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How China's vocational education formed its distinctive system: a five-element integration theory perspective

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Throughout the ages, a vocational education system with international influence must be supported by a distinctive industrial market, a strong organization, and a standardized and orderly education standard. The modern vocational education system with Chinese characteristics has experienced the embryonic form of technical colleges centered on primary vocational education (1949–1991), the semi-systematic state centered on secondary vocational education (1991–2012), the establishment of the system centered on higher vocational education (2012–2019), and the construction of the modern vocational education system with Chinese characteristics that highlights types of education Standing and sound (2019 to date) and other four stages. The reason why China's vocational education can form its own system needs to be explained by Chinese local theories. The Five-Element Integration Theory holds that the leadership of the party is unique and the core. The Ministry of Education is the standard setter for vocational education; Schools, including all kinds of vocational education schools at all levels, are the concrete implementors of training standards; Enterprises and industry associations have the right to set demand standards to a certain extent; The student body is the center of vocational education and the object of vocational talent training. Through international comparison, China's vocational education system is a standardized public platform relative to the one, two, three yuan of the main dimension and the students or enterprises of the core concern dimension.

KEYWORDS

Chinese vocational education autonomy theory system, vocational education theory, the evolution of vocational education policy, five-element, Five-Element Integration Theory, vocational education reform, vocational education system

1 Introduction

It is the goal of vocational education in the world to establish a vocational education system that adapts to the national economic and industrial structure, while it is a relatively difficult strategic choice to establish a characteristic vocational education system with international influence and promotion value. Looking at the development history

of modern vocational education, there are relatively few vocational education systems with the value of popularization and promotion. Typical examples include the German dual system (Duale Ausbildung), the American Competency Based Education Model (CBE), the Japanese dual serial model, and the Australian Technical and Further Education model (TAFE), British Business & Technology Education Council model (BTEC), Singapore teaching factory model (teaching and operation integration, schools as the main, enterprises as the auxiliary) (TFM). Combining the vocational education system with international communication and significant characteristics, the following characteristics can be found:

- (1) Characteristic industry support, especially relying on characteristic industry to open up a very broad international market, is the original market power to stimulate the brand of vocational education and improve the vocational education system. This situation is increasingly prominent in the era of new quality productivity (Liu et al., 2025).
- (2) Strong organizational traction, including school subjects, enterprise subjects, industry association subjects, government subjects, etc., or a combination of some of them, forms vocational education standards through vocational education norms, and finally forms vocational education promotion brands. This is the organizational dynamic of the vocational education system.
- (3) In the process of vocational education development and standardization, oriented academic certificates or vocational qualification certificates or both are generally realized through industry associations (semi-official) or education authorities (official), and play a role in regulating and guiding. This is the political impetus for the vocational education system (Kim and Yu, 2024).

Since the founding of the People's Republic of China, China has also been striving to promote vocational education to meet the historical process and practical needs of industrialization in the establishment of a complete industrial system, made in China, created in China, and intelligent made in China, and has completed the major transformation of primary vocational education, secondary vocational education, and higher vocational education to type education. In this exploration, China has learned from and absorbed a variety of vocational education models of Western developed countries, and even carried out competitive comparison of multiple models in different regions, accumulated rich experience, and initially completed all the preconditions for a self-contained system of vocational education. In June 2014, the National Vocational Education Work Conference officially put forward the strategic task of establishing a "modern vocational education system with Chinese characteristics" (MVESCC) for the first time. Since then, reforms at different levels, such as the layout of the vocational education system, vocational education standards, vocational education norms, and preconditions of vocational education, have given more prominence to Chinese characteristics and Chinese experience, making important contributions to the establishment and improvement of the modern vocational education system with Chinese characteristics (Zhu and Wu, 2017).

In October 2022, the 20th Report of the Communist Party of China further required that the vocational education system be transformed into a theoretical system, forming a discipline system of philosophy and social sciences with Chinese characteristics, an academic system, and a discourse system. This interpretation is a landmark watershed in China's vocational education strategic planning, marking a significant conceptual upgrade of China's vocational education from internal system construction to external system promotion. How to build the independent theoretical system of China's vocational education needs to be summarized and constructed at the level of operation, cooperation and planning, which is also one of the most important tasks of vocational education reform. This paper puts forward the Five-Element Integration Theory (FEIT), trying to explain the development process of modern vocational education system with Chinese characteristics, providing a new reference for the construction of independent theoretical system, and providing a continuation of thinking for the theoretical promotion of vocational education to the world.

2 Literature review

2.1 Vocational education and training (VET)

The vocational education system is the product of the joint shaping of the education field and the industry field, which retains the traces of both, and requires the instructional design model (VET; Ganefri, 2015; Poschauko et al., 2024). Vocational education and Training (VET) involves seven core elements, including regional location, vocational education level, economic level, skill type, educational basis, educational teaching method, market demand, etc. (Gupta et al., 2023), teaching system design and curriculum system construction in different countries should be combined with their own actual conditions, especially the special layout should be combined with the industrial needs of their respective countries. China's vocational education and training mainly has three sets of systems, the first is vocational colleges including vocational undergraduate colleges, vocational colleges, secondary vocational schools, in full accordance with the formal examination and admission process, with a fixed and long academic system. For example, Vocational undergraduate students need to study full-time for 4 years, vocational college students need to study full-time for 3 years, and vocational school students need to study full-time for 3 years. The second is the technical college system, including technician colleges, technical schools, generally based on vocational qualifications, do not issue academic certificates, the longer the length of 3 years, the shorter half a year. The third is the Open University system, including open universities in various provinces and open universities in various cities, which generally carries out vocational skills training for working adults, and students participate in learning while working. The academic system is mainly 3 years and adult education is issued (Cai et al., 2025). At the same time, China is also integrating the vocational education system to form a high-quality vocational education system (Zhang and An, 2024; Wang X. et al., 2024).

2.2 Vocational education system (VES)

Thanks to the early development of industrialization, Western developed countries took the lead in establishing vocational education systems and forming training systems with their own characteristics. Some countries combine graduation certificates with vocational qualifications. China has also introduced the "1 + X" certificate system based on the experience of other countries, Empowering skills training (Guo et al., 2024). Western countries generally follow K-12 education as the basis, throughout the whole process, and form a professional and systematic vocational skills training path. China, on the other hand, establishes a parallel education system of general education series and vocational education series. After 9 years of compulsory education, it forms a flow of students, forming a long-term training sequence of secondary vocational education (3 years), higher vocational education (3 years), vocational undergraduate education (4 years), professional master's degree (3 years), and professional doctor (4 years) (Li and Guo, 2022; Zhou et al., 2025). The vocational education system of all countries in the world is basically employment-oriented, and the demand of industry determines the sooner or later vocational education will be distributed (Gupta and Datta, 2023). The diverging orientation and the diverging time of the vocational education system in the developed countries in the world can be divided into four types: "occupation-early diverging," "occupation-late diverging," "academically early diverging" and "academically late diverging" (Deng and Zhang, 2024). China's vocational education belongs to the type of "vocational - early diversion."

2.3 Theoretical foundations of vocational education

In the process of the establishment and development of the vocational education system, it is necessary to establish vocational education theories, and then summarize or reflect on the past development process and practical exploration, and provide references for the future development policies of vocational education. It is a good theoretical framework to explain the relationship between the supply of vocational education talents and industrial demand based on the need theory (McGrath, 2012). Vocational education is closely related to lifelong learning, innovation and entrepreneurship, and entrepreneurship, which can also be explained through game-theoretical theory (Zuo et al., 2025). It is of great practical significance and explanatory power to establish a model to explain the behavior of vocational education from an economic perspective. Some scholars also apply this model to the calculation of China's vocational education, and the vocational education in economically developed areas is indeed more advanced and of higher quality (Li and Martins, 2024; Bouchaib, 2022). In recent years, Chinese scholars have also made efforts to construct a localized theoretical system to explain the characteristics of China's vocational education system, including the interpretation of the integration of industry and education from the perspective of organizational sociology (Yang and Li, 2025), the integration theory (Wu et al., 2024), and the vocational system theory (Wang and Wang, 2025) and other theories gradually

formed. The Five-Element Integration Theory is formed under the situation of Chinese localization theory, which mainly focuses on the five subjects that have the most core impact on the development of vocational education system and their roles in the development process of vocational education system.

3 Historical evolution of China's vocational education

After the founding of New China, the transformation from an agricultural country to an industrial country was the first priority of economic and social development, and vocational education was initially established to adapt to the situation of scattered industrial structure and low industrial level at that time. From the perspective of policy change, it can be simply divided into the stage of foundation laying (1985–2001), exploration and development (2002–2013), accelerated development (2014–2020), and deepening reform (since 2021) (Shi and Que, 2024). According to the perspective of attention, it can be divided into disequilibrium stage (1949–1982), system establishment stage (1983–2010), and harmonious development stage (since 2011) (Chen and Lin, 2019). From the perspective of modernization, it can be divided into the modernization of infrastructure construction (1978–1991), the modernization of basic capacity (1992–2001), the modernization of connotation construction (2002–2011) and the modernization of system construction (since 2012) (Gao et al., 2024).

Based on various perspectives and stages of academia, The modern vocational education system with Chinese characteristics has experienced the embryonic form of technical colleges centered on primary vocational education (1949–1991), the semi-systematic state centered on secondary vocational education (1991–2012), the establishment of the system centered on higher vocational education (2012–2019), and the construction of the modern vocational education system with Chinese characteristics that highlights types of education. The four stages of establishment and improvement (from 2019 to now) roughly describe the exploration process of modern vocational education system with Chinese characteristics from scratch to existence and from existence to excellence (Table 1).

In the early days of the People's Republic of China, the primary task of economic construction was to integrate the existing industrial foundation and establish a complete industrial system, which corresponded to the industrial demand of transitioning from an agricultural society to an industrial society (Industry 1.0). The focus of vocational education was to consolidate forces and establish a layout mainly based on primary vocational education. This core idea persisted until 1991 and was regarded as the first stage centered on primary vocational education.

It was not until 1983 that the focus of vocational education policy gradually shifted toward secondary vocational education. However, the market mechanism basically began to achieve a leapfrog development of Industry 2.0 in the 1990s, which in turn drove the elevation of the level of secondary vocational education, marking the second stage centered on secondary vocational education.

In the late 1990s, higher vocational education seized the opportunity for expansion. However, the problem of the "dead end"

TABLE 1 Comparative table of the development process of modern vocational education system with Chinese characteristics.

Vocational education system	Key points of vocational education	Economic demand	Industrial demand
Scale state of vocational education	Primary vocational education	Complete industrial system	Industry 1.0 (mechanization)
Semi-system state of vocational education	Secondary vocational education	Made in China	Industry 2.0 (electrification)
Vocational education system (junior high)	Higher vocational education	Created in China	Industry 3.0 (Networking)
Modern vocational education system with Chinese characteristics	Type vocational education	China intelligent Manufacturing	Industry 4.0 (intelligent)

of academic qualifications in the vocational education system was not completely resolved until the second decade of the 21st century, marking the third stage centered on higher vocational education.

Since 2012, measures such as the establishment of vocational education at the undergraduate level, the expansion of the scale of professional master's and doctoral programs, and the emphasis on the construction of applied universities have further promoted the steady construction of a modern vocational education system with Chinese characteristics, marking the fourth stage highlighting type education.

3.1 The embryonic stage of technical schools focusing on primary vocational education (1949–1991)

Industry positioning determines talent demand positioning, and industry scale determines talent demand scale. From 1949 to 1991, China's industrial economy can be simply translated as Industry 1.0, achieving the transition and upgrading of scattered industrial industries to a complete industrial system; At this time, the demand for vocational education talents is mainly for mass production of general workers, and the main positioning of vocational education is centered around primary vocational education. There is no demand for vocational education, let alone resources to establish a relatively complete vocational education system, which is why vocational education was in its infancy during this period.

First, the positioning of vocational education in the context of Industry 1.0. From 1949 to 1991, China's industrial system as a whole corresponded to Industry 1.0, going through basic stages such as fragmented industries, industrial chains, industrial systems, and complete industrial systems. The vocational education talents demanded were mainly general workers from primary vocational education, supplemented by technicians from secondary vocational education. This can be verified from the overall trend of changes in vocational education policies. In December 1949, the First National Education Work Conference emphasized the importance of technical education, initiating the reform of vocational education (Tang and Qiu, 2024). The reform measures from 1951 to 1952, especially the "Instructions on Rectifying and Developing Secondary Technical Education," clearly defined the key task of vocational education as cultivating junior technical personnel. In June 1979, the "Notice of the Ministry of Education on Soliciting Opinions on the Work Regulations of National Secondary Specialized Schools" clearly stated that the important task of secondary vocational schools remained the cultivation

of middle and junior-level cadres and technical personnel. In May 1983, the "Opinions on Reforming the Structure of Urban Secondary Education and Developing Vocational and Technical Education" emphasized that the policy focus began to shift toward the cultivation of secondary vocational talents. However, from the perspective of industrial level and job supply, even by 1991, the focus was still on the training of junior technicians (Xie and Xiang, 2023). In fact, from an employment perspective, vocational education students are more likely to adapt to the job environment than regular high school students (Larsson Taghizadeh and Österman, 2025).

Secondly, the scale of vocational education in the context of Industry 1.0. According to the data from the China Statistical Yearbook, the number of secondary technical schools has been increasing year by year since 1952, reaching a peak of 10074 in 1998, and has been declining since then. This to some extent indicates that the demand for vocational education talents from 1949 to 1991 was mainly for junior technicians, supplemented by intermediate technicians, but the quantity of demand gradually expanded with the process of industrial system construction. In October 1951, the "Decision of the State Council of the Central People's Government on Reforming the Educational System" established the educational system for the first time, implemented vocational education separation¹, and adapted to the practical needs of junior skilled workers. The number of students in secondary technical schools increased from 290000 in 1952 to over 1 million in 1985. Since then, with the promotion of education popularization and the policy of free secondary vocational education, the number of students has maintained stable growth, laying a solid foundation for the subsequent reform of the vocational education system, especially for the guarantee of student resources in higher vocational education. In fact, vocational education and labor education were closely integrated during this period, laying the educational tradition for subsequent vocational education to emphasize labor education and even industry education integration (Wu et al., 2024).

3.2 The semi systematic state of secondary vocational education (1991–2012)

The main task of the layout of secondary vocational education is to cultivate junior skilled workers. With the adjustment of industrial structure and upgrading after the reform and opening up, the positioning of talent cultivation has gradually shifted toward skilled workers. On the one hand, vocational education

reform is gradually moving toward systematic design, with primary vocational education, secondary vocational education, and higher vocational education forming a semi systematic state. On the other hand, the toolbox of vocational education policies has begun to become relatively rich, with requirements for the establishment of institutional norms for the vocational education system, vocational education policies, and vocational education training standards, in order to facilitate the subsequent systematic construction.

Participating in international industrial competition requires junior technical workers to transform into mid to senior level technical workers, and cultivating these talents requires upgrading the vocational education system, which is the most fundamental reason. However, at that time, China did not have sufficient funds to establish vocational undergraduate universities; More importantly, the lack of emphasis on vocational education in the entire society has become deeply ingrained. These three reasons have delayed the establishment of a complete vocational education system.

Firstly, vocational education reform in the context of Industry 2.0. In the 1990s, the opening-up to the outside world entered a new stage, with coastal opening-up radiating inland, and the rise of township economy and county-level economy. Industry 2.0 gradually became the main force and goal of industrial transformation and upgrading, and the demand for talent shifted toward batch skilled workers as the mainstay, with technicians as the supplement. The foundation for the emergence of Made in China has already been preliminary established. In October 1991, the "Decision of the State Council on Vigorously Developing Vocational and Technical Education" made a major decision to upgrade primary vocational education to secondary vocational education, indicating that the focus of vocational education was gradually shifting from primary skilled worker training to intermediate skilled worker talent training (Ren and He, 2025). The "Regulations on Vocational Skills Appraisal" and the "Regulations on Vocational Qualification Certificates" were

successively promulgated in November 1993 and March 1994, promoting the reform of the dual certification system design and laying the foundation for subsequent vocational education standards. The focus was on strengthening the professional level and professional identity of vocational education teachers (Li et al., 2025). In May 1996, the Vocational Education Law promoted the reform of vocational classification standards and vocational level standards, explored the pilot operation of the system of academic certificates, training certificates, and vocational qualification certificates, and further enhanced the process of systematization and standardization of vocational education (Wang and Zhang, 2023; Li and Hu, 2025). In December 1997, the "Opinions on the Reform of the Integration of Enrollment in Secondary Vocational Schools" further standardized and improved the reform of vocational education enrollment, basically completing the institutional preparation for the systematization of vocational education, especially the shift toward higher vocational education. In August 1998, the Higher Education Law emphasized the importance of vocational education and provided broad space for the shift of the focus of vocational education reform. The institutional documents such as the "Guiding Opinions of the Ministry of Education on Promoting the Coordinated Development of Secondary and Higher Vocational Education" and the "Several Opinions of the Ministry of Education on Promoting the Reform (Figure 1), Innovation and Scientific Development of Higher Vocational Education" in 2011 have clearly provided a roadmap for the reform of the vocational education system, effectively ending the development stage centered on secondary vocational education and opening up the construction stage of the vocational education system centered on higher vocational education (Xia, 2022).

Secondly, the vocational education talent training is divided into vocational and general education. In the 1990s, secondary vocational education basically reached its peak stage and was at the center of vocational education; Higher vocational education

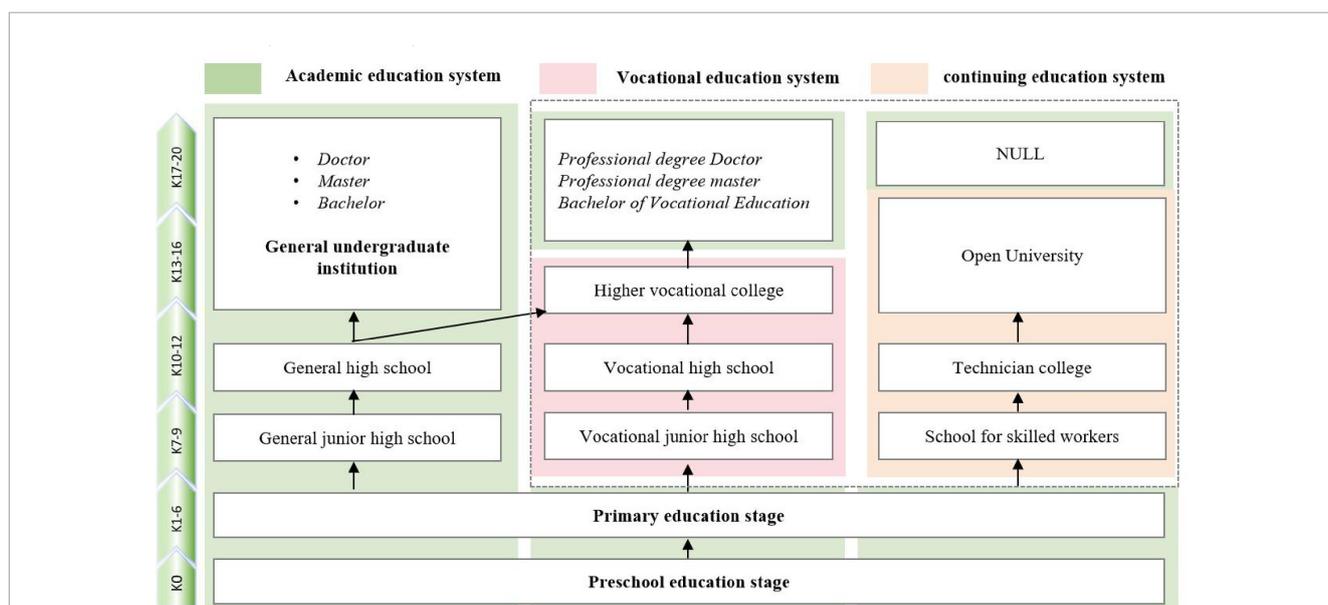


FIGURE 1 Schematic diagram of the semi system status of vocational education in China.

is gradually showing a high-speed development trend. It is necessary to maintain the orderly development of higher vocational education and ensure the steady improvement of secondary vocational education. The education reform policy of vocational and general education separation has emerged. Vocational education was originally a choice for underperforming students, but now education policies have changed (Guo and Wang, 2020). The Vocational Education Law promulgated in May 1996 for the first time clarified the reform concept and measures of "vocational and general education separation" (VGES), objectively promoting the evolution of vocational education from a semi systematic state to a complete systematic state (Xing, 2022). In August 1998, the Higher Education Law further confirmed the importance of vocational education, but it also failed to solve the policy problem of vocational education being at the bottom of general education, especially at the bottom of enrollment and admission, in the system design. This to some extent stimulated the emergence of the problem of "vocational and general education diversion" and provided a policy window for the shift from "vocational and general education diversion" to "vocational and general education integration" (VGEI). In August 2002, the State Council's "Decision on Vigorously Promoting the Reform and Development of Vocational Education" and subsequent important institutional documents basically maintained the overall policy of "equal proportion of secondary vocational education and general high school education."

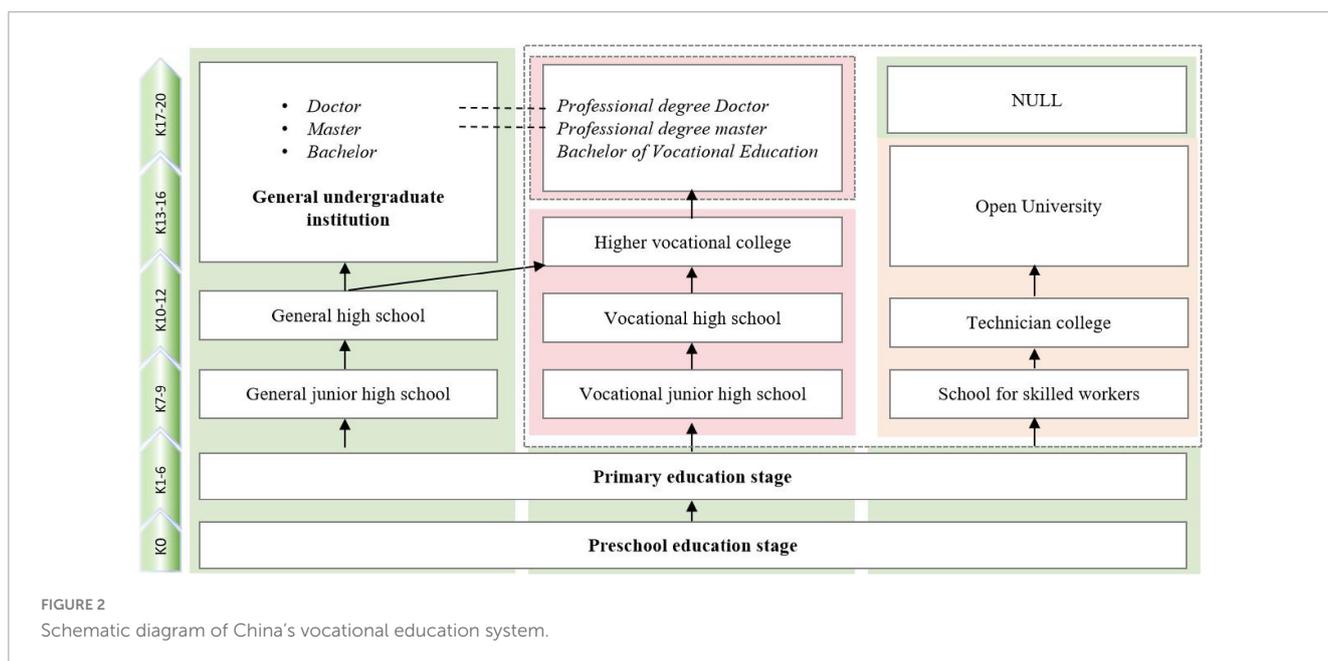
improvement of the higher vocational education system. After 2012, education policies and vocational education policy planning gradually clarified that the focus of vocational education system construction is higher vocational education reform, which is driven by China's economy undergoing a new round of transformation and upgrading and gradually adapting to the development needs of Industry 3.0. The establishment of a vocational education system and the stable delivery of a large number of technician talents, as well as the promotion of full process reforms such as enrollment reform, standardization of the education process, and standardization of skilled talents, became the focus of vocational education system reform at that time.

China's total economic output has risen to the second place in the world, and China has more resources to support the development of vocational education. In addition, the vocational education system and the academic education system have long been in a state of isolation, making it difficult for students to transition between the two education systems. At that time, the development of high-end manufacturing, especially the internet industry, needed to promote the integration of vocational education and general education. This is the reason for promoting the reform of the vocational education system with higher vocational education as its core (Figure 2).

Firstly, the construction of vocational education system under the background of Industry 3.0. At the beginning of the 21st century, the era of the internet led industrial transformation had just begun to emerge, and by 2012, it had basically formed an industrialization trend. The real talent demand for Industry 3.0 promoted the rapid development of higher vocational education. The number of vocational colleges increased sharply from 442 in 2000 to 1297 in 2012, and then maintained a slow growth, stabilizing at 1423 in 2019. The increase in the number of higher vocational education institutions and the transformation of some universities toward applied undergraduate programs have promoted the development of the vocational education system, and thus basically completed the task of vocational education system

3.3 Establishment of the system surrounding higher vocational education (2012–2019)

The large proportion of higher vocational education scale and the development of higher vocational education as the center are important reference indicators for the establishment and



layout. The focus of vocational education reform is gradually shifting toward addressing internal obstacles such as the "dead end of academic qualifications" problem, the lack of integration between vocational and general education, and the establishment of professional master's and doctoral degrees. In June 2014, the Decision of the State Council on Accelerating the Development of Modern Vocational Education clearly proposed "undergraduate level vocational education"², which solved the problem of the upper limit of vocational education qualifications in terms of concept. In June 2019, the Ministry of Education approved for the first time the upgrading of 15 vocational and technical colleges to vocational and technical universities, which solved the problem of incomplete and incomplete vocational education system in practice (Chen et al., 2023). Compared to primary and secondary vocational education, higher vocational education needs to place more emphasis on innovation ability education, which is also one of the advantages of the higher vocational education system and a key aspect for countries to strengthen education (Pongwat and Fisik Sean, 2025).

Secondly, the integration of vocational education and general education in talent cultivation. Education reform, especially the reform of the education process, including enrollment, training, graduation, etc., all focus on releasing the rights and interests of students as the main body. The education solidification brought about by the separation of vocational and general education has contributed to the stability of student sources and talent supply in a certain historical period, but the strict boundary between vocational education and general education has eliminated the space for students' autonomy; On the other hand, due to the fact that vocational education enrollment is at the lower level of general education and the growth space is narrow, it is also necessary to promote the integration of vocational education and general education. This historical period was a stage of exploring the integration of vocational and general education. Firstly, there were a small number of pilot programs for transferring students, which involved the flow of students from ordinary schools and vocational schools. However, the results often led to the loss of students from vocational schools. The second is the pilot program for comprehensive high schools³, which promotes the merger of general high schools and vocational schools, greatly strengthening vocational education. However, it is difficult to promote it in the context of a large number of orderly enrollment students. The third is the pilot program of free enrollment from vocational schools to vocational colleges, which often exacerbates the enrollment pressure of vocational colleges and promotes the reform of increasing the admission ratio of vocational colleges at the policy level. Overall, there have been significant explorations and pilot projects in the reform of integrating vocational and general education, but it is difficult to achieve substantial and systematic breakthroughs in the effectiveness of the reform. At the same time, it is also influenced by vocational education income (Qi and Li, 2025). The key to integrating vocational and general education lies in continuously strengthening the construction of laboratories or learning laboratories, operating spaces, etc., enhancing the employment competitiveness of vocational education students, and attracting more choices for general education students. This is also a common practice in other countries (Väljataga et al., 2025).

3.4 Establishing and improving the modern vocational education system with Chinese characteristics highlighting type education (2019 present)

With the development of applied university construction, especially the establishment of vocational undergraduate universities, the opportunity for specialized master's and doctoral programs to transition to applied universities is gradually maturing. The focus of vocational education system reform has gradually shifted from internal construction to external support, including the refinement of Chinese characteristics, the construction of independent theories, the model of vocational education going global, the construction and promotion of Chinese vocational education standards, etc., officially opening a new prelude to the establishment and improvement of a modern vocational education system with Chinese characteristics.

China is at a high level of competition in many industries and has certain advantages in the smart industry, which has prompted the Chinese government to emphasize the uniqueness of China's vocational education system. Then, China has also felt the importance of promoting standards in international exchanges of vocational education, which helps to form a relatively unified educational experience between China and other countries.

Firstly, the characteristic system under the background of Industry 4.0. The key driving force for promoting the development of a modern vocational education system with Chinese characteristics is the historical opportunity of the industrial revolution. Only industrial transformation can bring about a paradigm shift in vocational education and a series of vocational education systems and models. The concept and vision of the fourth industrial revolution that emerged after 2013 gradually unfolded, and by around 2019, major countries in the world had basically completed the strategic layout of Industry 4.0. Correspondingly, the reform of the vocational education system is accelerating toward meeting the demands of Industry 4.0. China is mainly carrying out in-depth reforms in the integration of education technology talents (breaking through departmental barriers), the integration of industry and education communities (Industry Education Integration 3.0), independent innovation and entrepreneurship capabilities, global vocational education governance, and independent knowledge systems (Li and Pan, 2024). In October 2021, the Chinese government issued the "Opinions on Promoting the High Quality Development of Modern Vocational Education," proposing a new concept of "building a skilled society" (BSS) and placing more emphasis on seeking characteristic development of the vocational education system toward industrial integration. In January 2025, the Chinese government released the "Outline of the Plan for Building an Education Strong Country (2024–2035)," which clearly proposes to accelerate the construction of a modern vocational education system, cultivate skilled craftsmen, skilled workers, and high skilled talents in the country, and provide a continuous supply of high skilled talents for the transformation of the intelligent industry. These development plans further highlight the orientation of adapting to industrial changes, as well as the reform orientation of the vocational education system with Chinese characteristics (Liu et al., 2025).

Secondly, the vertical and horizontal combination under type education. In June 2014, the "Plan for the Construction of Modern Vocational Education System (2014–2020)" attempted to clarify the type of education and accelerate the elevation of vocational education as a type of education. In February 2019, the Implementation Plan for National Vocational Education Reform clarified for the first time the equal legal status of vocational education and general education, and made a comprehensive plan for the systematic, forward-looking, and leapfrog development of vocational education, which is the "20 points of vocational education reform" for deepening reform. On the one hand, the "separation of vocational and general education" has evolved into "integration of vocational and general education," especially with the revised version of the Vocational Education Law implemented in May 2022, which has promoted the systematic connection between vocational education and general education, laying the foundation for the subsequent academic education system, vocational education system, and even continuing education system to maintain relative independence and free flow (Zeng et al., 2024). On the other hand, the integrated training within the vocational education system, including the integration of undergraduate and secondary education (4 + 3) and the integration of vocational and secondary education (5-year integrated system), has been promoted and accumulated rich experience for the subsequent integrated training of undergraduate, master's, and doctoral education in vocational education. Subsequently, the preparation and even exploration of joint training programs for professional master's and doctoral degrees by vocational and technical universities have become part of the reform and development plan for vocational education (Zhang, 2022). In December 2022, the Chinese government issued the "Opinions on Deepening the Reform of Modern Vocational Education System Construction," which for the first time proposed the "integration of industry and education in the city" (IIEC), and further improved the influence of vocational education types based on the "vocational education college entrance examination" (VECEE). The "Outline of the Plan for Building an Education Strong Country (2024–2035)" released by the Chinese government in January 2025 has further elevated the status of vocational education as a type of education, and the focus of subsequent education reforms continues to tilt toward the vocational education system with distinctive characteristics.

4 Theoretical explanation

There are some evaluation criteria in the academic community for autonomous vocational education systems with international influence. By integrating multiple perspectives, models, theories, and cases, the following aspects can be summarized:

- (1) a complete and sound vocational education training system and training standards, which are the educational foundation of autonomous and distinctive vocational education systems (Krötz and Deutscher, 2021).
- (2) The strong and leading industrial pattern, as well as the relatively unique model of industry education integration, provide sufficient protection for the interests of participating entities, which is the industrial foundation of the independent vocational education system (Bai et al., 2025; Hariyani et al., 2025).
- (3) A rich and rigorous theoretical explanation, as well as a clear hierarchical theoretical system, provide a detailed explanation of vocational education and the process of interaction with the outside world, which is the theoretical foundation of the autonomous vocational education system (Veen, 2021; Verboom et al., 2025).
- (4) A relatively fixed and authoritative organization formulates and updates standards, which is the basis for promoting the autonomous vocational education system (McNeill et al., 2025; Mavrot et al., 2025).
- (5) Having a certain degree of discourse power in the global vocational education governance system, and having successful experiences introduced, borrowed, and cooperated in multiple countries, this is the legal basis for independent vocational education systems (Allais, 2024; Song and Xu, 2024).

The modern vocational education system with Chinese characteristics has achieved something from scratch, from excellence to uniqueness, and from domestic to overseas. In addition to having the characteristics of a general independent vocational education system, it also has typical Chinese experience and requires the creation of local vocational education theories for explanation. Five-Element Integration Theory refers to the classic logical frameworks of element theory, process theory, and relationship theory in vocational education at home and abroad, emphasizing more on the dimensions of subject and relationship, and summarizing the historical development process of vocational education in China at the macro level (Table 2).

4.1 Theoretical framework and limitations

The Five Element Integration Theory was proposed in the grand context of China's independent knowledge system, with the aim of surpassing the limitations of traditional Western theories and establishing a theoretical system that is more in line with China's reality. The Five Element Integration Theory draws inspiration from Howard Gardner's Multiple Intelligences theory on multivariate decomposition, Dewey's "New Three Centered Theory" (NTCT) on educational integration, John Hattie's visible learning theory on the construction of comprehensive evaluation frameworks, Linda Darling Hammond's Deep Learning framework (DLF) on inclusive education, and more. This theory continues many theoretical frameworks and ideas in the Chinese theoretical environment, including Gu Mingyuan's "Education Modernization" theory (EMT) on international comparison, Shi Zhongying's "Five Education Integration" theory (FEIT) on element decomposition and integration, Qing Lijun's "The Five-Element Integration Talent Training System" (FEITTS) on system construction, and so on. Based on the above background, we propose the Five Element Integration Theory, which defines the five most influential elements in

TABLE 2 Comparison of the Five-Element Integration Theory of vocational education in China.

Participants	Planning objectives	Execution standards	Exploring patterns
Party leadership	Advanced goals (strategic planning)	Strategic standards 1. Adaptability (localization) 2. Transcendence (internationalization)	Qualitative research
Supervisory department (Ministry of Education)	Progressive goals (medium - to long-term goals)	Set a standard 1. Pre approval (conditions) 2. Standardized inspection (process) 3. Standard iteration (results)	Quantitative study
Main responsible department (school)	Progressive goals (short-term goals)	Training standards 1. Segmented filtering (entrance) 2. Classroom teaching (process) 3. Classification orientation (export)	Case study
Enterprise/industry association	Evolutionary goal (cumulative advantage increasingly shifting toward explosive advantage)	Requirement standards 1. Performance standards (standardized skills) 2. Innovation standards (innovation skills) 3. Escape criteria (transformative thinking)	Game of interest and responsibility
Student	Enterprising goals (regular skill target points plus optional skill target points)	Assessment criteria 1. Passing criteria (skill points) 2. Graduation criteria (coherence skills) 3. Development standards (innovative skills)	Empirical study

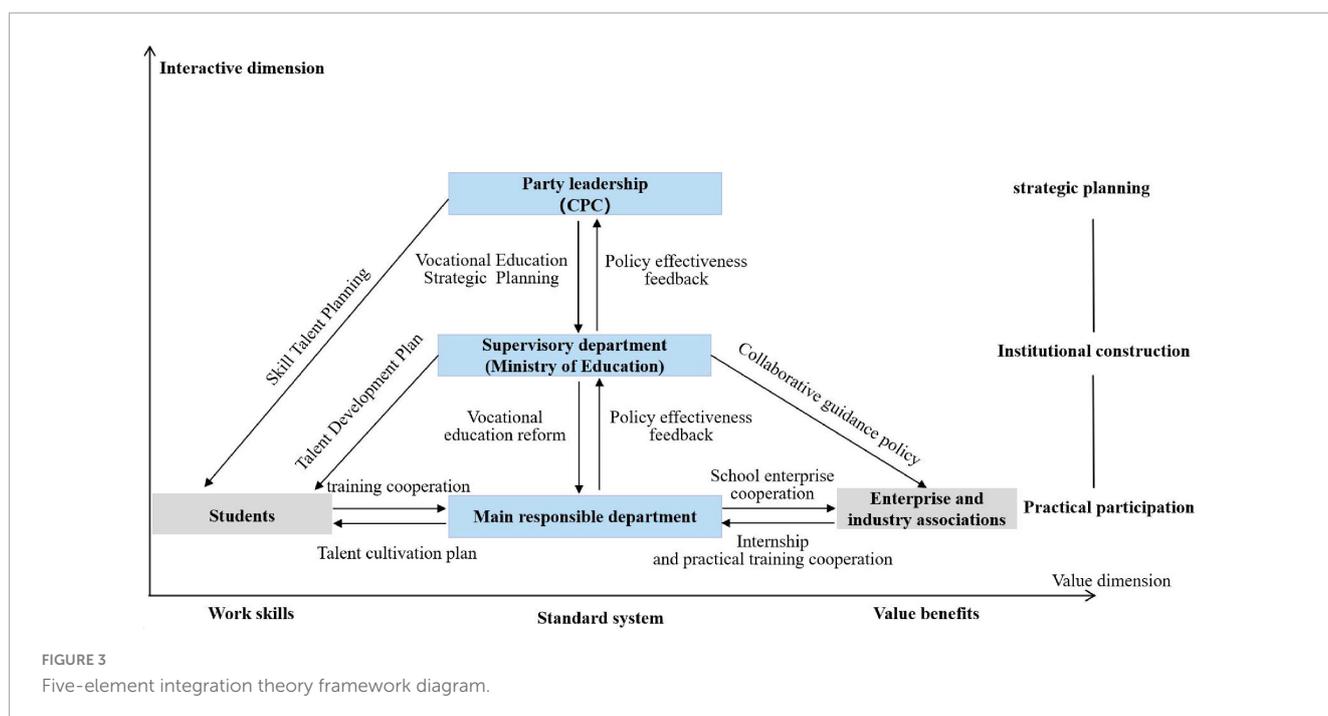


FIGURE 3 Five-element integration theory framework diagram.

the construction of China’s vocational education system as follows Figure 3:

(1) Party leadership (CPC). The leadership of the Party is the blueprint of the CPC for vocational education through strategic planning and policy adjustment. This is different from educational leadership in most countries. First, the leadership of the CPC over vocational education is strategic and long-term, and the general strategic planning is often ten, thirty, and 50 years. Other countries’ governments or political parties simply do not have the ability and execution capability for such long-term strategic planning. Second, the CPC has a strong ability to regulate and control resources in

the development of vocational education, and mobilize more large-scale resources through education authorities, industry associations, enterprises, etc. Thirdly, the stability of education policies. The CPC often does not directly participate in specific work, but gives goals. When adjusting major policies, education authorities must pass the leadership of the Party. Such policies are often relatively stable or gradual reform.

(2) Supervisory department (Ministry of Education). The education supervisory department includes the Ministry of Education, the Department of Education, and the Education Bureau, and is a hierarchical education management department led by the Ministry of Education of China. The education regulatory authorities mainly influence the

reform of vocational education through specific educational implementation policies, including specifying which reform behaviors to support, which reform projects to promote, and developing negative lists for vocational education. At the same time, China's education governance often adopts the principle of territoriality, which is more targeted.

- (3) The main responsible department (including teachers in schools). The main responsible department is vocational colleges, which include two major systems. One is the conventional vocational education system, which includes vocational universities, vocational colleges, and secondary vocational colleges. The other is the adult education system that is integrated into the vocational education system but has some distinctive features, including the Central Open University, provincial open universities, and municipal open universities. In China, vocational colleges are the most crucial force in the development of vocational education, directly responsible for the vast majority of vocational education talent cultivation work, and also responsible for leading collaborative education with other organizations.
- (4) China draws on the experience of vocational education in other countries to introduce enterprises and industry associations to participate in the training of vocational education talents, but it is often in a supporting role. With the deepening of vocational education reform, enterprises, especially key enterprises in the industry, will gain more dominance. Industry associations have gained significant dominance in vocational qualification certification.
- (5) Students mainly refer to the students who participate in the vocational education process, including students in the macro sense of vocational education sequence, students who have a certain learning experience in the vocational education sequence, and students in the open university education sequence.

4.2 Case explanation

The integrated community of industry and education is a case selected in our theoretical framework, which can clearly demonstrate how multiple entities operate independently and collaborate with each other. Before that, the CPC had issued two plans for the coordinated development of industry and education. From Industry Education Integration 1.0 (Integration of Engineering and Technology), Industry Education Integration 2.0 (Integration of Industry and Education) to Industry Education Integration 3.0 (Integration of Industry and Education), it is a systematic, structural, and comprehensive reform of the industrial industry to adapt to the development of the times in terms of education form, enterprise form, and talent type. It is a regular demand for the continuous deepening of the system and mechanism improvement of industry education integration in the germination stage of the intelligent era.

- (1) Publish the plan. In January 2019, the Implementation Plan for National Vocational Education Reform took the lead in

planning and promoting the construction of an "industry education integration community" (IEIC), marking the shift of industry education integration thinking from focusing on "positions" to focusing on "talents." It is the most critical strategic plan for vocational education to break through the "upper limit of vocational education qualifications" and establish "vocational and technical universities." This strategic plan aims to break through the rigid state of specialization between vocational colleges, enterprises, and technology management departments, promote the removal of protective barriers, and create a situation of mutual flow of information elements, providing new growth points for technological innovation and talent cultivation (Hardy and Liu, 2022).

- (2) Institutional construction. The construction of a community integrating industry and education in the city is the specific implementation of this plan. The Ministry of Education has clarified the construction framework, based on industrial parks, focusing on regional leading industries, proposing to deepen the "four cooperations" (cooperative education, cooperative education, cooperative employment, and cooperative development), and build a collaborative mechanism of "promoting production through education and assisting production," gradually forming a new form of industry education integration and a new mechanism for regional development (Zheng et al., 2024). The Ministry of Education has issued the "Construction Standards for Municipal Industry Education Joint Venture (Trial)," which sets three categories of primary indicators: basic, substantive, and negative. It is further refined into 16 secondary indicators and 44 tertiary indicators, clarifies key observation points, and strengthens the standardization and operability of construction.
- (3) Implement measures. Vocational colleges should strengthen professional construction, curriculum construction, textbook construction, faculty team construction, and internship and training construction, promote the transformation of vocational education from knowledge imparting to comprehensive skill improvement, and promote the deep integration of education chain and industry chain. Closely connect with the demand of the regional industrial chain, adjust the specialty settings through the "industrial demand+talent demand" dual clearing single machine system, add new specialties such as intelligent construction, industrial Internet, and promote the digital upgrading of traditional specialties. Apprenticeship is an important and effective form in the development of vocational education (Suyitno et al., 2022). Some vocational colleges promote models such as "order based training" (OBT) and "apprenticeship system," implement "classroom to workshop" practical teaching, carry out teacher on-the-job training, jointly build industry colleges and industry education integration training bases with enterprises, connect the segmented training system of secondary vocational education undergraduate education, and enhance the supply capacity of high skilled talents. Part of the large enterprises have opened up production scenarios to jointly build training bases, providing real project support for teaching. Through "dual teacher" teacher training, joint enrollment, and other methods, they deeply intervene in the teaching process, collaborate with universities to carry

out technical requirement list research and development, and share research and development results. The government also provides policy support such as tax reductions and employment incentives for these enterprises.

- (4) Student feedback. Students can directly participate in enterprise technology research projects through the "integration of industry, academia, research, training, and innovation" training model, transforming classroom knowledge into the ability to solve practical industry problems. In previous vocational talent training programs, students' classroom teaching often exceeded half, but now practical training, especially in solving practical problems on the front line of enterprises, exceeds half, truly elevating technology to a more important position and making it easier to adapt to job requirements.

4.3 Core viewpoints

In the construction of vocational education system, which subjects play a role, what responsibilities they undertake, and how they cooperate with other subjects are the main contents considered in theoretical construction, which can be simply summarized into two dimensions: subject dimension and relationship dimension. In terms of subject dimension, the entities that play an important role include the leadership of the Party (Party organizations), the competent department (Ministry of Education), the main responsible department (schools including teachers), enterprises and industry associations, and students. In terms of relationship dimension, the most crucial aspects are planning objectives, implementing standards, and exploring patterns.

- (1) The leadership of the Party is a unique element, the core, and the essential feature of the modern vocational education system with Chinese characteristics. The leadership of the Party is mainly reflected in strategic planning, maintaining policy continuity and stability, and ensuring the smooth and orderly achievement of advanced goals. The leadership style of the Party often involves setting agenda items and planning them in the highest level meetings and reports of the Party. The leadership of the Party mainly focuses on strategic standards, highlights mission, and on the one hand, promotes the localization of vocational education to serve the practical development of China's industrial structure; On the other hand, we need to promote the internationalization of vocational education and provide services for the overseas extension of Chinese industries (Chen and Wang, 2024).
- (2) The Ministry of Education is the standard setter for vocational education and the practical planner for implementing the leadership of the Party. The Ministry of Education pays more attention to progressive goals and often promotes vocational education reform by formulating medium - and long-term development plans. In the specific implementation process, the main reference is to the changes and trends of specific indicators, adjust vocational education policies, and ensure that vocational education reform proceeds according to the

- predetermined track. The main action logic is pre-approval, normative inspection, and standard iteration (Sun et al., 2024).
- (3) Schools, including various levels and types of vocational education schools, are the specific implementers of training standards. They pay more attention to progressive goals, which are related to the development and dynamic ranking of vocational colleges, and belong to short-term goals in vocational education reform, especially in vocational education development planning. The main task of vocational schools is to ensure the three key points, namely the entrance of students, the training process, and the exit of graduates, in order to provide labor skilled talents that match the market demand for the development of industries and enterprises, and make important contributions to the construction of a skilled society.
 - (4) Enterprises and industry associations are not dominant entities in vocational education reform, but due to their control over talent demand, they have the power to set demand standards to a certain extent, which affects the direction of vocational education talent cultivation. The development of industries has typical cyclicity, with the emergence, peak, and decline periods basically maintaining the existing basic profit model, while the transformation period will reshape the industry's profit model. The participation of enterprises and industry associations in the integration of industry and education emphasizes the game of interests and responsibilities, in order to strive for comprehensive compensation for talent, policies, land, and platforms.
 - (5) The student body is the center of vocational education and the object of vocational talent cultivation, paying more attention to the progressive goals of self growth and development. Students can choose three sets of standards in vocational education, namely passing standards, graduation standards, and development standards, to meet the needs of basic work scenarios, complex work scenarios, and innovative work scenarios. In the reform of vocational education, students are not the dominant subjects, but the beneficiaries of policy reform, whose actual contributions are ultimately balanced in the form of social compensation (Zhan and Wang, 2023).

In the Five-Element Integration Theory, the abstract overall national interests are the key factor that condenses various subjects, which is also one of the biggest characteristics that distinguishes it from any vocational education theory in developed Western countries. The leadership of the Party is to realize the abstract overall interests of the country into the practical interests of different specific entities, mainly in the form of strategic planning, decomposed into multi-level goals and multi-level standards, including guidance for other entities.

4.4 Explain the process

The formation of China's independent vocational education system is a slow process and a product of continuous iteration. The main relationships that run through it include the relationship between the economy and vocational education, and the relationship between policies and vocational education. Therefore,

TABLE 3 Comparison of changes in vocational education forms and scenarios.

Industry forms	Talent form	Educational form	Educational scene	China's technology ecosystem
Pre industrial (handmade)	apprentice	Apprentice workshop	Production scenario	Traditional technology system
Industry 1.0 (mechanization)	General worker	Vocational school (short-term training)	Simulated scene	Complete industrial system
Industry 2.0 (electrification)	Ordinary technician	Modern vocational schools (vocational education system)	Teaching scenario; Simulate production scenarios	Made in China
Industry 3.0 (networking)	Technician	Modern vocational schools (multi-level vocational education system)	Teaching scenario, simulation scenario, examination scenario	Created in China
Industry 4.0 (intelligence)	Engineer	Type education (complete vocational education chain)	Production scenario, teaching scenario, research and development scenario, online scenario	Intelligent manufacturing in China

¹From the perspective of the relationship between vocational education and general education, it roughly includes four stages: vocational separation, vocational separation, vocational coordination, and vocational integration. In order to clearly explain these reforms in the vocational education system and avoid confusion, only a brief explanation is given here. The stage of separating vocational and general education mainly focuses on reforming the education system, the stage of talent selection based vocational and general education diversion mainly focuses on reforming the source of students, the stage of vocational and general education coordination based on stable educational order mainly focuses on reforming the student conversion mechanism, and the stage of vocational and general education integration based on the cultivation of composite talents emphasizes the expansion of educational freedom to meet the needs of future intelligent industry development. ²Undergraduate level vocational education mainly refers to the reform marked by the establishment of vocational undergraduate colleges, which increases the sequence of vocational education colleges in ordinary higher education institutions. In fact, there have been professional master's and doctoral programs before, but they were all completed in research-oriented universities. This reform has achieved a clear positioning of academic education system and vocational education system in terms of education types. ³Comprehensive high school is relative to regular high schools and vocational high schools. In the design of China's education system, vocational high schools often only offer undergraduate and vocational education. Ordinary high schools allow students to attend universities, with some pursuing vocational education. Comprehensive high schools offer both general education and vocational education, providing a new option for students to attend university, vocational undergraduate programs, and vocational colleges.

selecting the two key explanatory perspectives of industry and policy can to some extent outline the formation process of China's independent vocational education system (Table 3).

First, from the industrial perspective, the industrial industries accumulated from the Westernization Movement to the early days of the founding of New China were basically consumed in the war, and the scattered industrial industries were heavily dependent on overseas industrial chains. China was still in the production mode dominated by the agricultural society. According to the viewpoint of historical materialism, the CPC understands that the most urgent problem in China is the transition from agriculture to industrialization. To promote industrialization, there is a need for talent supply in vocational education. In 1953, China launched its first Five Year Plan, with the core goal of achieving basic industrialization of the country in about 20 years. The essence of industrialization at that time was to make good use of the achievements of the first industrial revolution, namely Industry 1.0 (mechanization), and establish a relatively complete industrial system. From the establishment of the People's Republic of China to the early stages of reform and opening up, and even in 1991, the focus of China's industrial system remained at the level of mechanization, with a few areas developing toward Industry 2.0. Corresponding to the industrial system, vocational education is mainly based on vocational junior high schools, supplemented by vocational high schools, and supplemented by technical schools; The scale of vocational education (the number of schools and the number of students) has shown a rapid development trend, but vocational education has not formed a systematic ecology.

After the reform and opening up, especially in the 1990s, the socialist market economy system with Chinese characteristics continued to develop and improve through exploration, and the demand for talent shifted from general workers to skilled workers. The huge market foundation, talent foundation, and resource

foundation accelerated the birth of Made in China. At this time, the macro industrial policies of the Party and the state are accelerating the transformation and upgrading toward Industry 2.0. Correspondingly, vocational education has formed a semi systematic state of self employment, vocational high school, and higher vocational education, and even professional master's and doctoral programs have been piloted in academic universities.

From the beginning of the 21st century to the first two decades of the 21st century, the achievements of the third industrial revolution were finally integrated in the form of the internet industry. China timely promoted the transformation and upgrading of the whole field. The patents, inventions and technologies in some fields showed a significant growth and overtaking trend. The shipbuilding industry, the internet industry, high-speed rail industry and many other industries achieved cross regional development and overtaking at corners. Correspondingly, vocational education undergraduate programs have been established, and a complete vocational education system has gradually taken shape and developed toward specialization (Wang and Li, 2024).

In the third decade of the 21st century, the emergence of intelligent technology has accelerated, and major countries in the world have begun to carry out Industry 4.0 strategic planning. China is an early major country to formulate relevant development plans and actively proposed a new round of industrial transformation and upgrading, striving for the voice of emerging industries. The intelligent industry requires vocational education talents to be engineers, even senior engineers, which requires corresponding reform measures to be taken by the vocational education system. China has also accelerated institutional reforms such as the integration of education, technology, and talent, and the integration of industry and education into a community, in order to meet the needs of industrial transformation (Zhu and Cao, 2024).

Secondly, from a policy perspective, China's autonomous vocational education system is the process of other entities under the leadership of the Party advancing vocational education policies in a direction that is conducive to releasing their autonomy, and providing feedback to stimulate the evolution of vocational education from hierarchical education, semi systematic state, and systematic state to a modern vocational education system with Chinese characteristics. Among them, the first stage of vocational education focuses on primary vocational education, and the extreme shortage of talents has led to vocational schools being in a dominant position; The policy focus is also on determining the standards for vocational education system and accelerating the scale of vocational education. The second stage of vocational education focuses on secondary vocational education, which is becoming increasingly dominant due to the decreasing scale effect of vocational education talent supply and the accelerated expansion of the market; The policy focus has begun to promote the upgrading of vocational education levels, in order to stabilize student sources and promote the reform of vocational and general education separation (Liu et al., 2024). The third stage of vocational education focuses on higher vocational education, and the complexity of educational reform requires education authorities to bear more reform pressure and coordinate the interests of other entities to a certain extent; On the one hand, the policy focuses on accelerating the upgrading of vocational education levels, and on the other hand, adjusting the integration of vocational and general education to meet the rights and demands of diverse entities. The fourth stage of vocational education focuses on type education, and the vocational education system enjoys the same legal status as the academic education system and undertakes increasingly heavy (functional) and numerous (quantitative) tasks in the future education system. Strengthening the Party's leadership over vocational education comprehensively is more reflected in guiding diverse subjects to form a collaborative and co building ecosystem, and thus achieving a win-win situation for multiple interests; The policy focus also highlights the Chinese characteristics of the vocational education system, emphasizing the construction of a collaborative ecosystem for vocational education, independent theoretical support, and global discourse power in vocational education governance.

4.5 International comparison

There is a considerable amount of literature in the academic community on international comparisons of vocational education and research on vocational education models in major countries. It integrates multiple perspectives, classifications, and viewpoints from multiple experts and scholars, and compares them with vocational education in China. It can be found that China's vocational education system is super large in scale, super standardized in standards, super long in educational system design, and super combined in qualification certification. It fully absorbs advanced experience from other countries in multiple aspects, thus forming a unique vocational education system.

From the perspective of the subject dimension, vocational education in China is centered around the leadership of the Party and has irreplicability, because only the Party has the

stability of long-term strategic planning and the ability to mobilize diverse subject forces. The vocational education models in the United States, Japan, and other countries can be simply classified as centered around enterprises, while other entities also play important roles, especially in Japan where vocational education is increasingly inclined toward a tripartite system of shared core (Hao and Shi, 2020; Uchikoshi et al., 2025). Countries such as Singapore and Australia can be simply summarized as having vocational colleges as the core, with governments, businesses, and others also playing important roles. However, many standards for vocational education are still in the hands of vocational colleges. Germany, Switzerland, Austria, Estonia and other countries emphasize the shared responsibility between schools and businesses, making it difficult to distinguish between more core entities or leaning toward binary checks and balances (Wang M. et al., 2024; Bentsalo et al., 2025). Regardless of the core subject inclination of the above model, it basically undertakes the formulation of the vocational education system and standards, covering the diverse subjects involved in vocational education and the function of coordinating interests.

From the perspective of the core focus of vocational education systems, the vocational education models of all major countries can be condensed into one sentence, showcasing the most prominent features of vocational education, which is the core focus of vocational education systems. Vocational education in the United States emphasizes ability training, advocates practicality, and is more clearly and flexibly guided by enterprises. However, its system design, especially standardized design, is relatively difficult and tends to focus on curriculum or skill combinations or modularization (Wan and Wu, 2023). Vocational education in the United Kingdom emphasizes two certificates, namely outstanding standard certification, which is beneficial for the development of the vocational education industry and overseas promotion, and has strong replicable and promotable characteristics. Singapore's vocational education emphasizes the integration of knowledge and skills, which is more in line with the demand for advanced engineering talents in the era of intelligence. The core focus of vocational education in the three countries mentioned above is on students, with a greater emphasis on improving their skills (Brunello and Rocco, 2017; Newlands and Lutz, 2024).

Australian vocational education emphasizes the continuity of vocational skills and maintains a state of vocational skills through continuing education (Ziguras et al., 2024). Japanese vocational education emphasizes dual collaboration, leans more toward enterprises, and also pays attention to government supervision and participation (Kitada and Harada, 2019). It is difficult to distinguish the degree of responsibility between the dual entities of schools and enterprises in German vocational education, and they tend to lean toward school enterprise collaboration (Seizinger and Brunner, 2023). The core focus of vocational education in the three countries mentioned above can be regarded as concentrated in enterprises, emphasizing the auxiliary development role of vocational education in enterprises.

Compared to the core concerns of these countries, vocational education in China focuses more on enterprises, students, and schools, but pays more attention to the standardization of the vocational education system, emphasizing that it is a public platform for joint construction, sharing, and win-win outcomes, and that every subject can benefit from this platform. The foundation for ensuring the sustainable operation of the vocational

education system is a series of standards. Therefore, in a nutshell, the Chinese vocational education system is a standardized public platform.

4.6 Discussion

The modern vocational education system with Chinese characteristics was born and raised in China, absorbing the experience of various countries and benefiting the whole world. It provides successful experiences for developing countries on the path of industrialization and explores shared experiences for countries that cooperate and win in the era of intelligent industry.

Firstly, China's problems rely on China's practice. Adapting to the production mode of the intelligent era is the overall direction of the reform of the modern vocational education system with Chinese characteristics, including the integration of industry and education 3.0 (industry education integration community), the improvement of the vocational education system reform (professional master's and doctoral programs returning to applied universities), the reshaping of the vocational education ecosystem with intelligent technology (multi scenario), and the reshaping of the barriers between vocational education and technology (integration of education, technology, and talent). The key lies in the supporting role of vocational education in the intelligent ecosystem (Zhu and Xiong, 2022). These issues require local solutions in China, exploring solutions that balance the interests of multiple stakeholders, and establishing new long-term collaboration mechanisms in practice (Li and Martins, 2024).

Secondly, global governance requires China's participation. The core of vocational education is skills, but fundamentally it conveys social responsibility. Global vocational education governance is not about technology sharing or experience exchange, but about cultivating industrialization capabilities through vocational skills and sharing the achievements of global industrial chain development. The diligence, professionalism and dedication fostered by China's vocational education have written a footnote to Chinese path to modernization; Global vocational education governance cannot be separated from China's participation. The successful experience of sharing the education chain along the industry chain and the "small but beautiful" vocational education project overseas demonstrates China's ability to participate in global governance. In the future, China's participation is still needed in global issue setting, developing country vocational education project assistance, vocational education standards, and other aspects.

Thirdly, the leadership of the Party consolidates Chinese characteristics. Paradigm is a normative summary of the basic operating rules and logic of a certain field under different historical backgrounds. Every era change (production tools), every institutional change (production relations), and every major technological breakthrough (productivity) will form a new paradigm. The complete process of China's modern vocational education system with Chinese characteristics has gone through the entire process from Industry 1.0 to Industry 4.0, and in the short period of nearly a 100 years, it has self updated and systematized vocational education, just like a complete evolutionary history. Chinese characteristics include the arduous process of the Chinese

people led by the Party to explore technology to save the country, rejuvenate the country and strengthen the country through technology, as well as the future process of dynamically updating and iterating Chinese standards toward the world.

5. Research conclusion

5.1 Conclusion

The market size and population size of China are the foundation of its own vocational education system, and on this basis, a relatively complete and strong industrial production system has been formed to provide demand for the vocational education system. At the same time, China has almost introduced the vocational education systems of major developed countries around the world for learning and imitation, drawing on the successful experiences of other countries, and thus forming an extremely complex, massive, and completely fixed vocational education training chain.

- (1) The Chinese vocational education system is difficult to imitate. The key lies in the long-term planning of the CPC, which is irreplaceable by any government. There is no situation in China where the change of government in other countries leads to significant policy changes. The policies of vocational education in China have remained stable and have undergone minor reforms in a stable continuation.
- (2) Although the vocational education system in China has its own characteristics, it still has the general features of other countries in establishing vocational education systems, although these features have different specific manifestations in different countries. In China, these characteristics of vocational education are reflected in China's localization policies.
- (3) Overall, the vocational education system in China is relatively standardized and strict, which is similar to other aspects of China. China likes to make a long-term development plan for anything and establish a standard and strict implementation system. However, its drawbacks are also evident, which are that it requires significant resources and can be difficult to adjust.
- (4) Chinese vocational education is playing an increasingly important role in the governance of global vocational education, which is related to China's responsibility for domestic vocational education, as well as its vocational education exchange activities in multiple countries around the world. The world needs the exchange and dissemination of vocational education in China.

5.2 Future research directions

The Five Element Integration Theory is proposed in the context of China's autonomous theoretical system for vocational education, which itself will provide a new theoretical framework for global vocational education governance. Especially in the Chinese context, there are significant differences between many theoretical

frameworks and Western theories, which play an important role in explaining Chinese practices and should be given attention in the English context.

This article has initiated a good attempt, and there are still many works worth further research in the future. (1) The international comparison of vocational education theories, especially the research based on case analysis, is a new growth point in the future. (2) International comparison based on a certain factor is also an area worth paying attention to in the future. Place a variable within a theoretical framework and use quantitative analysis to compare multiple indicators of vocational education in various countries around the world. (3) The theory of vocational education autonomy includes multiple levels such as institutional level, practical theory, teaching and training theory, etc. These levels can also give rise to numerous theories, and future research is needed to delve into specific cases and literature to propose new theories of autonomy. In addition, new independent theories can be proposed based on different perspectives, subjects, relationships, industry demands, and reform models. (4) The research on the construction of vocational education standards, especially how to integrate current mainstream standards in future global vocational education governance practices, and provide more universal, concise and effective vocational education for countries around the world, is also a research focus that deserves attention.

Author contributions

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References

- Allais, S. (2024). How the global VET toolkit weakened local colleges in South Africa. *J. Vocat. Educ. Train.* 77, 81–100. doi: 10.1080/13636820.2024.2411509
- Bai, X., Shen, S., and Shi, Q. (2025). Modular construction of teaching mode of innovative talents training under the background of integration of industry and education. *Int. J. Innov. Sustain. Dev.* 19, 58–80. doi: 10.1504/IJISD.2025.142909
- Bentsalo, I., Ümarik, M., Loogma, K., and Väljataga, T. (2025). Understanding the roles of positive school culture and climate in supporting students' wellbeing in vocational schools. *Front. Educ.* 10:1596252. doi: 10.3389/feduc.2025.1596252
- Bouchaib, C. (2022). The Sino-African higher education exchange: Toward building a literature. *Asian Educ. Dev. Stud.* 12, 1–14. doi: 10.1108/AEDS-01-2021-0019
- Brunello, G., and Rocco, L. (2017). The labor market effects of academic and vocational education over the life cycle: Evidence based on a British cohort. *J. Hum. Capit.* 11, 106–166. doi: 10.1086/690234
- Cai, H., Pan, M., and Huang, L. (2025). Is it externally stimulated or internally driven? A study on the influencing mechanisms of Chinese graduate students' intention to continue online learning. *Comput. Educ.* 231:105293. doi: 10.1016/j.compedu.2025.105293
- Chen, L., and Lin, W. (2019). Attention measurement of the development of vocational education system in China since the founding of the People's Republic of China 70 years ago. *Vocat. Tech. Educ.* 40, 13–18.
- Chen, S., Xu, K., Gao, Y., and He, Z. (2023). The development of undergraduate vocational education in china: Current situation, problems, and paths. *China Electron. Educ.* 7, 43–50+77.
- Chen, Y., and Wang, J. (2024). The trend, logical orientation, and action direction of promoting the modernization of Chinese style vocational education under the background of a strong country. *Modern Educ. Manag.* 4, 119–128. doi: 10.16697/6.1674-5485.2024.012
- Deng, Z., and Zhang, S. (2024). Types and characteristics of vocational education system construction in major developed countries around the world. *Educ. Career* 21, 68–76.

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- Ganefri, H. H. (2015). Production based learning: An instructional design model in the context of vocational education and training (VET). *Proc. Soc. Behav. Sci.* 204, 206–211. doi: 10.1016/j.sbspro.2015.08.142
- Gao, M., Ding, H., and Yang, H. (2024). The evolution, characteristics, and prospects of modernization policies for vocational education in China: An analysis based on 30 policy texts. *Modern Educ. Manag.* 07, 85–96. doi: 10.16697/j.1674-5485.2024.07.009
- Guo, D., and Wang, A. (2020). Is vocational education a good alternative to low-performing students in China. *Int. J. Educ. Dev.* 75:102187. doi: 10.1016/j.ijedudev.2020.102187
- Guo, L., Li, P., Mao, S., Zhong, H., Zhang, Q., Zhang, R., et al. (2024). Innovation and evaluation of vocational pharmaceutical education system under the 1 + X certificate system in China. *Curr. Pharm. Teach. Learn.* 16:102090. doi: 10.1016/j.cptl.2024.04.006
- Gupta, P., and Datta, A. (2023). The role of accurate identification of vulnerable youth in vocational education and training systems for improved employability: Insights from experimental data. *Data Brief* 48:109258. doi: 10.1016/j.dib.2023.109258
- Gupta, S. L., Mittal, A., Singh, S., and Dash, D. N. (2023). Demand-driven approach of vocational education and training (VET) and experiential learning: A thematic analysis through systematic literature review (SLR). *Asian Educ. Dev. Stud.* 13, 45–63. doi: 10.1108/AEDS-07-2023-0083
- Hao, T., and Shi, W. (2020). Industrial structure transformation and vocational education mode reform: Based on comparative analysis of the United States, Germany, Japan, and China. *Modern Educ. Manag.* 8, 122–128. doi: 10.16697/j.1674-5485.2020.08.017
- Hardy, I., and Liu, S. (2022). Complex connectivities: Policy networks, data infrastructures and vocational education reform in China. *Int. J. Educ. Res.* 115:102045. doi: 10.1016/j.ijer.2022.102045
- Hariyani, D., Hariyani, P., Mishra, S., and Sharma, M. K. (2025). A literature review on lean tools for enhancing the quality in the outcome-based education system. *Think. Skills Creativ.* 57:101793. doi: 10.1016/j.tsc.2025.101793
- Kim, H., and Yu, K. (2024). Vocational education and political engagement: The case of South Korea. *Int. J. Educ. Res.* 127:102409. doi: 10.1016/j.ijer.2024.102409
- Kitada, M., and Harada, J. (2019). Progress or regress on gender equality: The case study of selected transport STEM careers and their vocational education and training in Japan. *Trans. Res. Interdiscip. Perspect.* 1:100009. doi: 10.1016/j.trip.2019.100009
- Krötzig, M., and Deutscher, V. (2021). Differences in perception matter – how differences in the perception of training quality of trainees and trainers affect drop-out in VET. *Vocat. Learn.* 14, 369–409. doi: 10.1007/s12186-021-09263-7
- Larsson Taghizadeh, J., and Österman, M. (2025). Choosing the right path: The effects of pursuing general versus vocational secondary education on dropout risk and youth inactivity. *Econ. Educ. Rev.* 106:102655. doi: 10.1016/j.econedurev.2025.102655
- Li, B., and Guo, G. (2022). Accelerate the theoretical framework and practical path of building a modern vocational education system with Chinese characteristics. *Educ. Career* 1, 28–35. doi: 10.13615/j.cnki.1004
- Li, D., and Martins, P. S. (2024). Does vocational education pay off in China? Evidence from city-level education supply shocks. *Econ. Model.* 140:106863. doi: 10.1016/j.econmod.2024.106863
- Li, L., and Hu, Y. (2025). “Navigating Precarity”: Motivation of English language teachers in a Chinese higher vocational college. *System* 130:103617. doi: 10.1016/j.system.2025.103617
- Li, Y., and Pan, H. (2024). What is a good vocational education reform—Analysis based on vocational education policies. *Inner Mongolia Soc. Sci.* 45, 197–204. doi: 10.14137/j.cnki.issn1003
- Li, Y., Li, T., Liu, J., Hu, Z., and Qi, Z. (2025). Decoding vocational teachers’ professional identity: Organizational climate and teacher self-efficacy as key factors in the Chinese educational context. *Int. J. Educ. Res.* 132:102651. doi: 10.1016/j.ijer.2025.102651
- Liu, H., Xu, Y., Zhang, R., Nie, J., Rule, A., Rozelle, S., et al. (2024). Comparing the payoff to vocational and academic secondary education in China over time. *Int. J. Educ. Dev.* 107:103038. doi: 10.1016/j.ijedudev.2024.103038
- Liu, X., Wang, Y., Li, S., Chen, L., Li, F., and Zhang, H. (2025). Research on the coupling coordination relationship between new quality productivity and high vocational education sustainable development. *Asian Educ. Dev. Stud.* 14, 241–266. doi: 10.1108/AEDS-07-2024-0152
- Mavrot, C., Potluka, O., Balzer, L., Eicher, V., Haunberger, S., Heuer, C., et al. (2025). What evaluation criteria are used in policy evaluation research: A cross-field literature review. *Eval. Program Plann.* 108:102512. doi: 10.1016/j.evalprogplan.2024.102512
- McGrath, S. (2012). Vocational education and training for development: A policy in need of a theory? *Int. J. Educ. Dev.* 32, 623–631. doi: 10.1016/j.ijedudev.2011.12.001
- McNeill, M., Rekhari, S., and Taslaman, S. (2025). Shifting from compliance to quality and innovation: Piloting self-accreditation through a higher apprenticeship. *J. High. Educ. Policy Manag.* 47, 435–441. doi: 10.1080/1360080X.2025.2470255
- Newlands, G., and Lutz, C. (2024). Occupational prestige and occupational social value in the United Kingdom: New indices for the modern British economy. *Res. Soc. Stratific. Mobil.* 91:100935. doi: 10.1016/j.rssm.2024.100935
- Pongwat, F., and Fisik Sean, B. (2025). School supportiveness and innovative abilities in vocational education: The mediating role of motivation to innovate among vocational teachers. *Front. Educ.* 10:1487560. doi: 10.3389/feduc.2025.1487560
- Poschauko, V. C., Kreuzer, E., Hirz, M., and Pacher, C. (2024). Engineering education goes lifelong learning: Modularized technical vocational education and training program for the automotive sector. *Proc. Comput. Sci.* 232, 1799–1808. doi: 10.1016/j.procs.2024.02.002
- Qi, C., and Li, X. (2025). Vocational education investment and middle-income group expansion in China. *Finance Res. Lett.* 76:107025. doi: 10.1016/j.frl.2025.107025
- Ren, S., and He, Z. (2025). The integration of industry and education in vocational education responds to the internal logic and optimization strategies of economic and social development. *China Vocat. Tech. Educ.* 2, 91–96+112.
- Seizinger, M., and Brunner, J. O. (2023). Optimized planning of nursing curricula in dual vocational schools focusing on the German health care system. *Eur. J. Operat. Res.* 304, 1223–1241. doi: 10.1016/j.ejor.2022.05.007
- Shi, N., and Que, M. (2024). The evolution process, change logic, and future prospects of China’s modern vocational education system policies: Based on the analytical paradigm of historical institutionalism. *China Vocat. Tech. Educ.* 33, 24–33.
- Song, X., and Xu, D. (2024). More graduates, fewer skills? Vocational education expansion and skilled labour shortages in China. *China Q.* 260, 970–985. doi: 10.1017/S0305741023001856
- Sun, T., Shao, C., Deng, S., and Xiang, Z. (2024). The macro governance changes of vocational education in China over the 75 years since the founding of the People’s Republic of China: An analysis based on vocational education policies (1949–2024). *Vocat. Educ. Forum* 40, 14–22.
- Suyitno, S., Yusri, K., Dwi, J., Muhammad, N., and Edi, S. (2022). Industrial apprenticeship model based on work-based learning for pre-service teachers in automotive engineering. *Front. Educ.* 7:865064. doi: 10.3389/feduc.2022.865064
- Tang, N., and Qiu, Y. (2024). The boundary evolution of adult education, vocational education, and continuing education in the 75 years since the founding of the People’s Republic of China, and their impact on the reform of the education system: From the perspective of constructing a new map of Chinese education. *Vocat. Educ. Forum* 40, 5–13.
- Uchikoshi, F., Toyonaga, K., and Teramoto, E. (2025). Consequences of expanded vocationally oriented programs for gender segregation and inequality: The case of Japanese higher education. *Res. Soc. Stratific. Mobil.* 97:101024. doi: 10.1016/j.rssm.2025.101024
- Väljätaga, T., Ümarik, M., Loogma, K., Bentsalo, I., Daukilas, S., Kaminskiene, L., et al. (2025). Educational learning lab supporting innovation adoption in vocational education. *Front. Educ.* 10:1422647. doi: 10.3389/feduc.2025.1422647
- Veen, M. (2021). Creative leaps in theory: The might of abduction. *Adv. Health Sci. Educ.* 26, 1173–1183. doi: 10.1007/s10459-021-10057-8
- Verboom, A. D. P. R., Pais, L., Zijlstra, F. R., Oswald, F. L., and dos Santos, N. R. (2025). Perceptions of artificial intelligence in academic teaching and research: A qualitative study from AI experts and professors’ perspectives. *Int. J. Educ. Technol. High. Educ.* 22:46. doi: 10.1186/s41239-025-00546-w
- Wan, Q., and Wu, L. (2023). The concept, content, and inspiration of the construction of vocational education standards in the United States: Based on the analysis of the “new jersey student learning standards - career preparation, life literacy, and key skills”. *Vocat. Tech. Educ.* 44, 65–72.
- Wang, J., and Wang, Z. (2025). The dilemma of social identity in vocational education and its solutions: An analysis based on vocational system theory. *Educ. Career* 3, 22–29. doi: 10.13615/j.cnki.1004
- Wang, X., Liu, S., and Zhang, L. (2024). How the “West as method” fails: A study of entrepreneurship education from the perspective of China. *Int. J. Manag. Educ.* 22:101073. doi: 10.1016/j.ijme.2024.101073
- Wang, M., Wang, X., and Yuan, L. (2024). Analysis of the German vocational education policy framework and its implications for China. *Educ. Career* 17, 83–90. doi: 10.13615/j.cnki.1004-3985.2024.17.002
- Wang, X., and Zhang, K. (2023). Exploration of the value logic and path of internationalization of the “1+X certificate” system. *Jiangsu High. Educ.* 02, 49–54. doi: 10.13236/j.cnki.jshe.2023.02.007
- Wang, Y., and Li, G. (2024). The era demands, type characteristics, and practical paths of undergraduate vocational education. *J. Shaanxi Normal Univers.* 53, 166–174. doi: 10.15983/j.cnki.sxss.2024.1115
- Wu, F., Hao, L., and Hu, S. (2024). The alienation dilemma and integration strategy of vocational education teachers’ enterprise practice: From the perspective of integration theory. *China Vocat. Tech. Educ.* 36, 90–95.

- Wu, S., Duan, J., and Luo, M. (2024). Evaluating and analyzing student labor literacy in China's higher vocational education: An assessment model approach. *Front. Educ.* 9:1361224. doi: 10.3389/feduc.2024.1361224
- Xia, X. (2022). From the eleventh five year plan to the fourteenth five year plan: Theme changes and prospects for high quality development of higher vocational education. *Vocat. Tech. Educ.* 43, 53–60.
- Xie, D., and Xiang, M. (2023). The evolutionary logic and performance evaluation of China's vocational education management system: Based on the perspective of historical institutionalism. *Vocat. Tech. Educ.* 44, 28–36.
- King, H. (2022). A review of the revision process of the vocational education law and an analysis of the basic points and impacts of the new law. *China Vocat. Tech. Educ.* 24, 5–14.
- Yang, Q., and Li, X. (2025). An analysis of the difficulties and relief strategies in the development of vocational education industry education integration organizations from the perspective of organizational sociology. *High. Eng. Educ. Res.* 2, 132–137.
- Zeng, T., Su, M., Li, J., and Hang, J. (2024). Practical exploration, practical difficulties, and coping strategies for promoting the integration of vocational and general education in China. *Chin. J. Educ.* 5, 42–47.
- Zhan, Q., and Wang, S. (2023). The decision on the boundary between general and vocational education: The logic of student school selection guided by educational equity. *J. East China Normal Univers.* 41, 117–126. doi: 10.16382/j.cnki.1000-5560.2023.08.011
- Zhang, D., and An, X. (2024). The era direction of modern vocational education system reform under the background of building a strong education country. *Educ. Res.* 45, 105–118.
- Zhang, X. (2022). The institutional logic and type characteristics of the governance model selection for undergraduate vocational and technical universities. *Explor. High. Educ.* 4, 15–20.
- Zheng, W., Zheng, X., and Zhu, X. (2024). Promoting integration of industry and vocational education: Exploring stakeholder intentions of hydrogen energy industry. *Int. J. Hydrogen Energy* 52, 454–464. doi: 10.1016/j.ijhydene.2023.06.072
- Zhou, Z., Tian, Q., Alcalá, J., and Yepes, V. (2025). Research on the coupling of talent cultivation and reform practice of higher education in architecture. *Comput. Educ. Open* 56:100268. doi: 10.1016/j.caeo.2025.100268
- Zhu, D., and Cao, D. (2024). The 'Chinese Road' for high quality development of vocational education: Internal logic and strategic choices. *J. Henan Normal Univers.* 51, 135–143. doi: 10.16366/j.cnki.1000-2359.2024.06.20
- Zhu, D., and Xiong, Q. (2022). How to reshape the new ecology of vocational education through digital transformation Modern Distance. *Educ. Res.* 34, 12–20.
- Zhu, G., and Wu, Z. (2017). The three stages and strategic focus of the development of modern vocational education system with chinese characteristics. *High. Educ. Manag.* 11, 16–24. doi: 10.13316/j.cnki.jhem.20170628.003
- Ziguras, C., Murray, D., and Honeywood, P. (2024). The international education association of Australia's first 20 years: Strengthening public diplomacy and social licence through professional development, advocacy and research. *Hist. Educ. Rev.* 53, 168–184. doi: 10.1108/HER-04-2024-0018
- Zuo, H., Zhang, M., and Huang, W. (2025). Lifelong learning in vocational education: A game-theoretical exploration of innovation, entrepreneurial spirit, and strategic challenges. *J. Innov. Knowledge* 10:100694. doi: 10.1016/j.jik.2025.100694