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Original Paper

A Comparative Study of Vocational Education Models in China and Germany

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Abstract

Industrial transformation and technological change are creating new demands for the education and training of technical and skilled workers. Vocational education in China and Germany has developed in different institutional and industrial contexts, giving rise to distinctive forms of provision: government-coordinated, institution-based education in China and collaborative training by companies and vocational schools in Germany. Drawing on a review of the literature and comparative analysis, this study outlines their historical development and compares five dimensions: education systems, education and training models, school–enterprise cooperation, teacher and trainer development, and funding and policy support. Both countries emphasize occupational competence, practical learning, and the participation of multiple stakeholders. Their differences lie primarily in the allocation of responsibilities, the organization of education and training, and cost-sharing arrangements; these differences do not warrant a simple ranking of the two models. Institutional coordination within Germany's dual system offers useful insights, although its outcomes also depend on the availability of company-based training and regional conditions. Building on government coordination and systematic education provided by schools, China is advancing industry–education integration through provision at multiple levels, the participation of diverse stakeholders, and regionally differentiated implementation.

Keywords

vocational education, China–Germany comparison, dual system, industry–education integration, education and training

1. Introduction

1.1 Research Background

A new wave of scientific, technological, and industrial change is driving the development of intelligent manufacturing, new energy industries, and the digital economy, while technological advances are

changing job tasks and competence requirements. Vocational education must both develop a skilled workforce and respond to workers' needs for career transitions and continuing learning. Translating industry needs into educational content while maintaining a coherent approach that supports learners' long-term development has become a central issue in vocational education reform. Research on industry–education integration provides a basis for examining coordination between education and industry (Shi & Hao, 2026).

China is at an important stage in the transformation and upgrading of manufacturing, and the education and training of technical and skilled workers must take account of industrial development, regional differences, and students' growth. The government issued the National Implementation Plan for Vocational Education Reform (State Council of the People's Republic of China, 2019) and revised the Vocational Education Law of the People's Republic of China in 2022 (Standing Committee of the National People's Congress [NPCSC], 2022). These measures reaffirmed the equal importance of vocational and general education and advanced reforms in vocational undergraduate education, differentiated entrance examinations and admissions, and industry–education integration. As educational provision and policy support continue to develop, curriculum articulation, enterprise participation, and resource allocation remain important reform issues, with arrangements shaped by regional industries and the conditions of individual fields of study. International comparison helps clarify the functions of different institutional arrangements and the conditions under which they apply.

Germany's dual system combines company-based training with vocational school education, providing an institutionalized pathway for young people to develop occupational competence and move from school to work. Studies have examined its operation through school–enterprise collaboration and enterprise participation (Gessler, 2017; Xu, 2021). Although the model merits investigation, its employment outcomes are also influenced by economic conditions, industrial structure, and the availability of training places. Germany's manufacturing performance and youth employment patterns therefore cannot be attributed to the dual system alone. This study examines how the system operates without assuming that either model is universally superior.

Since the 1980s, vocational education exchanges between China and Germany have gradually expanded to encompass education and training, teacher development, curriculum development, and occupational standards. Applying principles of the dual system in China requires adaptation to school governance, enterprise organization, and regional industrial conditions. Studies of dual higher education in Germany (Tang & Xie, 2023) and practice-oriented higher education in universities of applied sciences (He & Tang, 2024) provide evidence on different forms of cooperation between education providers and enterprises. Comparing the organization of vocational education in the two countries can thus help distinguish transferable mechanisms from arrangements that require adaptation to local conditions.

Previous research has examined school–enterprise collaboration in Germany (Gessler, 2017), comparisons of institutions and models in China and Germany (Chen & Wu, 2022; Song & Qu, 2022),

mechanisms of school–enterprise cooperation (Zhao, 2017), conceptions of vocational education (Jiang, 2017), and certification standards for "dual-qualified" teachers (Li & Liu, 2017). Building on this literature, the present study brings education systems, training processes, and supporting arrangements into a common analytical framework, focusing on the relationship between institutional provisions, implementation conditions, and educational outcomes. The comparison centers on vocational school education in China and dual initial vocational education and training (VET) in Germany. Where progression to higher education is discussed, the relevant distinctions are made; the dual system is not treated as synonymous with all vocational education in Germany. Given differences in educational levels, statistical definitions, and regional conditions, the analysis is primarily institutional and literature-based and does not infer the relative overall quality of provision in the two countries. Its purpose is to offer context-dependent insights into the division of responsibilities between schools and enterprises, practical learning, and teacher development, rather than to advocate the direct transplantation of a particular system.

2. An Overview of Vocational Education Development in China and Germany

2.1 The Development of Vocational Education in China

In the early years of the People's Republic of China, industrialization generated substantial demand for technical personnel and skilled workers. Vocational education gradually developed around institutions such as specialized secondary schools and skilled workers' schools. Government authorities and sectoral administrative bodies played important roles in the distribution of schools, the designation of fields of study, and the allocation of trained personnel, linking educational provision to industrial development at the time. Specialized secondary schools and skilled workers' schools differed in their educational objectives, curriculum structures, and administrative arrangements, offering general foundational education, occupational theory, and practical instruction with different emphases. Within the constraints of economic and educational development, the range of provision and the allocation of resources were still evolving. This period nevertheless established institutions, accumulated expertise in vocational fields, and trained technical personnel that supported subsequent development.

Following the introduction of reform and opening-up, industrial development and changing labor demand prompted vocational education to expand enrollment and adjust its fields of study. Local governments, industry, enterprises, and other nongovernmental actors became involved in increasingly diverse forms of provision. The 1985 Decision of the Central Committee of the Communist Party of China on Reform of the Education System identified restructuring secondary education and vigorously developing vocational and technical education as reform priorities. Secondary and higher vocational education subsequently expanded, with greater attention to the relationship between training and market demand. Building on existing institutions, vocational education adjusted its objectives, curricula, and links to employment. Ways of combining theoretical and practical learning diversified, while the pace of development varied across regions and schools.

Since the beginning of the twenty-first century, industrial restructuring in China has generated more diverse requirements concerning the qualification levels and competences of technical and skilled workers. System development, quality improvement, and the regulation of provision have proceeded in parallel. The State Council's 2014 Decision on Accelerating the Development of Modern Vocational Education called for closer links between secondary and higher vocational education, encouraged some general undergraduate institutions to shift toward applied technical education, and proposed exploring vocational education at the bachelor's degree level (State Council of the People's Republic of China, 2014). Application-oriented general undergraduate education and vocational undergraduate education differ in institutional mission and regulatory arrangements. Subsequent reforms have continued to address practical training facilities, the distribution of programs, and school–enterprise cooperation, alongside curriculum articulation across educational levels and coordination among different stakeholders (National Development and Reform Commission et al., 2023; State Council of the People's Republic of China, 2019).

The Vocational Education Law, revised in 2022, specifies that higher vocational school education is provided by higher vocational institutions and general higher education institutions at the short-cycle tertiary, bachelor's, and higher levels, providing a legal basis for its development (NPCSC, 2022). Reforms in vocational undergraduate education, differentiated admissions, and integrated progression programs are gradually broadening students' pathways. Enterprises engaged in industry–education integration, practical training platforms, and cooperative projects also receive policy support. The possibilities established in law require implementation through specific arrangements for admissions, curricula, and degrees, while articulation across levels remains under development. Current reforms therefore emphasize improving the quality and responsiveness of education and training alongside expanding progression opportunities.

2.2 The Development of Vocational Education in Germany

The emergence of vocational education in Germany is linked to the history of craft guilds and apprenticeship. Guilds participated in regulating entry to occupations, training, and examinations, providing a historical foundation for subsequent industry participation (Gessler, 2017). Huang (2008) examines the conditions underpinning German vocational education in terms of attitudes toward craftsmanship, a practical orientation, and traditions of vocational training. The emergence of the modern dual system was also shaped by industrialization, the development of public education, national legislation, and negotiations between employers and workers; it cannot be attributed to cultural traditions alone (Federal Institute for Vocational Education and Training [BIBB], 2025; Gessler, 2017).

Industrialization in the nineteenth century created new demands for workers' technical knowledge and occupational competence. Vocational continuation schools and, subsequently, vocational schools developed, and the combination of school education and company-based training became increasingly institutionalized. The dual system emerged through this extended process, with continuing adjustments

to curricula, training regulations, and organizational arrangements. Its development reflected the integration of traditional apprenticeship with modern public education (Gessler, 2017).

The enactment of Germany's Vocational Training Act (Berufsbildungsgesetz, BBiG) in 1969 marked an important stage in the development of the modern vocational training system (BIBB, 2025). Under the current framework, relevant vocational training legislation regulates company-based training, training contracts, examinations, and the responsibilities of competent bodies. Vocational school education is governed primarily by the school legislation and educational administration of the federal states (Länder), while training in the skilled crafts is also subject to the Crafts and Trades Regulation Code (Handwerksordnung, HwO). Companies and vocational schools have their respective training and educational responsibilities, linked through coordination among the federal government, the Länder, and other stakeholders (BIBB, 2024d; Federal Republic of Germany, 2025).

In response to digitalization and changes in industrial technology, Germany adapts vocational education through revisions to training regulations, updates to school curricula, and continuing vocational training (BIBB, 2025). Pathways also exist between vocational training and higher education, with entry requirements varying by qualification type and Land regulations (Standing Conference of the Ministers of Education and Cultural Affairs of the Länder in the Federal Republic of Germany [KMK], 2009). Updating training standards requires coordination among stakeholders, while implementation depends on company equipment, training personnel, and school resources. Effective links between institutional adjustment and teaching practice are therefore important to the capacity of vocational education to respond to technological change.

2.3 Key Features of Vocational Education in China and Germany

2.3.1 Key Features of Vocational Education in China

The key features of vocational education in China are **government coordination, school-based provision, industry–education collaboration, and development as a distinct type of education**. First, government plays an important role in development planning, educational standards, public funding, and the protection of equitable access. Public vocational institutions are major providers, while participation by nongovernmental actors is also encouraged. Second, vocational schools provide systematic education that combines general foundational learning, occupational studies, internships, and practical training, with enterprises participating in various ways. Third, articulation between secondary vocational education, short-cycle higher vocational education, and vocational undergraduate education is being strengthened, alongside links between general and vocational education. Fourth, industry–education integration and school–enterprise cooperation respond to regional industry needs. Fifth, provision accommodates employment, progression to further education, and continuing development, offering students diverse pathways (NPCSC, 2022; State Council of the People's Republic of China, 2019). Implementation varies across regions, institutions, and fields of study.

2.3.2 Key Features of Vocational Education in Germany

Vocational education in Germany encompasses the dual system, full-time vocational schooling, and continuing vocational training. A defining feature of the dual system is that **companies and vocational schools share responsibility for education and training**. Trainees generally hold the dual status of apprentice and student. Company-based training is regulated by the federal vocational training framework, whereas school education is primarily the responsibility of the Länder. Statutory competent bodies, including chambers of industry and commerce and chambers of skilled crafts, oversee training, registration, and examinations, with employer and worker representatives participating in coordination. Vocational qualifications provide institutional support for employment and career development, although their practical value also depends on the occupation, industry demand, and individual circumstances (BIBB, 2024d, 2026a; Federal Republic of Germany, 2025).

2.3.3 Similarities and Differences in Vocational Education Development

In both countries, vocational education aims to develop skilled workers for industry, support employment, and contribute to the real economy. Both uphold the integration of theory and practice and are pursuing reforms to deepen industry–education integration, develop lifelong VET systems, and respond to emerging industries.

Chinese vocational school education relies more heavily on schools to organize systematic education, whereas Germany's dual system places greater emphasis on the division of responsibilities and cooperation between company-based training and school education. Governments, schools, enterprises, and industry organizations participate in both countries, but their authority, responsibilities, and forms of participation differ. Both systems have legal and policy foundations; the differences concern their scope, specific rules, and implementation. Social perceptions of vocational education also vary across regions, industries, and groups and need to be considered in relation to employment conditions and development opportunities. Specific arrangements for cost sharing, teacher development, and qualification certification provide further dimensions for understanding these differences (Federal Republic of Germany, 2025; NPCSC, 2022).

3. A Comparative Analysis of Vocational Education Models in China and Germany

3.1 Education Systems

3.1.1 Program Structure and Duration

Secondary vocational schools in China primarily admit graduates of lower secondary education, with a standard duration of three years. Short-cycle higher vocational programs commonly last three years, while vocational undergraduate programs normally last four; specific arrangements vary by field of study and admission category. Five-year integrated programs generally provide a continuous route into higher vocational education for lower secondary school graduates. Localities also offer pathways linking secondary and short-cycle higher vocational education, secondary vocational and undergraduate education, and short-cycle tertiary and undergraduate education. Institutions organize provision within

national teaching standards and relevant policy frameworks, incorporating general foundational courses, occupational studies, internships, and practical training into the program structure and curriculum.

Dual initial VET in Germany generally lasts between two and three and a half years, as specified in the training regulations for the occupation concerned. Trainees who meet the relevant conditions may apply to shorten or extend this period. Training normally alternates between a company and a vocational school, although school instruction may also be delivered in blocks. After completing training and passing the examination, learners may enter employment, undertake continuing vocational training, or enter higher education if they meet the eligibility requirements. Program duration thus combines common occupational training requirements with legally permitted individual adjustments, linking occupational standards, prior learning, and the organization of training (BIBB, 2026a; Federal Republic of Germany, 2025; KMK, 2009).

3.1.2 Articulation between Educational Levels

China continues to strengthen articulation between secondary vocational education, short-cycle higher vocational education, and vocational undergraduate education. Differentiated entrance examinations, integrated progression programs, and pathways from short-cycle tertiary to undergraduate education are broadening opportunities for further study. Eligible graduates may progress to higher levels under national admissions regulations, with distinct eligibility and assessment requirements for different levels and types of education. Articulation involves not only admissions pathways but also program design, curricula, and the recognition of learning outcomes. National rules and local implementation plans jointly regulate these arrangements, resulting in multiple concurrent pathways administered at different levels (NPCSC, 2022; State Council of the People's Republic of China, 2019).

Progression pathways in Germany include advancement within the vocational qualification system and entry to higher education. After completing initial VET, learners who meet the relevant conditions may undertake advanced training for qualifications such as master craftsperson (Meister) or technician (Techniker). Certain advanced vocational qualifications confer eligibility for higher education, while other vocational qualification holders may need to satisfy requirements relating to work experience, subject relevance, or entrance assessment, as specified by the Länder. Admission also remains subject to the requirements of the program and institution concerned. These pathways broaden VET graduates' options and depend on arrangements for qualification recognition, curriculum articulation, and learning support (BIBB, 2025; Federal Republic of Germany, 2025; KMK, 2009).

3.1.3 Educational Credentials and Vocational Certification

China's vocational education system awards educational credentials, relevant occupational qualifications, and vocational skill-level certificates, while exploring the recognition and transfer of learning outcomes (NPCSC, 2022). Within this framework, the pilot 1+X certificate system extends vocational skills assessment alongside formal education (State Council of the People's Republic of China, 2019). Educational credentials primarily certify the completion of education at a given level; occupational qualifications and vocational skill-level certificates assess occupational requirements or

skill levels under their respective frameworks. The functions, awarding bodies, and levels of these certificates differ. Formal education and occupational assessment therefore form related but distinct institutional arrangements.

Final examinations in Germany's dual system are generally organized by statutory competent bodies, such as chambers of industry and commerce and chambers of skilled crafts. They assess occupational competence in accordance with the relevant training regulations, and successful candidates receive a vocational qualification. Continuing vocational training offers additional qualifications, including master craftsperson (Meister) and certified specialist (Fachwirt), each with its own eligibility and assessment requirements. Initial and advanced training thus provide different routes for vocational qualification development. Vocational qualifications are important for recruitment and career progression, although educational attainment, work experience, and demonstrated competence also influence hiring decisions. Common standards and examinations involving multiple stakeholders are important elements of quality assurance (BIBB, 2026a; Federal Republic of Germany, 2025).

3.2 Education and Training Models

3.2.1 China's Predominantly School-Based Model

Vocational schools are central providers of systematic vocational education in China. They develop training plans, curricula, and assessments on the basis of national program teaching standards, while industry and enterprises participate through joint program development, employer-commissioned training, apprenticeships, internships, and practical training. Schools are responsible for general foundational education, occupational studies, and students' all-round development; workplace practice gives students access to work processes. Institutional rules and cooperation agreements define the responsibilities of schools and enterprises. Cooperation extends beyond internships and employment to curricula, teaching personnel, and assessment. Provision is therefore organized primarily by vocational schools, with industry and enterprises participating in multiple ways (NPCSC, 2022; State Council of the People's Republic of China, 2019).

3.2.2 Germany's Dual Training Model

In Germany's dual system, companies and vocational schools share responsibility for education and training. Companies organize learning within work processes under training contracts and occupational training regulations and pay training allowances. Vocational schools provide occupational theory, general education, and the development of related occupational competences, retaining a relatively autonomous educational mandate. Company-based training follows the competence requirements of the relevant occupation, with learning tasks adapted to specific production conditions. This arrangement connects occupational knowledge with work experience, but training quality depends on content, company conditions, and the extent of school–enterprise coordination. Subsequent employment also depends on individual performance, company recruitment plans, and labor market conditions (BIBB, 2026a; Federal Republic of Germany, 2025).

3.2.3 The Balance between Theoretical and Practical Learning

Chinese policy stipulates that, in principle, practical learning should account for at least half of total teaching hours in vocational institutions (State Council of the People's Republic of China, 2019). Specific proportions and delivery arrangements are determined by the requirements of different educational levels and programs. Practical learning includes laboratory work, on-campus practical training, project-based learning, and workplace internships, encompassing both school-organized skills training and activities linked to workplace tasks. The proportion of teaching hours describes curriculum allocation, whereas task content, supervision, and assessment shape the actual learning process. Policy requirements and teaching practice therefore represent different levels of analysis.

Germany's dual system generally allocates three to four days per week to company-based training and one to two days to vocational school, although alternatives such as block-release instruction also exist (BIBB, 2026b). This allocation concerns time spent at the two learning venues: company-based training includes knowledge acquisition, and school curricula also include practical activities. Theory and practice are integrated across both venues through links between curricular content and workplace tasks. Comparisons of teaching arrangements in China and Germany must therefore distinguish learning venues from learning content and use consistent definitions when examining the share of practical activities and their relationship to theoretical learning.

3.2.4 Developing Students' Occupational Competence

Vocational education in China develops students' occupational competences, professional attributes, and capacity for continuing learning through classroom learning, internships, practical training, project-based teaching, skills competitions, and social practice. Different educational levels and fields of study place varying emphases on foundational knowledge, specialized skills, and the ability to apply technology, while employment and further study provide alternative pathways. Current educational objectives encompass job-related skills as well as scientific and general knowledge, professional ethics, and career development capabilities. General foundational education and occupational instruction together constitute the curriculum, reflecting an orientation that combines preparation for work with students' all-round development (NPCSC, 2022; State Council of the People's Republic of China, 2019).

Germany's dual system seeks to develop the occupational competence required in a recognized occupation, emphasizing the integrated application of knowledge, skills, and judgment in work situations. Training addresses specific job tasks as well as the ability to plan, carry out, and check work independently, supporting continuing development within the occupational field. Company-based training provides a context for understanding production processes and occupational norms, while vocational schools broaden knowledge through occupational and general education. Competence development rests jointly on occupational standards, training tasks, and school curricula. Outcomes depend on the quality of implementation at each stage and on learners' individual circumstances (BIBB, 2025, 2026a; Federal Republic of Germany, 2025).

3.3 Mechanisms of School–Enterprise Cooperation

3.3.1 The Current State of Industry–Education Integration in China

China advances vocational education reform through industry–education integration and school–enterprise cooperation, including employer-commissioned training, modern apprenticeships, jointly developed programs, and shared practical training bases. The Implementation Plan for Actions to Strengthen Industry–Education Integration in Vocational Education (2023–2025) incorporates the development of participating enterprises, improvements to practical training facilities, and policy support into targeted actions (National Development and Reform Commission et al., 2023). At the same time, Shi and Hao (2026) identify continuing weaknesses in administrative coordination and the depth of industry and enterprise participation. This finding concerns the mechanisms through which cooperation operates; it does not imply that cooperation is identical across all regions, schools, and enterprises.

3.3.2 Mechanisms of Enterprise Participation in Germany

German companies generally decide for themselves whether to offer apprenticeship places. Once they participate, they must meet requirements concerning the suitability of training premises and personnel and fulfill contractual and statutory obligations to provide training, pay allowances, and support learning (Federal Republic of Germany, 2025). The system thus combines voluntary participation with binding responsibilities once a company becomes a training provider. Participation is related to workforce planning and companies' economic circumstances; retaining apprentices may also reduce recruitment and induction costs (BIBB, 2024a, 2024c). The training content that a company can provide depends on its personnel and facilities. Chamber advisory services, inter-company training, and collaborative training arrangements help cover content that individual companies cannot provide, and eligible activities may also receive public funding (BIBB, 2024c).

3.3.3 The Role of Enterprises in Curriculum Design

Vocational institutions in China develop their training plans within the framework of national program teaching standards. The Vocational Education Law identifies the development of training plans, curriculum design, textbook development, and teaching as areas of school–enterprise cooperation and provides for enterprise participation in apprenticeships (NPCSC, 2022). Within this division of responsibilities, schools organize systematic teaching, while enterprises contribute industry and workplace resources. Cooperation agreements specify the rights, obligations, and resource contributions of both parties (NPCSC, 2022). These provisions establish a basis for enterprise participation in curriculum development, although its specific forms and extent depend on the cooperation arrangements.

Company-based training in Germany follows training regulations for state-recognized occupations. The relevant standards are developed with the participation of government, employer organizations, trade unions, and specialist bodies. The Länder's education authorities jointly develop framework curricula for vocational schools and coordinate them with the training regulations (BIBB, 2024d, 2025).

Companies draw up their training plans accordingly, while schools organize instruction within the framework curricula. Communication and cooperation help align content across the two venues. This arrangement accommodates both common occupational standards and specific training conditions. Responding to technological change also requires the revision of standards, the development of teaching personnel, and the updating of learning resources; coordination among these processes is an important part of the system's operation.

3.3.4 Enterprise Participation in Learner Assessment

Vocational schools in China are responsible for academic assessment and ensuring that graduation requirements are met. Enterprises may participate in internship assessment, project assessment, and assessments jointly designed with schools, with the scope of participation varying by cooperation model (NPCSC, 2022; State Council of the People's Republic of China, 2019). In Germany, companies and vocational schools assess their respective learning processes, while final examinations for dual vocational training are organized by statutory competent bodies. Examination boards generally include representatives of employers, workers, and vocational school teachers, reflecting participation by multiple stakeholders (Federal Republic of Germany, 2025). The principal differences between the two countries concern the allocation of assessment responsibilities and the organization of assessment.

3.4 Teacher and Trainer Development

3.4.1 Developing China's Dual-Qualified Teaching Workforce

Vocational education in China emphasizes the development of "dual-qualified" teachers, whose defining attribute is competence in both theoretical and practical teaching. The government supports teacher development through recognition standards, workplace practice, teacher training, and personnel exchanges between schools and enterprises, while encouraging technical and skilled industry personnel to participate in teaching (General Office of the Ministry of Education, 2022; Ministry of Education & Ministry of Finance, 2021; Ministry of Education et al., 2016; NPCSC, 2022). According to the Ministry of Education's statistics for 2024, dual-qualified full-time teachers accounted for 57.20% of full-time teachers of occupational (skills-related) courses in secondary vocational education. These statistics exclude skilled workers' schools administered by human resources and social security authorities (Ministry of Education, 2025). The current recognition system combines national basic standards with local implementation rules, differentiates recognition levels according to competence requirements, and provides for reassessment at intervals of no more than five years. Teaching competence, occupational skills, and industry work or practical experience jointly form the basis for recognition (General Office of the Ministry of Education, 2022).

3.4.2 Qualification Requirements for Vocational Teachers and Trainers in Germany

Germany's vocational teaching and training workforce consists primarily of vocational school teachers and in-company trainers, whose qualification requirements and preparation pathways differ. Vocational school teachers generally complete higher education and professional teacher preparation, with appointment and practical experience requirements determined by the Länder. Teachers of practical

subjects may also enter through relevant vocational qualifications and pedagogical training. In-company trainers must meet personal and professional suitability requirements, and their vocational pedagogical competence is generally assessed under the Ordinance on Trainer Aptitude. Different entry pathways correspond to different responsibilities, with quality assurance provided through school teacher management and the supervision of company-based training (BIBB, 2024e; Federal Republic of Germany, 2025).

3.4.3 Requirements for Workplace Experience

China's Regulations on Workplace Practice for Vocational School Teachers require teachers of occupational subjects, including practical training instructors, to undertake at least six months of practice in enterprises or frontline production and service settings over each five-year period, according to the characteristics of their field. Newly appointed teachers without industry work experience must undertake workplace practice before taking up their teaching duties (Ministry of Education et al., 2016). The specified forms include enterprise visits, skills training, part-time or temporary positions, and participation in product development and technological innovation. Enterprises are required to provide placements and guidance, while schools are responsible for planning, organization, and assessment. The regulations address both duration and content and require the conversion of workplace learning into teaching resources (Ministry of Education et al., 2016).

Practical experience requirements for vocational school teachers and in-company trainers in Germany vary with Land regulations, teacher categories, and occupational fields. Trainers' professional suitability is generally established through relevant vocational or academic qualifications, appropriate occupational experience, and training competence, with experience requirements varying by qualification pathway. The appointment and professional practice requirements of vocational school teachers are primarily governed by the Länder's education systems. The two groups focus respectively on school teaching and company-based training. Their practical experience must be translated into educational competence through instructional design and learning support and continually updated as occupational fields change (BIBB, 2024e; Federal Republic of Germany, 2025; Huismann & Hippach-Schneider, 2022).

3.4.4 Professional Development Systems

Professional development for vocational teachers in China is organized through a division of responsibilities among national authorities, local authorities, and schools. In the Plan to Improve the Quality of Vocational Teachers (2021–2025), the Ministry of Education and the Ministry of Finance set out a four-tier system: national demonstration and guidance, coordinated provincial implementation, joint municipal and county support, and school-based professional learning tailored to institutional needs. Projects address pedagogy, subject knowledge, technical skills, and technology-enhanced teaching. The plan provides for intensive workshops, online training, job shadowing or workplace placements, and practice after returning to teaching. School–enterprise exchange projects include teachers' workplace practice and the appointment of industry mentors, supported by process

management, quality monitoring, and project evaluation (Ministry of Education & Ministry of Finance, 2021). The design of these projects indicates a system differentiated by administrative level and teacher category, with multiple forms of professional learning. Policy arrangements and the actual outcomes of local projects nevertheless constitute different kinds of evidence.

A Germany country report published in 2022, based on information from 2021, states that the Länder are responsible for the continuing professional development of vocational school teachers. Schools draw up training plans according to their needs, with local bodies, universities, and other institutions involved in provision. In-company trainers can undertake professional development through employers, chambers, and other education providers. The report also notes that joint professional learning between school teachers and company trainers is affected by their different administrative systems and other factors, and that some forms of cooperation remain limited (Huismann & Hippach-Schneider, 2022). Both groups therefore have access to continuing professional development, but its organization and the extent of collaboration differ.

3.5 Funding and Policy Support

3.5.1 Public Funding Arrangements

Public finance is an important source of support for vocational education in China, alongside legally encouraged participation by enterprises and other nongovernmental actors. Central and local fiscal arrangements support institutional operations, practical training facilities, and teacher development, taking account of enrollment scale, training costs, and regional conditions (NPCSC, 2022; State Council of the People's Republic of China, 2019). A performance self-assessment report published by the Ministry of Education records a 75.31% compliance rate with standards for vocational school operating conditions in 2024, based on aggregated regional self-assessments. This represented an improvement over the previous year, although full compliance had not yet been achieved (Department of Finance, Ministry of Education, 2026). In Germany's dual system, vocational schools are financed mainly by Land and local public budgets, while companies bear the main costs of their own training. The federal government, Länder, and relevant public bodies also use targeted programs to support inter-company training, training for particular groups, and system development. Both countries combine public and enterprise contributions; their differences concern the allocation of funding responsibilities, expenditure patterns, and forms of support (BIBB, 2024b).

3.5.2 Costs Borne by Enterprises

Enterprise contributions to vocational education in China include establishing or jointly establishing schools, developing shared practical training bases, supplying equipment and technical personnel, and providing apprenticeships and internship supervision. Contributions therefore extend beyond direct financial expenditure to personnel, technology, and premises (NPCSC, 2022). Industry–education integration policies link incentives to enterprise participation and provide support for practical training bases, the development of participating enterprises, and cooperative projects (National Development and Reform Commission et al., 2023). Institutionally, public funding underpins vocational school

provision, while school–enterprise cooperation brings in enterprise resources. Cost sharing varies with the form of cooperation and is determined by the relevant institutional arrangements and agreements.

German companies participating in the dual system pay training allowances and bear the costs of company-based training (BIBB, 2024b). The cost–benefit survey for the 2017/18 training year published by the Federal Institute for Vocational Education and Training (BIBB) shows that apprentices' productive work offsets part of the expenditure. Net costs vary by occupation, training duration, company size, and region. Retaining apprentices after training may also reduce recruitment, selection, and induction costs (BIBB, 2024a). Public funding provides some support for eligible inter-company and collaborative training (BIBB, 2024c). Enterprise investment thus serves both skills development and future workforce needs, with costs and benefits varying according to the specific training conditions.

3.5.3 Legal and Regulatory Frameworks

China's vocational education is underpinned by the Vocational Education Law and supporting rules on industry–education integration, teacher development, student internships, and quality assessment. The law defines the responsibilities of government, schools, enterprises, and industry organizations in areas including enterprise participation in provision, teachers' workplace practice, student rights, and funding (NPCSC, 2022). Education, human resources and social security, and other relevant authorities implement these arrangements within their respective remits, while local authorities organize implementation within the national framework. The resulting structure combines legislation, departmental policies, and local implementation and depends on coordination across departments and stakeholders.

Germany's legal framework includes the Vocational Training Act, the Crafts and Trades Regulation Code, and the school legislation of the Länder, with company-based training and vocational school education governed by their respective frameworks. Training contracts, the suitability of personnel and premises, examination procedures, and the responsibilities of competent bodies are subject to relatively clearly defined rules, providing a basis for stable expectations among participants (Federal Republic of Germany, 2025). The division of powers between the federal government and the Länder, together with coordination of the responsibilities of companies, schools, and competent bodies, underpins the system's operation. Updating standards and monitoring implementation help these rules respond to changes in occupational fields.

4. Conclusions

The comparison shows that vocational education in China and Germany has developed different allocations of responsibilities and forms of provision within their respective industrial structures, education systems, and historical contexts. Under government coordination, Chinese vocational schools organize systematic education and cooperation among multiple stakeholders. Germany's dual system distributes responsibilities among companies, vocational schools, and relevant competent bodies. Both

countries emphasize practical learning, occupational competence, and legal safeguards. Their differences lie primarily in enterprise participation, curriculum organization, qualification assessment, and cost sharing. These differences do not in themselves establish a quality gap; their effects must be assessed in relation to specific regions, occupations, and student groups. As an institutional and literature-based comparison, this study cannot establish causal conclusions about the overall quality of education and training in either country.

4.1 Lessons from German Vocational Education

The principal insights offered by Germany's dual system concern the use of training contracts and occupational standards to clarify responsibilities; the connection between workplace learning and systematic education through cooperation between companies and schools; examinations organized by statutory competent bodies with multiple stakeholder participation; distinct professional development requirements for school teachers and in-company trainers; and the sharing of costs through public and enterprise funding. These arrangements depend on companies' training capacity, industry coordination, and public educational resources. Their outcomes are also influenced by the availability of training places and regional economic conditions. The applicability of these experiences is therefore closely related to industrial structure, institutional resources, and supporting arrangements.

4.2 Directions for Vocational Education Development in China

The development of vocational education in China centers on strengthening a modern vocational education system, deepening industry–education integration, and improving the quality of education and training, supported by an established legal and policy framework (National Development and Reform Commission et al., 2023; NPCSC, 2022; State Council of the People's Republic of China, 2019). The comparison suggests that the sustained operation of school–enterprise cooperation, the translation of teachers' workplace experience into teaching, and coordination across educational levels merit attention in subsequent reforms. Specific approaches depend on regional industrial conditions and institutional resources.

4.3 The Importance of a Vocational Education Path Suited to China's Conditions

Germany's dual system emerged within a particular historical, industrial, and governance context; its operational experience is inseparable from the conditions under which it applies. Vocational education in China is founded on the leadership of the Communist Party of China, the fundamental task of fostering virtue through education, and the joint development of moral character and technical skills. Under government coordination, it provides vocational school education at multiple levels and connects industry needs with students' development through industry–education integration and school–enterprise cooperation (NPCSC, 2022). Both systems have their own organizational foundations and development priorities. International comparison is valuable for explaining these differences and the conditions that produced them, thereby providing a reference for understanding domestic reform. The institutional and literature-based analysis presented here does not replace empirical evaluation of particular schools, programs, or students' development.

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