ISSN 2522-6398 Vol. 9, Issue 2: 111-118, DOI: 10.25236/FER.2026.090214

Research on Strategies for Deepening the Integration of Science and Education in the Field of Vocational Education

Wenqiu Hong*

Liaoning Vocational University of Technology, Jinzhou, 121007, China
**Corresponding author:1647634333@qq.com*

Abstract: *The Integration of Science and Education is the core path for the high-quality development of vocational education in the new era, and it is of great significance for cultivating high-quality technical and skilled talents. Based on an analysis of the connotative characteristics and realistic dilemmas of the Integration of Science and Education in vocational education, this paper systematically puts forward countermeasures and suggestions for deepening the Integration of Science and Education. Research shows that the current Integration of Science and Education in vocational education is facing realistic dilemmas such as "cognitive deviations in concepts, imperfect systems and mechanisms, insufficient support from platform carriers, lack of capabilities of teachers, and inadequate guarantee of resource elements". It is necessary to systematically promote it through paths such as "strengthening conceptual reshaping, improving collaborative mechanisms, building strong supporting platforms, optimizing the teacher structure, and reforming the evaluation system". The research results aim to provide theoretical reference and practical paths for the modernization of vocational education, promote the in-depth integration of vocational education with industrial needs, and enhance the quality of talent training and the ability to serve economic and social development.*

Keywords: *Vocational Education; Integration of Science and Education; Connotative Characteristics; Value Significance; Realistic Dilemmas; Countermeasures and Suggestions*

1. Introduction

With the in-depth development of the new round of technological revolution and industrial transformation, new technologies and new formats such as the digital economy, artificial intelligence, and intelligent manufacturing have exerted a profound impact on traditional professional positions, and the demand structure for technical and skilled talents has undergone significant changes[1]. As an educational type most closely linked to economic and social development, vocational education undertakes the important mission of cultivating high-quality technical and skilled talents and craftsmen. It plays an important role in serving national strategies, supporting industrial upgrading, and promoting employment and entrepreneurship. However, traditional vocational education is disconnected from industrial development needs in terms of teaching content, training models, and teacher structure, and the structural contradiction between the supply side of talent training and the demand side of the industry has not been fundamentally resolved. The Integration of Science and Education emphasizes the in-depth integration of scientific research and education and teaching[2]. By integrating cutting-edge science and technology, industrial technology, and innovative achievements into the entire process of talent training, it realizes the organic connection of the education chain, talent chain, industrial chain, and innovation chain. Therefore, deepening the Integration of Science and Education has become a key breakthrough for promoting the high-quality development of vocational education. Some vocational colleges only have a superficial understanding of the Integration of Science and Education, with inadequate systems and mechanisms, insufficient support from platform carriers, lack of teacher capabilities, and inadequate guarantee of resource elements, which restrict the depth and breadth of the Integration of Science and Education. This study systematically analyzes the realistic dilemmas faced in deepening the Integration of Science and Education and explores practical countermeasures and suggestions to help vocational education cultivate more compound technical and skilled talents with both practical capabilities and innovative literacy.

ISSN 2522-6398 Vol. 9, Issue 2: 111-118, DOI: 10.25236/FER.2026.090214

2. Connotative Characteristics of Deepening the Integration of Science and Education in the Field of Vocational Education

2.1 Cross-border Integration

Cross-border integration is the core characteristic of the Integration of Science and Education in vocational education, reflecting the in-depth intersection and integration of the three major fields of education, science and technology, and industry. The Integration of Science and Education breaks down the organizational barriers between universities, enterprises, and scientific research institutions, and promotes the collaborative linkage of multiple subjects in links such as talent training, technological research and development, and achievement transformation. This cross-border integration is not only reflected in the co-construction and sharing of physical space but also in the cross-domain flow of elements such as knowledge, technology, talents, and information. Cross-border integration requires all participating subjects to change their traditional thinking, establish an open and collaborative concept, and build a community of shared future for collaborative development.

2.2 Practice Orientation

Practice orientation is the essential attribute of the Integration of Science and Education in vocational education, emphasizing solving practical industrial problems and serving regional economic development as the fundamental starting point. Scientific research activities in the field of vocational education pay more attention to applicability, technicality, and transformability, requiring research topics to originate from the real technical needs of enterprises or practical problems in the production line. In the process of talent training, it is reflected in the teaching model of "learning by doing, researching while learning, and innovating through research", allowing students to master skills in a real or simulated working environment. This practice orientation not only focuses on the proficiency of students' technical skills but also on the cultivation of professional literacy.

2.3 Dynamic Adaptability

Dynamic adaptability is a prominent characteristic of the Integration of Science and Education in vocational education, emphasizing the education system's ability to quickly respond to technological changes and industrial upgrading. The Integration of Science and Education requires vocational colleges to establish a sensitive monitoring and early warning mechanism, timely track the development trend of industrial technology, and dynamically adjust professional settings, curriculum content, teaching methods, and research directions. This adaptability is not only reflected in the passive adaptation to existing changes but also in the active prediction and forward-looking layout of future trends. It quickly adjusts internal resource allocation and operation models according to changes in the external environment to maintain the appropriateness and competitiveness of talent training.

2.4 Collaborative Symbiosis

Collaborative symbiosis is the value pursuit of the Integration of Science and Education in vocational education, emphasizing that multiple subjects achieve mutual benefit and win-win results and common development through cooperation. Through the establishment of scientific benefit-sharing mechanisms and risk-sharing mechanisms, the Integration of Science and Education enables participating subjects such as universities, enterprises, and scientific research institutes to form a community of shared future. Collaborative symbiosis is reflected in multiple levels such as resource complementarity, capacity building, achievement sharing, and risk sharing. This collaborative symbiotic relationship is not a simple resource exchange but an in-depth cooperation based on common visions, common goals, and common interests, ultimately achieving a win-win situation for educational quality, enterprise development, and regional economy.

3. Value Significance of Deepening the Integration of Science and Education in the Field of Vocational Education

3.1 Improving the Quality of Talent Training

Improving the quality of talent training is the core value of deepening the Integration of Science and

ISSN 2522-6398 Vol. 9, Issue 2: 111-118, DOI: 10.25236/FER.2026.090214

Education in the field of vocational education, and it is also the key for vocational education to base itself on its origin and serve society. The Integration of Science and Education deeply integrates scientific and technological innovation resources, cutting-edge industrial technologies with the teaching process, injecting new vitality into talent training[3]. With scientific research projects as carriers, it transforms abstract theoretical knowledge into concrete practical tasks, guiding students to actively participate in links such as technical research and development and achievement transformation, and tempering professional skills and cultivating innovative thinking in practice. Finally, it realizes the transformation from "skill training" to "competence development", which is in line with the talent training goals of vocational education in the new era.

3.2 Promoting Teachers' Professional Growth

Deepening the Integration of Science and Education is an important path for promoting the professional growth of teachers in vocational colleges, providing multiple supports for the construction of teachers' teams. The Integration of Science and Education has built a high-quality platform for teachers' capacity improvement. In collaborative cooperation, teachers can timely capture cutting-edge industrial trends and the development direction of science and technology, making up for their shortcomings in practical experience and scientific research capabilities. The cooperative model of multi-subject collaboration provides teachers with opportunities for cross-field exchange and learning, helping them broaden their professional horizons and gradually grow into compound teachers with integrated teaching, scientific research, and practical capabilities, laying a solid foundation for the high-quality development of vocational education.

3.3 Serving the Development of Regional Industries

Serving the development of regional industries is the core mission of vocational education. Deepening the Integration of Science and Education provides a key starting point for vocational education to connect with regional industrial needs and empower industrial upgrading. As a bridge connecting talent training and industrial development, vocational education is deeply bound to regional industries through the Integration of Science and Education. On the one hand, vocational colleges carry out targeted talent training in conjunction with enterprises around regional industrial needs, accurately matching industrial job requirements. On the other hand, they focus on providing solutions to technical problems in the front line of enterprise production, promoting the transformation of scientific research achievements from laboratories to production workshops, and providing sustained momentum for the high-quality development of the regional economy and society.

3.4 Promoting the Modernization of Vocational Education

Promoting the modernization of vocational education is an important value destination of deepening the Integration of Science and Education, and it is also the core direction of the reform and development of vocational education in the new era. In terms of educational concepts, the Integration of Science and Education promotes the transformation of vocational education from "teaching-oriented" to "integration of teaching, scientific research, and practice", establishing an innovative educational concept. In terms of training models, it constructs an integrated training model of "theory + practice + scientific research", which meets the needs of modern talent training. In terms of the governance system, it promotes the collaborative governance of multiple subjects and improves the governance structure of vocational education. Through comprehensive reforms and upgrades, it enhances the overall quality and core competitiveness of vocational education and realizes high-quality development.

4. Realistic Dilemmas of Deepening the Integration of Science and Education in the Field of Vocational Education

4.1 Cognitive Deviations in Concepts

Cognitive deviation is a prerequisite dilemma restricting the deepening of the Integration of Science and Education in the field of vocational education. Different subjects have cognitive dislocations regarding the core connotation and value positioning of the Integration of Science and Education, making it difficult to form a consensus on collaborative promotion. Vocational colleges adhere to

ISSN 2522-6398 Vol. 9, Issue 2: 111-118, DOI: 10.25236/FER.2026.090214

traditional vocational education concepts, focusing their core energy on skill training, and ignoring the role of scientific research innovation and teaching integration in improving talent quality[4]. Enterprises overly pursue short-term economic benefits, regard the Integration of Science and Education as an additional burden, and lack a sense of value for talent training and technological innovation. Cognitive deviations lead to a situation of "one side being enthusiastic while multiple sides being cold" in the process of promoting the Integration of Science and Education, making it difficult to gather development momentum.

4.2 Imperfect Systems and Mechanisms

The imperfection of systems and mechanisms is a core institutional obstacle to deepening the Integration of Science and Education in the field of vocational education, lacking systematic institutional design and efficient operational mechanism support. In terms of the collaborative governance mechanism, the division of powers and responsibilities among departments is unclear, communication and collaboration are not smooth, and there is a problem of fragmented policy implementation. In terms of the incentive and restraint mechanism, preferential policies such as tax reductions and exemptions and financial subsidies are not fully implemented, making it difficult to force all parties to fulfill their responsibilities. In terms of the evaluation and assessment mechanism, the weight of evaluating the effectiveness of the Integration of Science and Education in vocational colleges is insufficient, and there is a lack of a scientific and quantitative evaluation index system, making it difficult to comprehensively and objectively measure the actual effect of the Integration of Science and Education.

4.3 Insufficient Support from Platform Carriers

Platform carriers are an important support for the implementation of the Integration of Science and Education. Currently, the construction of platform carriers for the Integration of Science and Education in the field of vocational education is lagging behind, making it difficult to meet the practical needs of in-depth integration. From the perspective of platform types, there is a lack of comprehensive platforms integrating talent training, scientific research innovation, achievement transformation, and technical services. From the perspective of platform construction quality, it is disconnected from the needs of cutting-edge industrial technologies and scientific research practices, making it difficult to support students in participating in high-level scientific research practices and technical research. From the perspective of platform coverage, high-quality platforms are mostly concentrated in developed regions and key vocational colleges, while other regions and colleges lack platform resources, and the resource radiation and driving effect are difficult to exert.

4.4 Lack of Capabilities of Teachers

Teachers are the core supporting force for deepening the Integration of Science and Education. Currently, the professional quality of teachers is difficult to meet the needs of the in-depth advancement of the Integration of Science and Education. They have weak practical abilities, lack work experience in the front line of enterprises and scientific research practice experience, making it difficult to effectively integrate cutting-edge industrial technologies and scientific research achievements into the teaching process; they have insufficient scientific research and innovation capabilities, lack scientific research thinking and scientific research method training, making it difficult to independently carry out scientific research projects or participate in enterprise technical research; they have a single ability structure, lacking compound capabilities of "teaching + scientific research + practice", making it difficult to undertake diversified teaching and scientific research tasks under the background of the Integration of Science and Education, which restricts the in-depth development of the Integration of Science and Education.

4.5 Inadequate Guarantee of Resource Elements

Inadequate guarantee of resource elements is an important basic dilemma for deepening the Integration of Science and Education in the field of vocational education. The insufficient supply of core resources such as funds, technology, and information makes it difficult to support the sustained advancement of the Integration of Science and Education. In terms of fund guarantee, the government's special investment in the Integration of Science and Education in vocational education is insufficient, and the distribution of financial funds is unbalanced; vocational colleges have a single source of

ISSN 2522-6398 Vol. 9, Issue 2: 111-118, DOI: 10.25236/FER.2026.090214

funding and lack channels for independent fund-raising; social capital has low participation enthusiasm and lacks an effective investment return mechanism. In addition, cutting-edge technologies and scientific research achievements are difficult to quickly transform into teaching content and practical projects, and all parties are difficult to quickly obtain the required resource information, which exacerbates the resource guarantee dilemma.

5. Countermeasures and Suggestions for Deepening the Integration of Science and Education in the Field of Vocational Education

5.1 Conceptual Reshaping: Establishing a New Thinking on the Integration of Science and Education

Firstly, vocational colleges should strengthen the top-level design concept. They should incorporate the Integration of Science and Education into their development strategic plans, clarify development goals, key tasks, and implementation paths, and form a development consensus that scientific research supports teaching, teaching promotes scientific research, and industry-education collaborates in innovation. University leaders should take the lead in changing concepts, take the Integration of Science and Education as an important starting point for promoting the high-quality development of the colleges, and make the concept of the Integration of Science and Education deeply rooted in the hearts of all staff.

Secondly, vocational colleges should establish a collaborative education concept. They should establish the concept that teaching and scientific research promote each other and complement each other. They should strengthen the sense of a community of shared future between schools and enterprises, and promote vocational colleges, enterprises, and scientific research institutes to form a joint force in education. They should guide teachers to recognize the dialectical relationship between scientific research feeding back teaching and teaching driving scientific research, and stimulate teachers' internal motivation to participate in the Integration of Science and Education.

Thirdly, vocational colleges should cultivate an innovative cultural atmosphere. They should create a cultural atmosphere that encourages innovation and tolerates failure through system construction, typical demonstration, and publicity and guidance. They should establish a fault-tolerance and correction mechanism to encourage teachers to boldly explore and take the lead in trying. They should carry out experience exchange activities on the Integration of Science and Education, promote successful practices, form a demonstration effect, and stimulate the enthusiasm and creativity of teachers and students to participate in the Integration of Science and Education.

5.2 Mechanism Innovation: Constructing a New Collaborative Operation Mechanism

Firstly, vocational colleges should improve the organizational management mechanism. They should establish a leading group for the Integration of Science and Education led by university leaders and participated by departments such as scientific research, academic affairs, and school-enterprise cooperation to coordinate resources, projects, and platform construction. Vocational colleges should establish cross-departmental and interdisciplinary collaborative working groups to form a normalized communication and coordination mechanism. They should clarify the division of responsibilities of each department, strengthen process management and supervision and assessment, and ensure that all work is implemented in place.

Secondly, vocational colleges should improve the incentive and evaluation mechanism. They should establish a classified evaluation system, implementing differentiated evaluation for teaching-oriented, research-oriented, and application-oriented teachers. Vocational colleges should incorporate the transformation of scientific research achievements, technical services, and teaching applications into evaluation indicators, highlighting the effectiveness of the integration of science and education. They should set up special awards for the Integration of Science and Education to commend outstanding achievements.

Thirdly, vocational colleges should establish a benefit-sharing mechanism. They should clarify the rules for the ownership of intellectual property rights and the distribution of income from achievement transformation in school-enterprise cooperation, and protect the legitimate rights and interests of all parties through methods such as technology shareholding, profit sharing, and co-construction of entities. Vocational colleges should establish a risk-sharing mechanism to reduce the uncertainty of cooperation.

ISSN 2522-6398 Vol. 9, Issue 2: 111-118, DOI: 10.25236/FER.2026.090214

They should improve the benefit compensation mechanism for school-enterprise cooperation, stimulate the enthusiasm of enterprises to participate, and form a sustainable cooperative relationship.

5.3 Platform Construction: Creating New Carriers for Diversified Support

Firstly, vocational colleges should build strong scientific research and innovation platforms. They should focus on regional key industries and emerging fields, and jointly build high-level laboratories, engineering research centers, and technological innovation centers with enterprises. Vocational colleges should support the construction of provincial and national-level scientific research platforms and strive for major scientific research projects. They should also strengthen the connotation construction of platforms, improve the operation and management mechanism, and enhance the scientific research carrying capacity and service capacity.

Secondly, vocational colleges should solidify industry-education integration platforms. They should deepen the construction of industrial colleges, vocational education groups, and industry-education integration communities, promote enterprises' real projects, real scenarios, and real tasks to enter the campus, and realize the integration of teaching venues and production venues[5]. Vocational colleges should establish a school-enterprise collaborative education mechanism to jointly formulate talent training programs, develop curriculum resources, and carry out teaching evaluation.

Thirdly, vocational colleges should build digital empowerment platforms. They should use technologies such as artificial intelligence, big data, and virtual simulation to build intelligent teaching platforms, virtual simulation training bases, and online scientific research collaboration platforms. Vocational colleges should promote the digitization, networking, and intelligence of high-quality scientific research resources and teaching resources, break the constraints of time and space, and promote resource sharing. They should also build an information management platform for the Integration of Science and Education to realize the dynamic management of information such as projects, achievements, and talents.

5.4 Teacher Optimization: Building a High-level "Dual-qualified" Teacher Team

Firstly, vocational colleges should improve teachers' scientific research capabilities. They should implement a plan to enhance teachers' scientific research capabilities, and raise their scientific research level through methods such as visiting studies, project cooperation, and team building. These colleges should encourage teachers to participate in enterprise technical research and accumulate practical experience. They should establish a scientific research tutor system to give play to the role of high-level teachers in mentoring, and further strengthen the construction of scientific research teams to form a reasonably structured scientific research echelon.

Secondly, vocational colleges should strengthen teachers' industry-education integration capabilities. They should establish a system for teachers' enterprise practice, encouraging professional teachers to engage in practical work in enterprises. These institutions should hire enterprise technical backbones and craftsmen as tutors to participate in teaching and scientific research guidance. They should also establish a two-way talent flow mechanism between schools and enterprises, and carry out training on industry-education integration capabilities to improve teachers' ability to transform industrial needs into teaching resources.

Thirdly, vocational colleges should cultivate teachers' innovative teaching capabilities. They should carry out teaching reform research and teaching method training to help teachers better transform scientific research achievements into teaching cases. These colleges should encourage teachers to offer demonstration courses where scientific research feeds back into teaching, establish teaching innovation teams to conduct research on teaching method reform, and improve the support system for teachers' teaching ability development to provide conditions and guarantees for their teaching innovation.

5.5 Evaluation Reform: Establishing a New Scientifically Oriented Evaluation System

Firstly, vocational colleges should reform school evaluation. They should incorporate the effectiveness of the Integration of Science and Education into the evaluation systems of vocational colleges' school-running level evaluation, professional construction evaluation, and teaching diagnosis and improvement. They should establish an evaluation standard centered on the effectiveness of moral education, service contribution, and the achievements of the integration of science and education. They should highlight the evaluation orientation of applied scientific research, technical services, and

ISSN 2522-6398 Vol. 9, Issue 2: 111-118, DOI: 10.25236/FER.2026.090214

achievement transformation, guiding schools to attach importance to the work of the Integration of Science and Education[6].

Secondly, vocational colleges should reform teacher evaluation. They should establish a classified evaluation system, highlighting different dimensions such as teaching performance, scientific research contributions, and social services. They should incorporate the transformation of scientific research achievements, technical services, and teaching applications into evaluation indicators, implementing equivalent evaluation. They should establish an evaluation mechanism centered on representative achievements and actual contributions to stimulate teachers' internal motivation to participate in the Integration of Science and Education.

Thirdly, vocational colleges should reform student evaluation. They should establish a competency-oriented evaluation system, incorporating scientific research literacy, innovation ability, and practical ability into students' comprehensive quality evaluation. They should implement a credit bank system to encourage students to participate in scientific research activities across majors. They should incorporate participation in scientific research projects, skill competitions, and innovation and entrepreneurship achievements into graduation requirements. They should establish multiple evaluation subjects, introducing third-party evaluation, etc.

6. Conclusions

Deepening the Integration of Science and Education in the field of vocational education is a systematic project that is crucial to the overall situation of the high-quality development of vocational education. It is also a key measure to serve the national innovation-driven development strategy and industrial transformation and upgrading. The countermeasures and suggestions put forward in this paper aim to provide practical references for the government, vocational colleges, enterprises, and other subjects to collaboratively promote the Integration of Science and Education, helping to build a sound ecology of the four interconnected chains: "education chain, talent chain, innovation chain, and industrial chain". In the future, with the continuous deepening of vocational education reform and the rapid development of the digital economy, the Integration of Science and Education will usher in a broader development space, continuously improving the quality of vocational education talent training and the ability to serve society, and making greater contributions to serving economic and social development.

Acknowledgements

This work is supported by 2023 Liaoning Provincial Research Project on Teaching Reform in Vocational Education and Continuing Education (LZJG2023174): Research on the Current Situation, Problems, and Countermeasures of Deepening the Integration of Science and Education in the Field of Vocational Education.

References

[1] W. B. Jia, X. Wen. Research on talent cultivation models in higher vocational education from the perspective of integration of science and education: An adaptability analysis based on the development of new productive forces[J]. Journal of Science and Education, 2025, 22(24): 7-10.
[2] H. Huang. The Value Logic, Main Directions and Practical Paths of Vocational Education's Integration of Science and Education to Empower the Development of New Quality Productive Forces[J]. Journal of Guangdong Industry Polytechnic University, 2025, 24(06): 46-55.
[3] S. T. Ruan, X. H. Ma. The Integration Between Science and Education Empowering the High-Quality Development of Vocational Education: Value Implications, Current Challenges and Future Pathways[J]. Contemporary Vocational Education, 2025, 16(06): 85-91.
[4] Y. Zhong, Z. F. Zeng. Value Implication, Practical Difficulties and Solutions of the Integration of Science and Education Promoting the Development of Higher Vocational Education[J]. Heilongjiang Education(Research and Evaluation of Higher Education), 2025, 50(12): 1-5.
[5] W. C. Pan, L. L. Deng, X. F. Wang, et al. From "Industry-education Integration" to "Science-education Convergence": Evolution, Logic and Pathways of High-quality Development of Vocational Education in China[J]. Vocational and Technical Education, 2025, 46(36): 50-56.
[6] T. Q. Wang, Q. Li. Study on the Educational Approaches and Evaluation of Vocational Education

ISSN 2522-6398 Vol. 9, Issue 2: 111-118, DOI: 10.25236/FER.2026.090214

under the Background of the Integration of Science and Education[J]. Neijiang Technology, 2025, 46(10): 131-133.