

Article

Construction and Practice of the "Post-Course-Competition-Certificate-Innovation-Research" Six-Dimensional Integrated Education Model for Vocational Undergraduate Programs: A Case Study of Hainan Vocational University of Science and Technology

Meijiu Zhao ^{1,*} and Zhongchun Wang ¹
¹ Hainan Vocational University of Science and Technology, Haikou, China

* Correspondence: Meijiu Zhao, Hainan Vocational University of Science and Technology, Haikou, China

Abstract: In response to the urgent demand for high-end skilled talents in the "4+3+3" key industries of the Hainan Free Trade Port, vocational undergraduate education must establish a new educational paradigm that aligns with industrial needs, matches job requirements, and fosters continuous innovation. To address these complex regional and economic challenges, Hainan Vocational University of Science and Technology has developed a comprehensive six-dimensional integrated education system. Grounded in its core vocational undergraduate mission, this innovative framework encompasses job-oriented curriculum design, competition-driven certification programs, innovation-driven research, and rigorous practical application training. This multifaceted system achieves the deep integration of essential educational elements through a robust three-pronged collaboration strategy, which includes government-university-industry partnerships, industry-academia-research synergy, and ethical-professional-development alignment. Furthermore, the model is executed alongside five strategic implementation approaches: comprehensive strategic planning, dual-track education models, advanced infrastructure development, innovation-driven research feedback mechanisms, and comprehensive digital empowerment. By systematically addressing the gap between academic preparation and workforce readiness, the model strictly adheres to the foundational principles of modern vocational undergraduate education. It strongly emphasizes industry-education integration and science-education convergence, ultimately providing valuable theoretical insights and highly adaptable practical references for similar higher education institutions seeking to modernize and innovate their pedagogical frameworks in a rapidly evolving global economy.

Keywords: vocational education; educational innovation; integrated curriculum; industry collaboration; science convergence

Received: 17 January 2026

Revised: 12 March 2026

Accepted: 26 March 2026

Published: 31 March 2026



Copyright: © 2026 by the authors. Submitted for possible open access publication under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

1. Introduction

Against the dual backdrop of advancing high-quality development in modern vocational education and the strategic construction of the Hainan Free Trade Port, vocational undergraduate programs are tasked with the critical mission of cultivating high-end technical professionals. These professionals must possess the ability to address complex challenges, apply technological innovations effectively, and pursue sustainable career growth in alignment with evolving industry demands. However, the current state of talent cultivation in this domain faces notable obstacles. These include a misalignment between curriculum frameworks and actual job standards, a gap between practical teaching methodologies and real-world production environments, and insufficient integration of skill training with innovative development. Additionally, discrepancies

between certification assessments and course instruction further hinder the ability to meet the competency requirements of high-end industries and advanced industrial sectors. Addressing these challenges necessitates a systematic approach that integrates six essential elements: job requirements, curricula, competitions, certifications, innovation, and research [1]. By establishing a comprehensive and integrated educational model, vocational undergraduate programs can better align with the needs of high-end industries, fostering a new paradigm of education that emphasizes practical relevance and innovation-driven development.

As one of the pioneering institutions in China to pilot vocational undergraduate education, Hainan Vocational University of Science and Technology has strategically aligned its educational initiatives with the industrial demands of the Hainan Free Trade Port [2]. Guided by the principle that "program offerings should follow industry trends and talent cultivation must address practical demands," the university has developed and implemented an innovative six-dimensional integrated education model. This model encompasses job roles, curriculum design, competitions, certification requirements, innovation, and research, ensuring a holistic approach to talent development. By fully integrating industry standards, professional competencies, competition criteria, certification specifications, innovative thinking, and research training into the educational process, the university has established a distinctive paradigm tailored to vocational undergraduate programs. This approach not only addresses regional industrial needs but also enhances the overall quality and relevance of vocational education. The systematic integration of these six dimensions ensures that graduates are equipped with the skills, knowledge, and innovative capabilities required to thrive in high-end industries, thereby contributing to the sustainable development of the Hainan Free Trade Port and beyond.

2. Theoretical Foundations and Construction Logic of the Six-Dimensional Integrated Education Model

2.1. Theoretical Basis

The Six-Dimensional Integrated Education Model is founded on essential theoretical principles that include the integration of industry and education, the convergence of scientific research and educational practices, the alignment of job roles with academic courses, and the enhancement of competencies through competition and certification mechanisms. This model is meticulously designed to address the unique characteristics of vocational and undergraduate education, emphasizing a demand-driven approach, competency-based methodologies, practical application, and leadership in innovation. By transforming external industry requirements into internal educational benchmarks, the model ensures that fragmented educational components are unified into a comprehensive system. This integration facilitates a shift from mere skill acquisition to the development of technological innovation, fostering a dynamic transition from unidirectional training to collaborative, bidirectional engagement [3, 4]. Furthermore, it promotes a progressive evolution from traditional classroom-based instruction to immersive, scenario-driven learning environments. Such a framework not only enhances the practical relevance of education but also prepares students to meet the complex demands of modern industries, ensuring their readiness for real-world challenges and fostering a culture of continuous innovation and adaptability.

2.2. The Four-Dimensional Leadership Concept

The university has developed a comprehensive framework based on four distinct dimensions to ensure its operational strategies align with its overarching goals. These dimensions—type logic, hierarchical logic, industrial logic, and educational logic—serve as guiding principles to streamline institutional processes and enhance the effectiveness of vocational education. By integrating these dimensions, the university aims to foster a robust academic environment that prioritizes precision, adaptability, and relevance in its educational offerings [5, 6].

1. Type logic emphasizes the core nature of vocational education, focusing on cultivating professional competencies and practical literacy among students. This dimension underscores the importance of equipping learners with the skills necessary to excel in specialized fields, ensuring they are prepared to meet the demands of dynamic industries. By prioritizing hands-on training and real-world applications, the university seeks to bridge the gap between theoretical knowledge and practical expertise.
2. Hierarchical structure pertains to the alignment of vocational education at the undergraduate level, emphasizing the development of technical skills, innovative applications, and comprehensive literacy. This dimension highlights the importance of fostering a balanced approach to education that integrates technical proficiency with creative problem-solving abilities. By focusing on these aspects, the university aims to produce graduates who are not only technically skilled but also capable of adapting to evolving industry requirements.
3. Industrial logic focuses on aligning the university's educational programs with the key industries of the free trade port. This dimension ensures that talent supply is precisely matched with industrial demand, enabling graduates to seamlessly transition into the workforce. By tailoring curricula to meet the specific needs of these industries, the university enhances its role as a pivotal contributor to regional economic development and industrial growth.
4. Educational philosophy emphasizes the holistic development of students by integrating moral character and professional skills. This dimension advocates for the simultaneous cultivation of ethical values and technical expertise, promoting a balanced approach to education. By incorporating work-based learning and fostering all-round development across five key areas, the university aims to nurture individuals who are not only proficient in their fields but also socially responsible and adaptable to diverse challenges.

2.3. Three-Dimensional Collaboration Mechanism

A three-dimensional synergy among government, schools, enterprises, industry-academia-research collaboration, and moral-technical-practical integration establishes a robust framework for holistic development. The collaboration between government, schools, and enterprises effectively combines policy directives, industrial advancements, and educational resources, ensuring a seamless alignment of objectives and outcomes [7]. This integration not only enhances the relevance of educational programs but also ensures that industrial needs are met with precision. Simultaneously, the industry-academia-research collaboration serves as a critical driver for the practical application of research findings, facilitating the transformation of theoretical knowledge into tangible innovations. This process enriches teaching methodologies and provides students with access to cutting-edge resources, fostering a dynamic learning environment. Furthermore, the moral-technical-practical synergy emphasizes the cultivation of a well-rounded professional identity. By nurturing craftsmanship spirit, ethical values, and technical expertise, this approach ensures that students are equipped with the necessary skills and character to excel in their respective fields. Collectively, these elements create an educational ecosystem characterized by multi-party coordination, continuous innovation, and end-to-end collaboration, paving the way for sustainable development and societal progress.

3. Construction of a Six-Dimensional Integrated Education System Encompassing "Positions, Courses, Competitions, Certifications, Innovation, and Research"

3.1. Position-Oriented Approach: Focusing on Job-Specific Competencies to Define the Core Educational Objectives

In collaboration with leading industry enterprises, comprehensive job surveys and detailed task analyses are conducted to establish a robust four-dimensional mapping system [8]. This system encompasses job positions, typical tasks, core professional

competencies, and curriculum modules, forming a structured framework for educational alignment. By translating job standards, industry norms, and technical requirements into actionable training objectives, graduation criteria, and course content, the approach ensures that educational programs are meticulously tailored to meet industrial demands. Furthermore, this alignment facilitates the integration of curriculum content with professional standards, ensuring that students acquire the necessary skills and knowledge to excel in their respective fields. The teaching processes are designed to mirror production workflows, thereby bridging the gap between theoretical learning and practical application. This methodology not only enhances the precision of program design but also fosters a seamless transition for graduates into the workforce. By maintaining a dynamic feedback loop with industry stakeholders, the system remains adaptive to evolving technological advancements and market trends, ensuring its relevance and effectiveness in preparing students for real-world challenges.

3.2. Building a Solid Foundation through Curriculum: Revising the Curriculum System to Strengthen Core Competencies

A modular curriculum system should be established, integrating "public foundations," "specialized courses," and "practical instruction" to ensure a comprehensive educational framework. Practical teaching must constitute no less than 60% of the total instructional hours, emphasizing hands-on learning and real-world application. To support this, virtual simulation training platforms and productive training bases should be developed, creating immersive teaching environments that replicate "real-world scenarios, authentic tasks, and genuine projects." These platforms can simulate complex professional environments, enabling students to gain practical experience in a controlled setting. Continuous refinement of the curriculum is essential to keep pace with evolving industry demands and technological advancements [9]. This includes fostering innovation in teaching methodologies, such as integrating interactive and experiential learning techniques, and reforming assessment approaches to focus on evaluating practical skills and innovative problem-solving abilities. By enhancing the curriculum's role in developing professional competencies and innovative capabilities, students will be better equipped to meet the challenges of modern industries and contribute effectively to their respective fields.

3.3. Competitions for Skill Development: A Four-Level Competition System to Enhance Practical Skills

A comprehensive four-tier competition system is proposed to enhance the practical skills and technical proficiency of students. This system includes competitions at the class, school, provincial, and national or international levels. By integrating competition content, technical standards, and scoring criteria into the curriculum and practical training sessions, students are provided with a structured framework to develop and demonstrate their abilities. Furthermore, the implementation of a credit recognition and incentive mechanism for competition achievements serves as a motivational tool, encouraging active participation and excellence. Competitions are strategically utilized as a platform to bridge theoretical knowledge with practical application, fostering an environment where learning, teaching, and hands-on practice are seamlessly interconnected. This approach not only improves students' technical skills but also enhances their ability to perform under competitive conditions, preparing them for real-world challenges. Such a system ensures that students are equipped with the necessary competencies to excel in their respective fields, contributing to their overall professional development.

3.4. Certification-Driven Job Placement: Deep Integration of Courses and Certifications to Enhance Role Matching

The implementation of the "2+7" certificate system represents a significant advancement in aligning vocational education with industry requirements. By integrating pilot programs such as the "1+X" certificate system and vocational skill level certification, educational institutions can ensure that students acquire both theoretical knowledge and

practical expertise. This approach involves embedding certificate assessment components directly into curriculum modules, thereby creating a seamless connection between academic learning and professional qualifications. Furthermore, mutual recognition between course assessments and certificate evaluations enhances the credibility and applicability of the certifications obtained. Such integration not only improves students' job relevance but also significantly boosts their professional competitiveness in the labor market [10]. By fostering a deeper connection between educational outcomes and industry standards, this system equips students with the skills and certifications necessary to excel in their chosen careers, ensuring a more effective and targeted role matching process.

3.5. Cultivating Excellence through Innovation: Empowering Innovation Platforms to Foster Innovative Thinking

By leveraging innovation and entrepreneurship incubation bases, an advanced educational model has been developed, characterized by the integration of "workshop + project + team" methodologies. This model ensures that innovative education is seamlessly embedded throughout the entire talent cultivation process, fostering a holistic approach to learning and skill development. Through the strategic use of innovation and entrepreneurship training programs, as well as academic competitions, students are provided with dynamic platforms to enhance their innovative thinking and practical engineering abilities. These initiatives not only cultivate a strong sense of innovation but also equip students with the necessary skills to translate their research outcomes into commercially viable solutions. By engaging in hands-on projects and collaborative teamwork, students gain valuable experience in problem-solving, critical thinking, and project management. This comprehensive approach ensures that graduates are well-prepared to meet the demands of a rapidly evolving global economy, driving progress and innovation across various industries.

3.6. Expanding through Research: Scientific Research Enriches Teaching Practices and Drives Institutional Advancement

By utilizing advanced research platforms and dedicated R&D centers, institutions can foster a dynamic environment where students actively engage in faculty-led research projects and collaborative initiatives with industry partners. This approach not only bridges the gap between academic theory and practical application but also transforms cutting-edge technological advancements into valuable teaching cases, hands-on training modules, and enriched curriculum content. Such integration ensures that students are equipped with both foundational knowledge and innovative skills, preparing them to excel in rapidly evolving technological landscapes. Furthermore, these research-driven practices contribute to institutional growth by enhancing academic reputation, attracting high-caliber talent, and fostering partnerships that drive mutual progress. By embedding research outcomes into educational frameworks, institutions elevate talent development from mere skill application to the cultivation of technological innovation, ensuring graduates are not only proficient but also capable of pioneering advancements in their respective fields.

4. Implementation Pathways for the Six-Dimensional Integrated Education Model

4.1. Top-Level Design: Establish a Robust Institutional Framework to Achieve Closed-Loop Management

To effectively implement the six-dimensional integrated education model, it is essential to establish a comprehensive organizational mechanism that ensures seamless coordination across the university. This mechanism should facilitate collaboration between various departments and foster active participation from both academic institutions and enterprises. A robust institutional framework must be developed to address key areas such as talent cultivation, curriculum reform, competition management, credit recognition, and the enhancement of teaching through research-driven methodologies. Additionally, a three-tier achievement evaluation system should be

designed to assess course objectives, graduation requirements, and overall training quality. This evaluation system will provide a structured approach to measure educational outcomes and identify areas for improvement. Furthermore, the implementation of a closed-loop management framework is critical. This framework should encompass the stages of planning, implementation, evaluation, and continuous improvement, ensuring that the education model remains dynamic and responsive to evolving academic and industry needs. By integrating these elements, the model can achieve its intended goals of fostering innovation and excellence in education.

4.2. Dual-Nature Education: Strengthening School-Enterprise Collaboration and Joint Process Management

The university has adopted a comprehensive dual-mentor system that integrates the expertise of professional educators with the practical knowledge of industry mentors. This collaborative approach has led to the establishment of modern industrial colleges, specialized training bases, apprenticeship programs, and tailored training classes designed to meet specific industry needs. Schools and enterprises work closely together in every aspect of the educational process, including the development of strategic training plans, the design of industry-relevant curricula, the delivery of instruction through a combination of theoretical and practical methods, and the implementation of rigorous assessment mechanisms. This partnership ensures that students receive a well-rounded education that aligns with the demands of the modern workforce. By fostering such deep collaboration, the university not only enhances the employability of its graduates but also contributes to the development of a skilled labor force capable of driving innovation and economic growth in key industrial sectors.

4.3. Platform Development: Establishing an Integrated Platform to Facilitate Resource Transformation

The establishment of vocational education groups, municipal industry-education alliances, and sector-specific industry-education integration communities plays a pivotal role in fostering collaboration between industries and educational institutions. By integrating industrial and educational resources, these initiatives aim to create specialized industry-specific colleges that cater to the unique demands of various sectors. Additionally, the development of open practical centers and virtual simulation training platforms provides learners with immersive and hands-on experiences, bridging the gap between theoretical knowledge and practical application. These platforms are designed to offer comprehensive support across multiple dimensions, including realistic scenarios, advanced technological tools, and access to highly skilled faculty members. This six-dimensional integration ensures that students are equipped with the necessary skills and competencies to meet the evolving needs of the workforce [11, 12]. Such efforts not only enhance the quality of vocational education but also contribute to the sustainable development of industries by fostering a well-trained and adaptable talent pool.

4.4. Research Innovation Feedback: Promoting Technology Commercialization and Deepening Factor Integration

Establishing a collaborative research and development (R&D) team between universities and enterprises is a critical strategy for fostering innovation and addressing industrial challenges. Such partnerships enable the provision of tailored technical services that directly tackle key issues faced by regional industries [13]. By integrating academic research with practical applications, these collaborations facilitate the transformation of research outcomes into actionable solutions, corporate projects, and industry standards. Furthermore, these outputs can be systematically incorporated into educational resources, enriching the academic curriculum and ensuring that students are equipped with industry-relevant knowledge and skills. This approach not only strengthens the synergy between scientific research and teaching but also promotes the dual objectives of innovation and talent cultivation. By deepening the integration of various factors, including technology, expertise, and resources, this model supports the

commercialization of technological advancements and contributes to the sustainable development of regional economies.

4.5. Digital Empowerment: Innovating Teaching Models to Enhance Educational Effectiveness

The development of AI-powered course modules and blended teaching models represents a significant advancement in modern education. By integrating artificial intelligence into course design, educators can create personalized learning experiences tailored to the needs of individual students, thereby enhancing engagement and comprehension. Establishing digital training resources and a smart teaching platform further supports this initiative by providing educators and learners with access to cutting-edge tools and materials that facilitate interactive and dynamic learning environments. Additionally, advancing digital management and resource sharing within the teaching process ensures streamlined operations and promotes collaboration among educators, students, and institutions. This approach contributes to the modernization and efficiency of educational practices, aligning them with the six-dimensional integrated implementation framework. Such innovations not only improve the quality of education but also prepare students to thrive in an increasingly digital and interconnected world.

5. Model Value and Theoretical Contributions

5.1. Pattern Value

The six-dimensional integrated education model of "Job-Curriculum-Competition-Certification-Innovation-Forschung" represents a transformative approach to vocational undergraduate education. By emphasizing the interconnectedness of these dimensions, the model shifts educational practices from fragmented and isolated elements to a cohesive and synergistic framework. This integration ensures that the educational process evolves from being segmented into a comprehensive and holistic system, fostering a deeper alignment between academic objectives and industry requirements. Furthermore, the model transitions learning goals from a narrow focus on skill acquisition to a broader emphasis on innovation and creative problem-solving. Such a paradigm enhances the adaptability of vocational education graduates, equipping them with the competencies needed to thrive in dynamic industrial environments. By bridging the gap between talent cultivation and real-world demands, this approach strengthens the competitiveness of vocational undergraduate programs, ensuring their relevance in a rapidly changing global economy. This model underscores the importance of innovation-driven education in preparing students for future challenges.

5.2. Theoretical Contributions

This model significantly enhances the theoretical understanding of industry-education integration and science-education convergence within vocational undergraduate education. By systematically analyzing and integrating six critical elements—job requirements, curriculum design, competitions, certification programs, innovation initiatives, and research activities—it establishes a comprehensive framework that elucidates the inherent logic and interconnections among these components. The model provides vocational universities with a replicable and scalable paradigm to refine their talent cultivation systems, ensuring alignment with evolving industrial demands and fostering regional economic growth. Furthermore, it emphasizes the importance of bridging theoretical knowledge with practical applications, thereby promoting innovation and adaptability in educational methodologies. This framework not only supports the development of specialized skills tailored to industry needs but also encourages interdisciplinary collaboration and continuous improvement in vocational education practices. By addressing the dynamic interplay between education and industry, the model contributes to the sustainable development of vocational institutions and their role in advancing regional industrial ecosystems [8].

6. Conclusion

Hainan Vocational University of Science and Technology's "Job-Course-Competition-Certificate-Innovation-Forsching" six-dimensional integrated education model represents a transformative approach to vocational undergraduate education. This model is designed to be demand-oriented, competence-centered, integration-driven, and innovation-focused, creating a comprehensive framework that aligns seamlessly with the principles of vocational education and the evolving needs of regional industries. By integrating job requirements, curriculum design, competition participation, certification acquisition, innovation practice, and scientific research, the model fosters a holistic development of vocational talents. Conceptual guidance ensures that the framework remains adaptable to emerging trends, while institutional innovation provides the structural flexibility needed to accommodate diverse educational and industrial demands. Pathway optimization further enhances the efficiency and effectiveness of the integration process, ensuring that students are equipped with the skills and knowledge required to excel in their respective fields. Moving forward, the focus should be on leveraging advancements in digital technologies to empower the framework, fostering deeper collaboration across sectors to address interdisciplinary challenges, and refining the model to better serve emerging industries such as green energy, artificial intelligence, and advanced manufacturing. Additionally, continuous efforts should be made to improve the quality of vocational undergraduate talent cultivation, ensuring that graduates not only meet but exceed industrial expectations, thereby contributing significantly to regional and national economic development.

Funding: Special Research Project Commissioned for the Qualification Assessment Reform of Vocational Undergraduate Programs at Hainan Vocational University of Science and Technology: "Research and Practice on Curriculum Development and Textbook Design for Vocational Undergraduate Programs" (Project Number: HKWT2024-08)

References

1. Yuming, H., Ningze, G., Yang, Z., and Fei, C., "Exploration and practice of project-based blended teaching mode based on OBE-CDIO concepts-example of 'Project Planning and Control'," in *SHS Web of Conferences*, vol. 209, p. 01013, EDP Sciences, 2024.
2. Qian, X., Lan, X., Zhu, H., and Yan, H., "Motion trajectory prediction of quadruped robots in complex terrain by improving the transformer temporal modeling algorithm," *Scientific Reports*, 2026.
3. Zhao, W., "Innovation and practice of talent cultivation models in higher education from the perspective of industry-education integration," *Higher Education Practice*, vol. 10, h241515, 2024.
4. Li, Y., and Pan, W., "The Integrated Education Mode of 'Post Course Competition Certificate' in China: Its Connotation, Value and Implementation Paths," in *4th International Conference on New Computational Social Science (ICNCSS 2024)*, Atlantis Press, Apr. 2024, pp. 95-101.
5. Chen, J., and Chen, X., "Rethinking talent cultivation for carbon neutrality: a case study of higher education reform in China," *Journal of Chinese Economic and Business Studies*, pp. 1-16, 2025.
6. Backes-Gellner, U., and Lehnert, P., "The contribution of vocational education and training to innovation and growth," 2018.
7. Kovalchuk, V., Maslich, S. V., Tkachenko, N. M., Shevchuk, S. S., and Shchypyska, T. P., "Vocational education in the context of modern problems and challenges," *Journal of Curriculum and Teaching*, vol. 8, no. 11, pp. 329-338, 2022.
8. Phakamach, P., Panjarattanakorn, D., Saengkaew, P., Pangthai, S., and Onsarpant, S., "Innovative practices in vocational education administration," *International Journal of Educational Communications and Technology*, vol. 3, no. 2, pp. 1-19, 2023.
9. Truba, H., Radziievska, I., Sherman, M., Demchenko, O., Kulichenko, A., and Havryliuk, N., "Introduction of innovative technologies in vocational education under the conditions of informatization of society: Problems and prospects," *Conhecimento & Diversidade*, vol. 15, no. 38, pp. 443-460, 2023.
10. Zhuravlova, Y., Kichuk, N., Zhuravska, N., Yakovenko, O., Zhytnyk, V., and Yashchuk, S., "The problem field of professional (vocational) education: Innovations and ways to improve," *Studies of Applied Economics*, vol. 39, no. 5, 2021.
11. Våljataga, T., Ümarik, M., Loogma, K., Bentsalo, I., Daukilas, S., Kaminskiene, L., et al., "Educational learning lab supporting innovation adoption in vocational education," in *Frontiers in Education*, vol. 10, p. 1422647, Frontiers Media SA, Apr. 2025.
12. Tan, L., and Du, F., "Integrating entrepreneurship and innovation education into higher vocational education teaching methods based on big data analysis," *Wireless Communications and Mobile Computing*, vol. 2022, no. 1, p. 4616446, 2022.
13. Toner, P., "Innovation and vocational education," *The Economic and Labour Relations Review*, vol. 21, no. 2, pp. 75-98, 2010.

Disclaimer/Publisher's Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of Publisher and/or the editor(s). Publisher and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.