

Development Models, Key Characteristics, and Implications of High-Level Modern Apprenticeship Systems: A Case Study of Britain, Germany, and the United States

Aoying Wei

Faculty of Education, East China Normal University, Shanghai 200062, China

Abstract: With the upgrading of modern industrial structures and the advent of the digital age, higher education in vocational training at the undergraduate level plays a crucial role in adapting to the demands of economic transformation, cultivating high-level technical skills talents, and enhancing the appeal of vocational education. The high-level modern apprenticeship systems in countries such as the UK, Germany, and the US exhibit distinct features in areas such as top-level design coordination, operational mechanism collaboration, standard system construction, and quality assurance supervision. Drawing on their advanced experiences is beneficial for filling the gaps in policies, improving operational efficiency, responding to the demands of the era, and addressing questions of quality in China's undergraduate-level vocational education modern apprenticeship system.

Keywords: High-level Modern Apprenticeship System; Undergraduate Vocational Education; Vocational Education; Development Models.

1. Introduction

With the advancement of industrial infrastructure and modernization of the industrial chain, the demand for high-level technical skills in the labor market is becoming increasingly urgent. Deepening industry-education integration and school-enterprise cooperation, while enhancing the adaptability and attractiveness of vocational education, is especially important for the high-quality development of undergraduate vocational education (Chen and Pastore, 2024; Guan and Blair, 2024). In China, numerous documents related to the establishment of high-level apprenticeship systems have been released. The "Overall Plan for Deepening the Reform of Education Evaluation in the New Era," issued by the Central Committee of the Communist Party of China and the State Council in 2020, emphasized the exploration of "a high-level apprenticeship system with Chinese characteristics." The "Measures for the Management of Undergraduate Vocational Education Program Settings (Trial)," issued by the Ministry of Education in 2021, proposed that "undergraduate vocational education should actively explore modern apprenticeship training models," providing policy support for the implementation of high-level modern apprenticeship systems in China.

Currently, many countries have explored high-level modern apprenticeship systems. Notable examples include the UK's degree apprenticeship system, which deeply integrates higher education and vocational training; Germany's dual system, which alternates between school education and enterprise practice; and the U.S. registered apprenticeship system, which expands in key fields such as STEM. Analyzing the experiences of the UK, Germany, and the U.S., and examining their main features, provides valuable insights for China in expanding the modern apprenticeship system to include undergraduate and higher-level vocational education.

2. Development Models of High-Level Modern Apprenticeships Internationally

2.1. Britain's Degree Apprenticeship System: A Deep Integration of Higher Education and Vocational Training

The UK has a long history of apprenticeship, transitioning from traditional apprenticeships to modern apprenticeships in 1993, and in 2006, it incorporated higher apprenticeships into the modern apprenticeship system. Due to industrial structure upgrades and the impact of Brexit, the UK has faced a shortage of high-level technical skilled workers. In 2015, the UK introduced the degree apprenticeship system, which primarily focuses on four areas: digitalization, automation engineering, banking, and construction. In 2017, the degree apprenticeship system was officially incorporated into the apprenticeship framework. The UK's degree apprenticeship system is employer-led, with employers collaborating with universities and professional bodies to develop the program. It combines paid work with part-time study, allowing students to earn a degree without having to pay tuition fees (Chankseliani et al., 2016).

During the apprenticeship period, 20% of the time must be spent studying at a university or other educational institution, while 80% is spent on training at the company, with a minimum of 30 working hours per week. The training can alternate on a weekly or monthly basis, or be arranged in a separate block of time. The apprenticeship typically lasts between 3 to 6 years. Upon completing the apprenticeship and passing a third-party assessment, apprentices can earn bachelor's and master's degrees of equal value to those awarded to full-time graduates (Aldous and Brown, 2021).

2.2. Germany's "Dual University" System: Alternating School Education and Enterprise Practice

The modern apprenticeship system in Germany dates back to the 1920s, and its high-level modern apprenticeship model is primarily represented by the "Dual University" system (Duale Hochschule). Due to economic and social development and the transformation of industrial structures, there has been an increasing demand for higher technical skills among workers. To address the mismatch between the supply of and demand for high-level technical skills, Germany's new undergraduate vocational institutions—the "Dual Universities"—were established, facilitating the transfer of the dual education system into higher education (Cai et al., 2019). Currently, the "Dual University" model is widely recognized, with more than 60 similar institutions, primarily concentrated in universities of applied sciences, dual academies, vocational colleges, and a few comprehensive universities.

The core feature of Germany's "Dual University" system is its emphasis on practical experience. Under this model, the government and companies jointly provide policy and financial support for vocational education and training. Vocational schools and companies cooperate closely, and students hold the status of apprentices. The apprenticeship process follows these steps: companies announce job openings, conduct interviews, and sign a national standard apprenticeship contract with the apprentices. Students must apply to companies, and only those deemed suitable by the company are accepted. After being admitted, apprentices receive practical skills training in the company while simultaneously studying the foundational theoretical knowledge supporting their vocational skills at the school. The two forms of education are interlinked and alternate, with 60% of the time spent in the company and 40% at school each week (Arribas, 2016). Apprentices not only learn specialized theoretical knowledge but also participate in real production processes within companies, gaining practical work experience and developing the methods, abilities, and social skills needed for their careers. Upon completing the program, apprentices receive internationally recognized bachelor's and master's degrees, as well as relevant qualifications.

2.3. The Registered Apprenticeship System in United States: Expanding Key Fields (STEM)

The United States passed the National Apprenticeship Act in 1937. Since the 21st century, the U.S. apprenticeship system has entered a phase of reform and development (Schrank, 2020). In 2014, the Registered Apprenticeship College Consortium (RACC) was established to strengthen the connection between industries, enterprises, and schools, and to expand apprenticeship pathways to higher education. In 2017, the U.S. introduced the "Expansion of Apprenticeships" plan to develop apprenticeships in the smart manufacturing industry and other sectors with urgent workforce needs. In 2019, the U.S. Department of Labor (DOL) launched the Industry-Recognized Apprenticeship Program. In the 2021 revision of the National Apprenticeship Act, the U.S. government proposed an investment of \$3.5 billion over five years to expand registered apprenticeships, youth apprenticeships, and other programs, aiming to create

collaborative partnerships between businesses, community colleges, and higher education institutions.

The U.S. registered apprenticeship system combines on-the-job training at companies with theoretical education at community colleges, allowing apprentices to acquire both the practical skills and theoretical knowledge required for high-skill vocational positions. Employers, industry unions, and educational institutions can initiate registered apprenticeship programs through a registration process. These programs are typically jointly initiated and registered with state apprenticeship agencies (SAAs) or the U.S. Department of Labor (DOL) apprenticeship management office (OA). Apprentices and employers sign apprenticeship agreements, and employers, community colleges, and educational institutions jointly train the apprentices. Through initiatives like the Registered Apprenticeship College Consortium (RACC) and the Expansion of Apprenticeship Programs (ECCA), apprentices can also apply to community colleges to pursue associate degrees and bachelor's degrees. Upon meeting the required credits and earning an associate degree, they can choose to apply for admission to applied universities or academic universities to continue their studies and earn higher-level degrees.

3. Key Characteristics of High-Level Modern Apprenticeship Systems Internationally

3.1. Establishing a Coordinated Management and Well-Structured Top-Level Design

Although the development models of high-level modern apprenticeship systems in countries such as the UK, Germany, and the U.S. differ, their core characteristic is "institutionalization." These systems integrate various ecosystems of education, society, public welfare, and the economy through laws and regulations. Different laws and regulations complement each other, guiding the achievement of vocational education goals through regulation, standardization, and cultural recognition (Kong and Jiang, 2020).

In the UK, the higher education legal framework provides a stable legal basis for apprenticeships, ensuring the system's place within the education structure. The UK government has introduced a range of policy measures, such as tax incentives for apprenticeships and training subsidies, to promote the participation of businesses and individuals in apprenticeship programs.

In Germany, the government collaborates with industry organizations, unions, and other stakeholders to establish a comprehensive apprenticeship training system, ensuring that apprentices receive extensive technical training and practical experience within companies.

In the U.S., the government encourages businesses and industry organizations to initiate apprenticeship training programs independently, offering scholarships and subsidies to incentivize apprenticeship development. Meanwhile, the U.S. apprenticeship system focuses on market demand and industry development, allowing apprentices to choose different training programs and fields based on personal interests and career goals. This flexibility helps apprentices better adapt to the constantly changing economic environment and job market (Li and Pilz, 2023).

3.2. Building a Multi-Stakeholder Cooperation and Collaborative Governance Mechanism

To ensure the effective operation of high-level modern apprenticeship systems, governments, industries, businesses, and educational institutions each play distinct roles in creating a multi-stakeholder platform for mutual interests.

Firstly, at the government level, there is a guiding role in high-level modern apprenticeships. From a macro perspective, the government oversees the management of modern apprenticeships; from a meso perspective, it establishes management and service agencies at both the national and local levels and sets up quality assurance mechanisms; and from a micro perspective, it incorporates the apprenticeship training system into the national qualifications framework and links it with the national vocational framework.

Secondly, industry associations and businesses play a leading role in high-level modern apprenticeship systems. They are responsible for the formulation and development of apprenticeship programs, collaborating with government management agencies and educational institutions to create apprenticeship standards and vocational standards. Furthermore, they serve as the main implementers of modern apprenticeship systems, jointly with the government providing educational investments for apprenticeships. Industry associations oversee and assess businesses and apprentices, while companies provide practical skill training, as well as wages and allowances, to apprentices.

Finally, educational institutions, particularly universities, are important participants in high-level modern apprenticeships. Schools and businesses collaborate to train talent, integrating academic plans, curricula, and faculty management with industry needs. They offer bachelor's and master's degrees to apprentices who meet the assessment standards.

3.3. Creating a Systematic and Socially Recognized Standardization System

The implementation of high-level modern apprenticeships is reflected in the construction of standards. The UK, Germany, and the U.S. have all developed standardized series of systems, including apprenticeship training institution registration standards, third-party final evaluation standards, apprenticeship entry standards, and teacher qualification standards, among others.

In the UK, the development of degree apprenticeship standards is employer-led, with input from the Apprenticeships and Technical Education Agency, the Office of Qualifications and Examinations Regulation (Ofqual), and End-Point Assessment Organizations (EPAOs), helping employers establish apprenticeship standards. The apprenticeship occupation standards include definitions of the occupation, typical job descriptions, job responsibilities, knowledge, skills, and behaviors (KSB), entry qualifications (English and math levels), legal and professional recognition, job levels, duration, and review dates.

Germany's vocational training regulations are jointly developed at the national level by educational institutions and industry businesses. A vocational standard-setting committee is formed by vocational education research institutes, industry enterprises, and schools, and the standards are adjusted as needed. The Federal Institute for Vocational Education and Training leads the development of the "Vocational Education Regulations," which set out the names of educational

professions, occupation specifications, framework plans, training duration, and exam requirements. Industry and commerce associations develop vocational training standards through the "Enterprise Vocational Training Regulations," and each state's Department of Education and Culture establishes teaching standards for vocational schools through "School Framework Curricula" (Wang et al., 2020).

3.4. Providing Multi-dimensional Supervision and Triple-party Evaluation for Quality Assurance

The implementation of high-level modern apprenticeships in the UK, Germany, and the U.S. is based on multi-dimensional cooperation, ensuring the quality of apprenticeship training through the establishment of quality assurance agencies, the introduction of third-party evaluation institutions, and the creation of monitoring and evaluation systems.

The UK government has established a systematic quality monitoring and evaluation system. It has set up a National Qualifications Framework to ensure the quality of apprenticeship training. A Quality Alliance was formed, including institutes, the Education and Skills Funding Agency, the Office of Qualifications and Examinations Regulation (Ofqual), the Quality Assurance Agency for Higher Education, and the Students' Office, each responsible for overseeing aspects such as pre-apprenticeship preparation, apprenticeship duration, and post-apprenticeship employment and practice.

Germany implements a combination of external and self-assessment in its quality monitoring and evaluation system. Third-party institutions, comprising the government, vocational colleges, employers, professionals, and even the general public, work together, with a team of apprenticeship experts conducting external evaluations of institutions. The federal and state governments of Germany appoint educational experts, educational administrators, and business representatives to jointly establish educational quality assessment agencies that evaluate the apprenticeship quality assessment system.

The U.S. also establishes third-party organizations to evaluate Registered Apprenticeship and College Consortium (RACC) member programs. Third-party evaluation organizations include the American Council on Education (ACE), the National College Credit Recommendation Service, and certain higher education centers, ensuring that apprenticeship completion certificates carry university credit values. Furthermore, all participating colleges in the consortium must be accredited by regionally recognized accrediting agencies approved by the U.S. Department of Education.

4. Implications for the Modern Apprenticeship System at the Undergraduate Level in China

4.1. Accelerating the Establishment of a More Comprehensive Legal System to Fill Policy Gaps

A complete legal system is the fundamental guarantee for the implementation of high-level modern apprenticeships. The UK, Germany, and the US, which have developed high-level modern apprenticeship systems, have all established

comprehensive laws and regulations. Through government legislation, they have coordinated the apprenticeship system at a macro level and clearly defined its organization, division of responsibilities, financial taxation, and rights protection, providing a solid legal foundation and policy environment for the implementation of apprenticeship programs.

Overall, China's system and mechanisms for modern apprenticeships at the undergraduate level are still underdeveloped, and a relatively complete legal system has not yet been formed. To draw on the international experience in high-level modern apprenticeships, further progress needs to be made in the following areas: First, a comprehensive legal and regulatory system should be established. The government should legislate and regulate modern apprenticeship programs in undergraduate vocational education, including clear provisions on program organization, responsibilities, training standards, fiscal and tax policies, and protection of apprentices' rights, ensuring the smooth implementation and effective operation of the system. Second, government guidance and support should be strengthened. The government can encourage enterprises and educational institutions to actively participate in apprenticeship programs by implementing policies such as financial subsidies, tax incentives, and reward mechanisms. Additionally, the government should enhance its supervision and evaluation of the apprenticeship system to ensure its quality and effectiveness (Forster and Bol, 2018).

4.2. Establishing a Multi-Dimensional Collaborative Education System with Clear Responsibilities and Rights, and Improving Operational Barriers

The multi-dimensional collaborative education system is the solid foundation for implementing high-level modern apprenticeship systems (Rustico et al., 2020). From the development of high-level modern apprenticeship systems in countries like the UK, Germany, and the US, it can be seen that despite differences in economic environments and cultural backgrounds, the specific operational models of these apprenticeship systems vary. However, all these countries place significant emphasis on the coordination and collaboration among various stakeholders, including the government, industries, enterprises, schools, and apprentices. This results in an operational model characterized by multi-party participation, clear responsibilities, positive cooperation, and collaborative education, ensuring the smooth operation of high-level modern apprenticeship systems (Ni and Ye, 2018).

Currently, the pilot projects for modern apprenticeships at the higher vocational and tertiary education levels in China have achieved certain results, but the exploration of high-level modern apprenticeships is still in its infancy and requires further enhancement and upgrading. Drawing on the experiences of international high-level modern apprenticeship systems, further development should focus on the following two aspects: First, strengthen the role of government guidance and coordination. This can be achieved by formulating policy measures, establishing coordination mechanisms, and integrating resources from all parties to promote a multi-party participation model with clear responsibilities. Second, enhance the leading role of industries and enterprises. Industry associations can establish industry standards and training regulations, providing technical support and guidance for the apprenticeship system.

Enterprises, as the main venues for apprenticeship training, should strengthen their training and guidance for apprentices, providing them with practical opportunities and skills training, thus fostering the overall development and career growth of apprentices. Third, reinforce the support and collaboration of schools and educational institutions. Schools can provide apprentices with theoretical knowledge and academic support, offering them platforms for learning and training. Educational institutions should collaborate with industries and enterprises to jointly design apprenticeship training courses and programs, promoting the integration of theory and practice to support the career development of apprentices. Fourth, strengthen apprentices' involvement and the protection of their rights. Apprentices should actively participate in the learning and training within the apprenticeship system, acquiring knowledge and skills. At the same time, the government and enterprises should enhance the protection of apprentices' rights, ensuring fair treatment and reasonable compensation during their training, and encouraging them to make positive contributions to social and economic development.

4.3. Constructing a Systematic and Standardized Modern Apprenticeship Standard System to Meet the Needs of the Times

A systematic and standardized set of standards is a critical basis for the implementation of high-level modern apprenticeship systems. In countries such as the UK, Germany, and the US, high-level modern apprenticeships are primarily reflected in apprenticeship standards. Government management service agencies take the lead, with industry enterprises at the forefront, collaborating with schools and educational institutions to develop a series of standards that define the training goals apprentices should achieve. This ensures the quality of talent development in high-level modern apprenticeship systems (Handayati et al., 2020).

In China, the standards developed during the pilot phase of modern apprenticeships are not yet sufficiently systematic or standardized. Drawing on the experiences of international high-level modern apprenticeship systems, improvements are needed in the following three areas: First, consider the establishment of standards for undergraduate-level programs. These should address the specific skill requirements, practical ability development, and integration of theory and practice for various professional fields to ensure that apprentices gain relevant practical experience and skills during their training. Second, enhance the systematization and standardization of the standards. This includes setting standards for apprentice admission, training plans and curriculum design, faculty qualifications, and practical environments and facilities. Government agencies should lead the formulation of these standards in collaboration with industry enterprises and educational institutions, ensuring the comprehensiveness and scientific nature of the standard system. These standards should clearly define the training goals apprentices must achieve, ensuring the quality of the apprenticeship system. Third, strengthen the supervision and evaluation mechanisms for the standards. Government departments should enhance oversight of the implementation of these standards, addressing any issues or deficiencies in a timely manner. Industry organizations, enterprises, and educational institutions should also intensify their supervision and

evaluation of the implementation of standards, collaboratively driving the continuous improvement and enhancement of the standard system.

4.4. Perfecting the Teaching Quality Monitoring and Evaluation System with Multi-Stakeholder Participation to Address the Question of Quality

The involvement of multiple stakeholders in teaching quality monitoring and evaluation is a critical component for the successful implementation of high-level modern apprenticeship systems. In countries like the UK, Germany, and the US, where high-level modern apprenticeships are implemented, government bodies, industries, enterprises, schools, and apprentices themselves all actively participate in the monitoring and evaluation of apprenticeship training quality. Additionally, third-party evaluation agencies are introduced, with evaluation content covering the entire apprenticeship journey, including knowledge, skills, and behavior assessment, thereby enhancing the vitality of the apprenticeship system.

In China, pilot programs for modern apprenticeships have also made active efforts in teaching quality monitoring and evaluation. However, there are still gaps in meeting the objectives of undergraduate-level modern apprenticeships in terms of monitoring and evaluation subjects, content, standards, and methods. Drawing on international experiences with high-level modern apprenticeship systems, improvements need to be made in the following three areas: First, clarify the responsibilities and division of labor among the monitoring and evaluation stakeholders. The government should establish a regulatory mechanism, while industry and enterprises should be responsible for formulating specific standards and indicators for monitoring and evaluation. Schools and educational institutions should actively participate in the monitoring and evaluation process, providing necessary support and cooperation. Apprentices, as beneficiaries, should provide feedback on their learning progress and training experiences to enable timely adjustments and improvements. Second, establish a comprehensive evaluation content and standard system. The evaluation should include multiple aspects such as theoretical knowledge, practical skills, and professional qualities. The focus should not only be on academic achievements and certificates obtained during school but also on the performance and practical abilities demonstrated during enterprise-based practice. The evaluation standards should be specific, clear, and highly operational to facilitate effective monitoring and evaluation. Third, introduce third-party evaluation agencies for independent assessments. Third-party evaluation agencies, independent from the government, industry, and enterprises, can assess the quality of apprenticeship training, offering objective evaluation results and improvement recommendations to all participating stakeholders. This enhances the objectivity and fairness of the

monitoring and evaluation process.

References

- [1] Aldous, D., and Brown, D. A critical analysis of CIMSPA's transformative aspirations for UK Higher education sport and physical activity vocational education and training provision[J]. *Sport Education and Society*, 2021, 26(6):634-647.
- [2] Arribas, J. Governance Dynamics and the Application of the Multilevel Governance Approach in Vocational Education and Training (VET) in the European Neighbourhood Countries: the case of the ENPI South region[J]. *European Journal of Education*, 2016, 51(4):495-512.
- [3] Cai, Y., Hu, M. Q., and Zhang, J. R. The development status and trends of the German "dual university" model[J]. *Higher Engineering Education Research*, 2019(6):180-185.
- [4] Chankseliani, M., Relly, S. J., and Laczik, A. Overcoming vocational prejudice: how can skills competitions improve the attractiveness of vocational education and training in the UK?[J]. *British Educational Research Journal*, 2016, 42(4):582-599.
- [5] Chen, J., and Pastore, F. Dynamics of returns to vocational education in China: 2010-2017[J]. *Humanities & Social Sciences Communications*, 2024, 11(1):118.
- [6] Forster, A. G., and Bol, T. Vocational education and employment over the life course using a new measure of occupational specificity[J]. *Social Science Research*, 2018, 70:176-197.
- [7] Guan, S. S., and Blair, E. Exploring conceptualisations of vocational education in China: how the hierarchical education system mirrors social hierarchy[J]. *British Journal of Sociology of Education*, 2024, 45(5):778-797.
- [8] Handayati, P., Wulandari, D., and Soetjipto, B. E., et al. Does entrepreneurship education promote vocational students' entrepreneurial mindset? [J]. *Heliyon*, 2020, 6(11):e5426.
- [9] Kong, D. L., and Jiang, W. C. A comparative study of modern apprenticeship talent cultivation models: From the perspective of institutional complementarity[J]. *Chinese Higher Education Research*, 2020(7):103-108.
- [10] Li, J. M., and Pilz, M. International transfer of vocational education and training: a literature review[J]. *Journal of Vocational Education and Training*, 2023, 75(2):185-218.
- [11] Ni, H., and Ye, Y. H. Entrepreneurship Education Matters: Exploring Secondary Vocational School Students' Entrepreneurial Intention in China[J]. *Asia-Pacific Education Researcher*, 2018, 27(5):409-418.
- [12] Rustico, L., David, R., and Ranieri, A. 'Apprenticeship' in the Italian approach to the dual system[J]. *Transfer-European Review of Labour and Research*, 2020, 26(1):91-103.
- [13] Schrank, A. Mobile Professionals and Metropolitan Models: The German Roots of Vocational Education in Latin America [J]. *Archives Europeennes De Sociologie*, 2020, 61(2):185-218.
- [14] Wang, J. H., Liang, W. Y., and Li, J. M., et al. The secret to Germany's "dual system": Research and implementation of vocational education standards[J]. *Vocational and Technical Education*, 2020(24):66-70.