases serve as the physical infrastructure for practical teaching, while "dual-qualified" teachers—those possessing both theoretical teaching competence and frontline industry experience—are the primary agents of practical instruction; both are indispensable. The Ministry of Education and three other departments have issued documents explicitly requiring vocational institutions to ensure the provision of specialized, production-oriented training facilities, establish bidirectional talent mobility mechanisms between schools and enterprises, and build teaching teams that combine theoretical instruction with frontline construction experience, thereby addressing the shortcomings in skilled talent cultivation from both the hardware and software perspectives.

1.2. Prominent Issues in Existing Industry Training Bases

Based on the current operational status of domestic construction-related vocational institutions and industry survey data, four major structural deficiencies are prevalent in the construction and operation of industry-education integration training bases:

(1) Educational philosophy deviates from the essence of vocational education, exhibiting a tendency toward "undergraduate-style operation."

The majority of construction-related institutions continue to follow the disciplinary logic of general undergraduate institutions, using a complete curriculum system and theoretical examination scores as the core evaluation criteria for talent cultivation. The operational orientation is "graduation-oriented" rather than "employment-oriented." Teaching is organized primarily around classroom theoretical lectures, with practical training relegated to an ancillary component of courses. Job-specific hands-on practice and real project execution are not placed at the center of the educational process, resulting in inadequate job-readiness among students and prolonged pre-employment training cycles and high costs for enterprises.

(2) Training base construction standards are low, lacking authenticity, systematicity, and advancement.

A large number of campus-based training bases are built around individual specialized courses, resulting in fragmented spaces, miniaturized equipment, and simplified scenarios that can only support individual basic operations and cannot replicate the complete construction workflow. Surveys indicate that approximately 67% of construction-related training bases suffer from equipment that lags behind industry standards and training scenarios disconnected from actual construction sites. The coverage rate of cutting-edge training modules such as prefabricated construction, BIM digital twins, and construction robotics is less than 40%, making it difficult to meet the skill training demands of the modern construction industry. Furthermore, base resources are closed off, available only to enrolled students, with low levels of open sharing, high rates of idle space and equipment, and poor resource utilization efficiency.

(3) Structural shortages in the "dual-qualified" teaching workforce result in weak practical instruction capabilities.

The majority of specialized course teachers in vocational institutions follow a "school-to-school" career path, entering teaching directly after graduation without frontline experience at construction sites or in construction enterprises. They are unfamiliar with actual construction techniques, site management procedures, and the latest industry technical standards. Although some institutions meet the proportion targets for dual-qualified teachers, these individuals often merely hold vocational qualification certificates without complete project-based practical experience. Specialized teachers with hands-on capabilities in intelligent construction and prefabricated construction account for less than 18% of the total. Practical teaching has become a mere formality, incapable of guiding students through real engineering project training. The lack of normalized incentive mechanisms for enterprise master craftsmen and technical experts to teach at institutions results in an obstructed bidirectional faculty mobility channel between schools and enterprises.

(4) Operation models are monolithic, lacking self-sustaining capacity and long-term development vitality.

Most campus-based training bases serve only daily institutional teaching and do not offer market-oriented training services to industry enterprises, social workers, secondary vocational institutions, or the general public. Revenue sources rely entirely on institutional fiscal allocations, which can only maintain basic equipment operation and maintenance, with no capacity for sustained investment in new technologies and processes. The absence of school-enterprise joint construction and management mechanisms leads to low enterprise enthusiasm for participation in construction and operation, resulting in the phenomenon of "schools operating alone with superficial enterprise partnerships"—a disconnect between industry and education.

1.3 Research Approach and Significance

This paper departs from the conventional construction thinking of "planning training spaces based on academic disciplines" and constructs a reverse design logic of "work environment → job position → skills → tasks → curriculum," using real enterprise job requirements as the starting point for designing training facilities. Using the Modern Building Technology Public Training Center at Guangzhou City Construction College as an empirical case, the paper comprehensively deconstructs the base planning, nine functional zones, hardware and software provisioning, faculty coordination systems, and diversified market-oriented operation systems, summarizing replicable construction standards and sustainable operation mechanisms.

Theoretical significance: This study enriches the theoretical framework for constructing industry-education integration training bases in the construction sector, constructs a job-task-oriented training base development framework, and improves the operational evaluation standards for construction-related public training centers.

Practical significance: This study provides actionable solutions for construction-related vocational institutions seeking to establish or upgrade training bases, addressing four major practical challenges—space planning, school-enterprise coordination, financial operation, and faculty development. It assists institutions in cultivating high-quality technical and skilled talents suited to the intelligent construction industry, thereby serving the high-quality development of the regional construction industry.

2. Innovative Construction Path for Industry-Education Integration Training Bases: Beyond Disciplines, Grounded in Job Tasks

Traditional training bases delineate training areas according to academic discipline catalogs and course chapters, resulting in fragmented scenarios, disjointed training, and disconnection from job requirements. This paper proposes an entirely new construction logic: building bases that serve enterprises, serve job positions, and serve the cultivation of high-quality skilled talent. Rather than dividing spaces by discipline or course, training scenarios should be planned around real job positions and complete construction tasks to create a full-chain training environment.

2.1. Three Core Construction Principles

(1) **Employment-oriented principle:** All training scenarios and training projects must benchmark against the recruitment standards and skill assessment requirements of frontline positions in construction enterprises. Students' training outcomes should be equivalent to enterprise job-specific practical assessments, achieving seamless integration between training and employment. As long as the base can meet the real production and employee skill enhancement needs of enterprises, it will inevitably match the practical learning needs of enrolled students. The teaching process should be deeply integrated into the production workflow, with production standards reversely guiding the design of course-based training.

(2) **Deep school-enterprise cooperation principle:** Leading construction enterprises should be brought in to participate throughout the entire process of base planning, equipment procurement, curriculum development, training evaluation, and faculty development. Joint-stock and mixed-ownership co-construction models should be adopted, with enterprises contributing equipment, technology, and industry project resources, while institutions provide space, teaching management, and student resources. Benefits should be shared and risks borne jointly, eliminating superficial "name-plate" cooperation.

(3) **Deep industry-education integration principle:** Adhering to the trinity of "real scenarios, real materials, and real tasks," complete construction projects from construction enterprises

should be decomposed into hierarchical, progressively advanced training tasks. Industry-relevant new materials, new equipment, new processes, and digital technologies should be synchronously introduced, with training content updated in step with the pace of industrial iteration.

2.2 Reverse Construction Logic: Work Environment → Job Position → Skills → Tasks → Curriculum

Distinct from the conventional forward design of "curriculum → training project → facility," the job-task-oriented approach employs a reverse derivation model:

Step 1: Survey the complete job inventory across the regional construction industry chain, encompassing all trades and management positions including construction workers, quality inspectors, safety officers, prefabricated component installation workers, BIM modelers, surveyors, masonry and plastering workers, and concrete workers.

Step 2: Deconstruct the essential core skills, operating procedures, safety standards, and quality acceptance requirements for each position, forming a comprehensive job skill map.

Step 3: Integrate individual skills into complete construction tasks, such as "hoisting and grouting construction of prefabricated shear wall components," "BIM comprehensive pipeline optimization for commercial complexes," and "foundation pit safety protection setup and quality inspection"—all based on real project tasks.

Step 4: Based on the sites, equipment, materials, and tools required for the complete execution of each task, construct a fully authentic work environment.

Step 5: Reconstruct modularized training courses based on real-scenario tasks, eliminating purely theoretical chapters disconnected from the worksite, and achieving "tasks as courses, workstations as desks."

2.3. Three Core Construction Standards: Authenticity, Systematicity, and Advancement

(1) Authenticity: Replicate the complete environment of a construction site, using the same construction materials, standard tools, safety protection facilities, and quality inspection equipment as enterprises. Restore construction sequences, quality acceptance procedures, and safety management protocols to achieve "zero distance" between campus training and the construction site. Complement this with VR/AR digital twin virtual training spaces that simulate high-risk, high-cost construction scenarios, allowing students to engage in repeated trial-and-error training with zero risk.

(2) Systematicity: Cover all construction disciplines, all positions, and the entire construction lifecycle. Form a complete training chain from foundational safety education, hands-on trade operations, main structure construction, prefabricated construction, comprehensive project management, digital modeling, and quality inspection to industry outreach and faculty training, meeting the needs of basic training, comprehensive training, WorldSkills intensive training, skill certification, and enterprise employee training across multiple scenarios.

(3) Advancement: Establish a dynamic equipment update mechanism with a maximum update cycle of no more than five years, and a three-year iteration cycle for intelligent construction and digital simulation equipment. Collaborate with leading enterprises such as Oriental Yuhong and China Construction Fourth Engineering Division to jointly build new technology demonstration zones, synchronously deploying cutting-edge training modules including BIM, construction robotics, 3D-printed buildings, and green energy-efficient building materials, matching the digital transformation trends of the construction industry.

2.4. Supporting System: Collaborative Development of Dual-Qualified Faculty

The efficient operation of training bases is inseparable from a teaching team that combines full-time and part-time members and facilitates school-enterprise mobility. In accordance with the national Implementation Plan for Deepening the Reform of "Dual-Qualified" Teacher Team Development in the New Era of Vocational Education, a three-tier faculty system is constructed:

(1) Full-time dual-qualified institutional teachers: Construction-related specialized course teachers are required to accumulate no less than six months of frontline enterprise practice experience within every five-year period, participating in the construction management of real engineering projects. The base is equipped with enterprise practice stations for teachers, regularly dispatching faculty to affiliated enterprises for temporary assignments while simultaneously obtaining vocational certificates such as construction worker, BIM engineer, and prefabricated construction technician. The proportion of dual-qualified full-time teachers should be no less than 80%.

(2) Enterprise industry mentors (part-time teachers): Enterprise professionals with five or more years of industry experience, intermediate professional titles or senior worker qualifications and above, project chief engineers, master craftsmen, and WorldSkills coaches are recruited to be based at the training base. Master craft studios are established to deliver hands-on courses, WorldSkills intensive training, and enterprise employee training, integrated into the institutional part-time teacher compensation and professional title incentive system.

(3) School-enterprise joint teaching innovation teams: Institutional teachers and enterprise mentors collaboratively develop training task briefs, modularized textbooks, and skill evaluation standards. They jointly conduct teaching research, skill competition training, vocational skill level certification, and industry technology research, creating a closed-loop bidirectional faculty mobility system.

3. Practice Case of Industry-Education Integration Training Bases in the Construction Industry: The Modern Building Technology Vocational Skills Public Training Center at Guangzhou City Construction College

3.1 Overview of the Base

Addressing the construction industry talent shortage in the Guangdong-Hong Kong-Macao Greater Bay Area, Guangzhou City Construction College established the Modern Building Technology Vocational Skills Public Training Center in August 2017. Located in the Conghua District of Guangzhou, the training center occupies a total site area of 110 mu (approximately 7.33 hectares), with a total building area of 40,000 square meters and a total investment exceeding 40 million yuan. It is a regional shared, comprehensive public training facility integrating administrative offices, enrolled student training, enterprise employee training, skill level certification, WorldSkills intensive training, faculty training, youth construction science education, and accommodation support. The base construction strictly follows the principles of "employment orientation, school-enterprise cooperation, and industry-education integration," breaking away from the single-discipline construction framework to plan nine functional zones benchmarked against the full industry chain job tasks of the construction sector. The hardware comprises 1,132 sets of real-scenario training facilities and digital simulation equipment, capable of simultaneously accommodating 2,000 individuals for various training and education programs. The service scope covers the entire Guangdong Province and radiates nationwide to construction institutions, enterprises, and housing and urban-rural development authorities.

3.2. Systematic Layout of Nine Functional Zones (Aligned with Job-Task Construction Logic)

(1) Safety Education Experience Zone: Replicates safety risk scenarios from construction sites including foundation pits, working at heights, temporary electricity, and lifting operations, equipped with a VR safety simulation system to conduct pre-employment safety training for all personnel, implementing the "safety first" baseline requirement of the construction industry.

(2) Construction Quality Experience Zone: Physically displays common engineering quality defects such as wall cracking, water seepage, and insufficient concrete cover for reinforcement, equipped with a complete set of engineering quality inspection instruments to train the practical inspection skills of quality inspectors and supervisory personnel.

(3) Common Trades Training Zone: Covers standardized workstations for 11 traditional construction trades including masonry, plastering, tiling, reinforcement, formwork, scaffolding, and concrete work, matching the basic skill training needs of frontline industrial workers.

(4) Comprehensive Project Training Zone: Fully replicates the complete construction lifecycle scenarios of multi-story residential and commercial buildings, integrating foundation, main structure, decoration, and roofing workflows to conduct cross-trade comprehensive project training.

(5) Prefabricated Construction Training Zone: Equipped with a complete set of precast shear walls, composite slabs, staircase components, and grouting sleeves, covering the entire process of prefabricated construction detailed design, component hoisting, and sleeve grouting, aligned with emerging prefabricated construction positions.

(6) School-Enterprise Co-construction Zone: Jointly established with enterprises such as Oriental Yuhong and China Construction Third Engineering Bureau to build specialized training modules, with enterprise technical mentors stationed on-site and real enterprise projects under construction introduced as training tasks.

(7) WorldSkills Training Zone: Benchmarked against the international competition standards of the WorldSkills Concrete Construction project, featuring professional competition venues and high-precision inspection equipment, undertaking national WorldSkills candidate selection and intensive training.

(8) Youth Construction Science Education Zone: Offers construction structure, green building materials, and engineering safety science education and practice activities for primary and secondary school students, expanding the social public service functions of the base.

(9) Online Public Training Center: Establishes a BIM cloud platform and virtual simulation training system, providing online modeling, construction simulation, and remote training guidance, achieving integrated online-offline virtual-real teaching.

3.3 Base Construction Achievements and Official Qualification Certifications

Relying on the systematic, job-oriented construction model, the training center has successively obtained national-level and industry-authoritative qualifications, with outstanding educational outcomes:

(1) Designated by the Ministry of Human Resources and Social Security as the Chinese training base for the Concrete Construction project of the 45th, 46th, and 47th WorldSkills competitions.

(2) Designated by the Ministry of Education as the national-level "dual-qualified" teacher education and training base for the Architectural Engineering Technology specialty (group), aligning with the national policy direction for dual-qualified faculty development.

(3) Authorized by the Ministry of Housing and Urban-Rural Development as a pilot unit for vocational skill certification in the housing and urban-rural development industry, with qualifications for all-trade vocational level certification in the construction sector.

(4) In terms of educational outcomes: Won 2 National Teaching Achievement Awards (second prize) and 2 Guangdong Provincial Education and Teaching Achievement Awards (first prize).

(5) In terms of skilled talent cultivation: Cultivated the global champion of the Concrete Construction project at the 45th WorldSkills Competition and the national champion of the Concrete Construction project at the First National Skills Competition, forming a progressive "WorldSkills → provincial competition → institutional competition" tiered skill talent development system.

4. Sustainable Operation Model for Industry-Education Integration Training Bases: A Case Study of the Guangzhou City Construction Training Center

Distinct from traditional training facilities that serve only campus-based teaching and rely on fiscal allocations, this public training center has constructed a market-oriented, open operation system characterized by "teaching as the foundation, training for self-sustenance, school-enterprise symbiosis, and diversified services," addressing the three major operational challenges of funding, vitality, and sharing.

4.1. Diversified Service Business System: Broadening Revenue Channels and Achieving Self-Sustenance

(1) Campus-based routine training and teaching (foundational public welfare function)
Priority is given to ensuring the daily practical teaching of more than 10 specialties including architectural engineering technology, engineering cost, intelligent construction, and prefabricated construction. Following the talent cultivation plan, a four-tier progressive training system is implemented: first-year foundational awareness, second-year individual skills, third-year comprehensive projects, and pre-graduation workplace readiness, fulfilling the institution's core educational responsibility.

(2) Market-oriented vocational skill training (core revenue-generating business)

Market-based paid training is offered to four categories of trainees, with annual training totals consistently exceeding 20,000 person-times:

① Regional construction enterprise employees: Skill enhancement training in prefabricated construction, BIM application, smart site management, and safety management; nearly 10,000 industrial workers have been trained for Guangzhou-area construction enterprises cumulatively.

② Government administrative personnel in the housing and urban-rural development system: Specialized training on new technologies and engineering management for housing authorities in Guangzhou, Hezhou, and other cities.

③ Faculty and students from secondary and higher vocational institutions within and outside the province: Over 70 institutions including South China University of Technology, Henan Vocational College of Architecture, and Wuchang University of Technology have sent faculty and students for on-campus training and faculty professional development.

④ Social urban and rural workers and rural construction craftsmen: Vocational skill level certification training is conducted to assist construction industry laborers in obtaining certified qualifications. Revenue generated from training services is fully reinvested into base equipment renewal, consumable procurement, and enterprise mentor compensation, completely breaking free from the operational predicament of relying solely on institutional fiscal input. Public data indicates that the base's annual social training service revenue exceeds 20 million yuan.

(3) Vocational skill level certification and industry skill competition hosting

Leveraging the Ministry of Housing and Urban-Rural Development pilot certification qualification, vocational skill certification is conducted for all construction trades including masonry workers, prefabricated component installation workers, and BIM technicians, with compliant certification service fees collected. The base also undertakes provincial and national construction industry skill competitions and WorldSkills selection events, generating event-related service revenue while simultaneously enhancing the base's industry brand influence.

(4) Technical services and school-enterprise collaborative research and development

In collaboration with partner construction enterprises, technical services including BIM detailed design, construction process optimization, and quality inspection are conducted. Faculty-student teams undertake digital services for small-scale engineering projects, achieving integration of teaching, training, and technical service. School-enterprise joint development of training textbooks, industry skill standards, and digital training resources generates intellectual property revenue.

(5) Public welfare science education and industry exchange reception

Free construction science education activities are offered to primary and secondary school students. The base also receives visiting domestic and international vocational institutions, industry associations, and construction enterprises, fulfilling the public welfare function of a regional public training platform and expanding the demonstration and radiation effect of industry-education integration.

4.2 School-Enterprise Co-Management Mechanism: Building a Community of Shared Interests

(1) Joint construction and management organizational structure: A Training Center Management Committee is established, comprising the institution, leading industry enterprises, and competent authorities from the housing and urban-rural development and human resources and social security departments. The committee jointly formulates base operation management systems, training pricing standards, equipment renewal plans, and training project development plans, with enterprises deeply involved in operational decision-making, thereby transforming the single-institution management model.

(2) Joint-stock resource investment mechanism: Enterprises contribute training equipment, construction materials, real engineering projects, and industry mentor human resources as equity, while the institution provides space, teaching management teams, and student resources. Training and technical service revenue is distributed according to investment proportions, stimulating sustained enterprise engagement in operations.

(3) Bidirectional talent mobility operational support: The base establishes a normalized system for enterprise mentors to be stationed on-site and full-time teachers to undertake enterprise practice. Enterprises entrust the base with their entire employee pre-employment and skill enhancement training, while the institution directionally supplies graduates who have undergone real-scenario training to partner enterprises, forming a closed loop of "training → employment → re-training."

4.3. Digitalized and Refined Operation Management for Long-Term Sustainability

(1) Full-process information management platform: An integrated online system encompassing training reservation, training registration, equipment ledgers, consumable management, trainee evaluation, and revenue accounting has been launched. Each functional zone implements staggered scheduling to maximize space and equipment utilization and reduce idle rates. Equipment maintenance ledgers are maintained with weekly basic maintenance and biannual comprehensive inspections, ensuring an equipment serviceability rate above 95%.

(2) Tiered and categorized training course repository operation: Differentiated modularized course packages are developed for enrolled students, enterprise workers, competition participants, and science education youth. Frontier training modules such as prefabricated construction and intelligent construction are regularly updated in collaboration with enterprises, ensuring that training content remains aligned with the latest industry standards.

(3) Safety and quality standardization operation system: Comprehensive safety operating procedures and quality assessment standards for all construction training processes are established. All training and education programs follow the protocol of "safety experience first, then hands-on training." Dedicated safety management officers and quality assessors are deployed to mitigate safety risks associated with construction-site-type training.

5. Summary of Core Development Principles for the Construction and Operation of Industry-Education Integration Training Bases in the Construction Industry

Drawing on policy requirements, industry challenges, and the practical outcomes of the Guangzhou City Construction Training Center, four core principles that permeate the entire construction and operation lifecycle are distilled, providing value guidance for similar base construction:

5.1. Adhering to Employment Orientation and Abandoning the Singular Graduation Orientation

All construction planning, training projects, and evaluation standards for the base must use real enterprise job employability as the core benchmark, rather than treating the completion of campus courses and passing final examinations as the endpoint of education. Graduate job-readiness, enterprise employment satisfaction, certification rates, and skill competition results should serve as the core assessment indicators for base construction and operation, reversing the traditional discipline-based educational mindset.

5.2 Adhering to Dual Goals of Student Success and Enterprise Satisfaction, De-emphasizing Singular Institutional Performance Metrics

The core value of industry-education integration training bases lies in balancing the educational needs of institutions with the employment needs of enterprises. The assessment focus shifts from "institutional awards and teacher recognition" to student practical skill improvement and enterprise talent supply quality. A regular enterprise satisfaction survey mechanism is established, with training scenarios and tasks dynamically adjusted based on enterprise feedback, achieving a win-win outcome for both schools and enterprises.

5.3. Adhering to Policy Alignment and Industry Connection, Addressing Real Enterprise Challenges from an Industry Perspective

The base should closely follow the Outline for Building an Education Power, the Ministry of Housing and Urban-Rural Development's intelligent construction industry policies, and fiscal support policies for industry-education integration. It should proactively align with regional construction industry cluster development plans, designing training and technical service offerings that address real enterprise challenges such as recruitment difficulties, slow employee skill updating, and difficulties in promoting new technologies. By positioning the base as a public service platform supporting industry upgrading, it can secure dual policy and resource support from both government and industry.

5.4 Adhering to Normalized Vocational Training, Using Training to Support Continuous Base Iteration

Vocational training is the core pathway for the long-term development of training bases. On one hand, market-oriented training generates stable cash flow to support equipment renewal, consumable procurement, and faculty incentives. On the other hand, the training process compels institutional teachers to continuously engage with frontline enterprise technologies and job standards, driving improvement in the practical capabilities of the dual-qualified faculty. Simultaneously, deep engagement with enterprise employee training binds industry resources, providing access to real construction projects, new processes, and new technologies that continuously enrich training and teaching content, forming a virtuous cycle of "training promoting teaching, and teaching supporting training."

6. Conclusion and Prospects

6.1. Research Conclusions

Industry-education integration training bases in the construction industry are indispensable core vehicles for modern vocational education to interface with the transformation and upgrading of the construction sector. The traditional model of discipline-based, closed operation with a singular teaching function can no longer meet industrial development demands. At the construction level, it is essential to break free from the constraints of disciplinary curricula, construct the reverse planning logic of "work environment → job position → skills → tasks → curriculum," uphold the three construction standards of authenticity, systematicity, and advancement, and simultaneously build a dual-qualified faculty support system combining full-time and part-time members. At the operation level, it is necessary to pursue the pathways of open sharing, diversified services, school-enterprise joint-stock management, and market-oriented training for self-sustenance, breaking free from singular fiscal dependence and constructing a sustainable operation closed loop.

The practice of the Modern Building Technology Public Training Center at Guangzhou City Construction College demonstrates that the job-task-centered construction approach and the diversified social training operation model can simultaneously achieve high-quality student training, enterprise employee skill enhancement, industry skill certification, faculty development, skill competitions, and science education services. This effectively addresses common challenges including the practical training shortcomings in construction vocational education, superficial school-enterprise cooperation, and insufficient base operational funding, providing a mature and replicable practical paradigm for domestic construction-related regional public training bases and institutional production-based training bases.

6.2. Future Development Prospects

- (1) Deepening virtual-real integrated training construction: Continue to increase investment in digital training scenarios such as BIM digital twins, construction robotics virtual simulation, and meta-sites, reducing the costs of physical training consumables and safety risks, and adapting to the digital development trends of intelligent construction.
- (2) Expanding municipal industry-education consortium collaborative operation: Collaborate with regional construction industrial parks and multiple secondary and higher vocational institutions to jointly build and share training bases, coordinating regional training resources to avoid redundant construction and improve overall resource utilization efficiency.
- (3) Improving the industry-education integration evaluation system: Construct a multi-party evaluation standard involving government, industry associations, enterprises, institutions, and third-party organizations, incorporating talent output quality, social training scale, technical service outcomes, and school-enterprise cooperation depth into routine assessment.
- (4) Extending the lifelong vocational education service chain: Build an integrated lifelong skill training system of "in-school training → on-the-job enhancement → skill certification → craftsman cultivation" for practitioners across the entire lifecycle of the construction industry, continuously empowering the high-quality and digital transformation and upgrading of the construction sector.

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