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Research on the Logical Path of High-quality Development of Vocational Education Driven by Science and Technology

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ABSTRACT
The in-depth advancement of the new round of science and technological revolution and industrial transformation has made technology empowerment an important engine for the high-quality development of vocational education. Based on the strategic orientation of the coordinated development of education, science and technology, as well as talent, this paper systematically deconstructs the theoretical logic, practical logic, and value logic of improving the quality and efficiency of vocational education driven by science and technology, and clarifies the internal mechanism of the deep integration of science and technology and vocational education. Based on the actual demand for highly skilled talents driven by the development of new quality productive forces, this paper constructs a targeted and operable practical framework from three dimensions: the underlying logic reconstruction of the digital transformation of the teaching system, the collaborative innovation path of the industry-education integration mechanism, and the stepwise improvement of the scientific and technological literacy of the teaching staff. It aims to provide reference for improving the modern vocational education system with deep integration of industry and education and cultivating technical and skilled talents that are suitable for industrial upgrading.

KEYWORDS
Technology empowerment; Vocational education; High-quality development; Development logic

1 Introduction

"The 2024-2034 Master Plan on Building China into a Leading Country in Education" clearly states that "it is necessary adhere to an application-oriented approach and governance as the foundation, promote integration, intelligence and internationalization, strengthen and fully utilize the national smart education public service platform, and establish a digital education system that is horizontally and vertically connected and provides collaborative services", and emphasizes the need to "deepen the role of artificial intelligence (AI) in promoting the construction of the teaching staff, build an AI education large model, construct cloud-based schools, and establish an educational evaluation and scientific decision-making system supported by big data and AI". This series of arrangements not only responds to the contemporary proposition of technology empowering education, but also clarifies the technical direction for the high-quality development of vocational education. In the current era of deep integration between the science and technological revolution and industrial transformation, as a crucial node connecting the education chain and the industrial chain, the development quality of vocational education not only directly affects the structure and efficiency of the supply of technical and skilled talents, but also profoundly influences the cultivation speed and development quality of new quality productive forces. Based on the national strategic demands and in the wave of digital transformation in education, exploring the internal logic and practical path of high-quality development of vocational education driven by science and technology is an important means to break through the traditional development bottlenecks of vocational education and achieve connotative improvement, and also an inevitable requirement for strengthening vocational education's role in serving industrial upgrading and supporting the construction of Chinese-style modernization.

2 Logic Paths of High-quality Development of Vocational Education Driven by Science and Technology

2.1 The Theoretical Logic of High-quality Development of Vocational Education Driven by Science and Technology

Marx once clearly pointed out that the level of labor productivity depends on multiple factors, including the average skilled degree of workers, the social integration form of production, the scale and efficiency of means of production, as well as the level of scientific development and its practical application in technology. As an important carrier for cultivating and enhancing the productive labor capacity, education has an inseparable and inherent collaborative relationship with scientific and technological progress and the development of productive forces from the beginning to end. In the context of the accelerated evolution of new quality productive forces, science and technology have become

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an important engine driving the great-leap-forward development of productivity levels. As the main front for cultivating technical and skilled talents, vocational education must develop in tandem with the pace of scientific and technological progress, and its reform direction must closely follow the trend of the scientific and technological revolution [1]. The in-depth implementation of the coordinated development strategy for education, technology and talents has provided a distinct contemporary support and practical guidance for the high-quality development of vocational education. The transformation of vocational education driven by science and technology is not a simple superimposition of technology or form improvement, but rather a systematic change from surface application to in-depth reconstruction through technology empowering the innovation of educational concepts, the transformation of training models, and the reshaping of governance systems, thus enabling the quality standards and competence structure of talent cultivation in vocational education to be precisely aligned with the demands of industrial technology iteration. This transformation process has achieved an organic connection among the education chain, talent chain, industrial chain and innovation chain, and is deeply in line with the core essence of human capital theory, which is to enhance the quality of the labor force, strengthen the supply of human resources and ultimately promote the sustained development of the economy and society through education investment.

2.2 The Practical Logic of High-quality Development of Vocational Education Driven by Science and Technology

The new round of science and technological revolution has brought about the transformation of industrial forms and technological iterations, which have given rise to emerging industrial clusters such as big data, AI, and intelligent manufacturing, and driven traditional industries to achieve a qualitative leap under the dual impetus of digital transformation and green upgrading. This transformation has directly set unprecedented high standards for the depth of digital literacy and innovative practical abilities of technical and skilled talents. This inelastic demand is forcing vocational education to carry out a systematic reform that touch upon its essence from the core goals of talent cultivation, the logic construction of curriculum systems to the specific paths of teaching implementation. In the field of vocational education, it takes the in-depth application of digital technology as a breakthrough point to reconstruct teaching scenarios, and creates multi-functional internship and training bases integrating practical teaching, real production, and technical services, so as to achieve seamless connection between the teaching process and the production process in terms of standards, rhythms, and technical applications. At the same time, it relies on the construction mechanism of municipal industry-education consortia and industry-specific industry-education integration communities to collaborate with core enterprises in the industrial chain to jointly develop courses and build practical training platforms, and fully integrate the cutting-edge technology standards of the industry and the core ability requirements of positions into all aspects of talent cultivation. In addition, the in-depth advancement of the national education digitalization strategy provides solid support for this series of practical changes. The full establishment and regular application of the Smart Education of China breaks down the barriers to the flow of vocational education resources among regions, promotes the cross-regional sharing of high-quality teachers, practical training resources, and curriculum systems, and effectively narrows the quality gap in vocational education development among different regions. These practical explorations, rooted in industrial demands and supported by technological empowerment, not only precisely respond to the urgent need for high-quality technical and skilled talents in industrial technology iteration, but also continuously enhance the school-running quality and core competitiveness of vocational education through resource integration and model innovation. As a result, a virtuous cycle has been formed in which technology empowers industrial upgrading, industrial demands drive educational reform, and the improvement of educational quality supports industrial development.

2.3 The Value Logic of High-quality Development of Vocational Education Driven by Science and Technology

The high-quality development of vocational education driven by science and technology has always adhered to the fundamental principle of fostering virtue and nurturing talents, and taken serving national strategic needs and promoting the all-round development of individuals as its core orientations. Its contemporary value and social value are continuously highlighted in the practice of technology empowerment. From the perspective of national strategy, this development path can precisely meet the urgent demand for highly skilled talents in the development of new quality productive forces, inject technological impetus into the transformation and upgrading of the manufacturing industry, and provide talent support for the expansion of emerging industries to facilitate the realization of high-level self-reliance and self-improvement in science and technology, and it also can lay a solid talent foundation for the implementation of national strategies such as strengthening education and building a manufacturing powerhouse [2]. At the level of social development, technological empowerment breaks down the regional and hierarchical limitations of vocational education

resource allocation, which can significantly enhance educational equity and accessibility, and promote the formation of a social ecosystem where everyone can become talented and fully display their abilities. At the same time, through deepening integration with regional economies, it can provide indispensable skill support and talent guarantee for the implementation of major strategies such as rural revitalization and coordinated regional development. For individuals, technology empowerment enables vocational education to accurately capture practical differentiated demands, effectively enhance students' technical and skill levels as well as their lifelong learning capabilities by leveraging diverse carriers such as personalized learning plans and intelligent learning platforms, and expand multiple channels for individual growth and success, thus promoting their all-round development.

3 Practical Paths of High-quality Development of Vocational Education Driven by Science and Technology

3.1 Construct a Digital Teaching System to Empower the Innovation of Talent Cultivation Modes

Building a digital teaching system is an critical path for technology to drive the high-quality development of vocational education, and institutions need to implement systematic innovation by taking resource construction, teaching model innovation and evaluation mechanism optimization as fulcrums. First, institutions should rely on the Smart Education of China to integrate high-quality digital resources, including the construction of digital course resource libraries, virtual simulation training projects and digital textbooks in the fields of emerging industry and transformation and upgrading of traditional industry. Through this method, while promoting the cross-regional and cross-school sharing of high-quality resources, they can deeply combine with the regional industrial characteristics, and cooperate with leading enterprises in the industry to fully integrate the cutting-edge technology standards and process flows of the industry into resource construction. Through the collaboration between schools and enterprises, the resources can not only meet practical needs, but also have a forward-looking perspective. Second, institution should promote new models such as online-offline blended teaching and project-based teaching, utilize big data and AI technologies to analyze students' learning behaviors to precisely match their personalized learning needs, build a digital twin innovation platform, and create digital teaching scenarios such as virtual training workshops and smart classrooms to enable students to hone their practical operation skills in a highly simulated production environment, thereby break through the multiple limitations in traditional practical training teaching related to venues, equipment and safety [3]. Third, institutions should establish a digital evaluation system covering the effectiveness of online learning, practical operation ability, acquisition of skill certificates and innovative achievements to achieve the automatic collection, analysis and feedback of evaluation data through technical means, and enhance the scientificity and accuracy of the evaluation. At the same time, they should build a dynamic adjustment mechanism based on the industrial technology development and the feedback of teaching practice to ensure that the evaluation indicators are in line with the demands for improving the quality of talent cultivation.

3.2 Deepen the Collaborative Mechanism of Industry-Education Integration to Build a Development Ecosystem Empowered by Technology

The government needs to strengthen policy guidance and overall coordination, and fulfill the primary responsibility of local governments for the overall planning and development of vocational education. By improving incentive policies and increasing financial input, the government can promote the construction of municipal industry-education consortia and industry-specific industry-education integration communities, and achieve the precise matching between vocational education resources and regional industrial layout. At the same time, it can establish a cross-departmental coordination mechanism to integrate resources in the fields of education, science and technology, and industry, thus providing full-process policy guarantees for school-enterprise cooperation, and encourage enterprises to deeply participate in the establishment of vocational education and the in-depth collaboration of all links of school operation and talent cultivation. Vocational institutions and leading enterprises in the industry should assume the primary responsibility to build a long-term and stable cooperative relationship, and jointly establish industrial colleges, practical training bases and technology research and development centers. Enterprises need to deeply engage in the entire chain of talent cultivation, spanning from specialty setup, course development, teacher training, and internship and practical training to employment recommendation, and transform their technological advantages into teaching effectiveness. Vocational institutions should rely on their teaching staff and educational resources to provide employee training and technology research services for enterprises, forming a synergistic effect of resource complementarity and advantages superposition [4]. In addition, building a strong industry-education integration service platform is an important support. It is necessary to create a comprehensive platform integrating talent cultivation, technology research and development,

and achievement transformation to promote the transformation and application of scientific and technological achievements in the field of vocational education, and facilitate the precise integration of the education chain and talent chain with the industrial chain and innovation chain. Meanwhile, it can build an information service platform leveraging big data technology to release information on the demand for industrial talents and vocational education resources, thus enhancing the accuracy and efficiency of school-enterprise cooperation, and forming a benign development ecosystem of industry-education collaboration and technological empowerment.

3.3 Strengthen the Improvement of Teachers' Scientific and Technological Literacy to Lay a Solid Foundation for Quality Assurance

First, vocational institutions should establish a regular digital literacy training mechanism, incorporate cutting-edge content such as big data, AI, and digital teaching into compulsory courses, and carry out specialized training programs and exchange activities based on the resources of universities, research institutes, and industry enterprises. At the same time, they should regularly organize teachers to participate in technological research and production practices in leading enterprises in the industry to accumulate practical teaching experience through the exploration at the forefront of industrial technology, and promote the deep integration of the dual identities of "teacher" and "technician", so as to consolidate teachers' digital teaching capabilities and deepen their understanding of industrial technology. Second, vocational institutions should optimize the standards and channels for teacher recruitment, increase the introduction of highly skilled talents with industry work experience and mastery of cutting-edge technologies, attract enterprise technical backbones and industry experts to serve as part-time teachers through the special appointment system of industrial mentors, and provide high-quality working conditions and development space with targeted incentive policies, thus compensating the lack of practical experience of full-time teachers while strengthening the teaching team [5]. Third, vocational institutions should improve the evaluation system for teacher development by comprehensively incorporating scientific and technological literacy, digital teaching ability and the effectiveness of school-enterprise cooperation into the assessment and professional title appointment indicators to establish a clear development orientation. In addition, they can build a professional development platform to support teachers in participating in digital teaching reform and scientific research projects, and encourage teaching teams to carry out collaborative research with enterprise technical teams, thus enhancing the their scientific research and innovation capabilities through innovative practices.

4 Conclusion

The high-quality development of vocational education driven by science and technology is not only an inevitable requirement of the development stage of new productive forces, but also an vital support for the construction of a country strong in education. Its high-quality development is based on profound theoretical logic, practical logic and value logic. In the future, vocational institutions should focus on building a digital teaching system, deepen the collaborative mechanism of industry-education integration, and strengthen the enhancement of the scientific and technological literacy of teaching staff, so as to truly lead the high-quality development of vocational education with science and technology. This is an inexorable requirement for cultivating master craftsmen, skilled artisans, and highly skilled talents, but also an inherent part of comprehensively advancing the Chinese-style modernization.

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