Research Article

Ting Liu*

Integration of Vocational Education and Lifelong Learning in the Digital Era: Pathways and Challenges

Summary of the Session on the Integration of Vocational Education and Lifelong Learning

https://doi.org/10.1515/wvte-2025-2006
Published online March 18, 2025

Abstract: In response to the impact of digital technology, an in-depth discussion on how vocational education and lifelong learning can achieve integrated development in the digital age was held at the parallel session on "Integrating Vocational Education and Lifelong Learning" on November 22, 2024, during the World Vocational and Technical Education Development Conference. The session brought together nearly 200 experts and scholars from the global education and business sectors for keynote speeches and open discussions, sharing insights and practical experience from various countries on this topic. The participating experts exchanged views on the experience, challenges, and future development pathways of vocational education and lifelong learning in the digital age, providing valuable references for fostering organic integration.

Keywords: digital technology; vocational education; lifelong learning

In September 2024, the United Nations General Assembly adopted the "Global Digital Compact", which highlights that digital technologies are rapidly transforming our world and bringing hope for accelerating the achievement of sustainable development goals. Chinese President Xi Jinping emphasized at the National

***Corresponding author: Ting Liu**, Tianjin University of Technology and Education, Tianjin 300222, China, E-mail: tingliu1213@foxmail.com

Open Access. © 2025 the author(s), published by De Gruyter. This work is licensed under the Creative Commons Attribution 4.0 International License.

Education Conference the importance of vigorously cultivating master craftsmen, skilled artisans, and high-skilled talent, as well as enhancing public services for lifelong learning. Against this backdrop, improving the quality of skilled talent training in the digital age and achieving the organic integration of vocational education and lifelong learning have become a shared development consensus in the global education sector. The 2024 World Vocational and Technical Education Development Conference focused on this theme, engaging in in-depth discussions about the new challenges, opportunities, and initiatives in the process of integrating vocational education and lifelong learning. It aims to jointly promote the prosperous development of vocational education and lifelong learning worldwide, contributing wisdom and strength to the integration and development of vocational education and lifelong learning in China and globally.

1 The Integration of Vocational Education and Lifelong Learning as an Inevitable Requirement of Current Social Transformation

1.1 Industrial Restructuring and Increased Career Mobility

During the process of social transformation, industrial structures are in a state of continuous dynamic change. Traditional industries are constantly upgrading, while emerging industries such as artificial intelligence, big data, and new energy are rapidly rising. This adjustment in industrial structure leads to an accelerated update of professions, requiring workers to frequently change jobs or continuously learn new skills within the same position. For example, as the manufacturing industry transitions to smart manufacturing, workers who previously relied solely on manual labor and simple mechanical operations now need to learn new skills such as CNC programming and industrial robot operation. The integration of vocational education and lifelong learning can provide workers with pathways for skill enhancement throughout their careers, enabling them to update their knowledge and skills in line with industrial changes and adapt to new job requirements. The increase in job mobility also enhances the possibility for workers to switch between different professional fields. For instance, in the Internet industry, individuals working in traditional media might transition to roles in new media operations or digital marketing. The integration of vocational education and lifelong learning can offer cross-industry vocational training, helping workers acquire the foundational knowledge and professional skills needed in new industries, thereby facilitating smooth career transitions.

1.2 Technological Advancement and Accelerated Knowledge Renewal

The rapid development of modern technology is one of the key features of social transformation. New technologies are emerging continuously, and the pace of knowledge renewal is faster than ever before. In the field of information technology, programming languages are frequently updated, and new software and applications are constantly being introduced. For professionals, relying solely on one-time formal education is no longer sufficient to meet job demands. The integration of vocational education and lifelong learning can provide professionals with opportunities to learn the latest technological knowledge through various methods such as short-term training courses and online learning programs. For example, software developers can enhance their programming skills and keep up with technological advancements by participating in training courses on new programming languages and development frameworks offered by vocational schools or online education platforms. Technological advancements also change work methods and content. For instance, with the widespread application of automation equipment on production lines, workers need not only to master equipment operation skills but also to understand the principles of automation control systems, as well as fault diagnosis and maintenance. The integration of vocational education and lifelong learning can offer targeted training for these changes, helping professionals to master new work methods and content, thereby improving work efficiency and quality.

1.3 Demographic Changes and Individual Career Development Needs

During the period of social transformation, demographic structures are also changing, with average life expectancy increasing and, consequently, career spans extending. As workers spend more time in the workforce, they need to continuously learn to maintain their competitiveness. Additionally, with the advent of an aging society, some older adults also have the desire to continue participating in the workforce or to pursue personal development. The integration of vocational education and lifelong learning can provide diverse vocational education services for people of different age groups. For example, it can offer leadership and project management training courses for middle-aged workers aspiring to advance to management positions, and part-time job skills training suitable for older workers' physical abilities and interests, such as handicrafts and community service skills.

From the perspective of individual career development, everyone hopes to continuously progress in their career and achieve personal value. The concept of lifelong learning has become deeply ingrained, and people recognize that

continuous learning is essential for adapting to societal changes. The integration of vocational education and lifelong learning can provide flexible learning pathways, such as credit accumulation and transfer systems, allowing learners to freely choose courses across different vocational education institutions based on their own schedules and interests. This enables them to accumulate credits and ultimately obtain relevant vocational qualifications or academic certificates, providing strong support for individual career development.

1.4 Shifts in Social Values and the Construction of a Learning Society

Social transformation has led to a shift in societal values, where learning is no longer viewed solely as a task for the youth but as a lifelong lifestyle. People increasingly value the enhancement of their comprehensive qualities and the enrichment of their spiritual and cultural lives. The integration of vocational education and lifelong learning can meet the needs of individuals in both professional skill enhancement and personal development. For example, by taking courses that combine vocational and humanistic education, learners can improve their communication skills, teamwork abilities, and professional ethics while acquiring professional skills.

Building a learning society is one of the key goals of social transformation. As an essential part of the education system, the integration of vocational education and lifelong learning can expand educational offerings and raise the overall educational level of the population. For instance, vocational education institutions can collaborate with communities to provide various vocational skills training and cultural education activities for residents, fostering a community learning atmosphere and contributing to the construction of a learning society.

2 International Experience and Best Practices in Integrating Vocational Education with Lifelong Learning

2.1 Policy-Driven High-Quality Development of Vocational Education

Policies define the development direction of vocational education. There is a close interaction between vocational education policies and their development directions, as a country's vocational education policies often reflect the current

focus of vocational education development. Wang Qiming, President of the Open University of China, mentioned that the fourth plenary session of the 19th Central Committee of the Communist Party of China (CPC) proposed improving the coordinated development mechanism of vocational and technical education, higher education, and continuing education. The decision passed at the third plenary session of the 20th CPC Central Committee emphasized "accelerating the construction of a vocational education system that integrates vocational and general education, and industry-education integration", thus pointing out the direction for the current talent cultivation model in China's vocational education. Hon. Tozen Leokana, Minister of Education and Human Resources Development of the Solomon Islands, also noted that the "Solomon Islands Tertiary Education and Skills Authority Act 2017" and the "National Education Action Plan 2016–2020" clearly stated the need to expand the scope and improve the quality of vocational and technical education and training, providing a policy framework and direction for its development. Alison Dell, Minister-Counsellor (Education and Research) at the Australian Embassy in Beijing, introduced Australia's National Skills Agreement, which ensures that Australia's Vocational Education and Training (VET) system provides individuals with opportunities for high-quality skills training, enhancing their employability and career development prospects in the labor market.

Policies guide the allocation of vocational education resources. In some developing countries, including China, governments often establish policies to dictate the allocation of educational resources, which is crucial for the development of local vocational education. For example, the Chinese government has developed and implemented the "Outline of the National Medium- and Long-Term Program for Education Reform and Development", increasing financial investment and policy support for vocational education. This approach directs resources towards vocational education, supporting the construction of vocational institutions, faculty development, and the improvement of teaching facilities, thereby promoting the optimal allocation and development of vocational education resources. A typical example is Xinjiang, China, where the "Aid to Xinjiang" mechanism has facilitated the establishment of several vocational skill colleges, ensuring high-quality vocational education for local students.

In the Democratic Republic of the Congo, the government's Development Program for the 145 territories (PDL-145T) has updated vocational school infrastructure, revised vocational education curricula, and funded teacher training, greatly promoting educational equity and digital transformation. The Solomon Islands Government also provides funding support through national policies for the operation and maintenance of public vocational and technical education schools, improving teaching facilities, training teachers, and providing learning materials. Similarly, the government of Guyana has increased financial investment in vocational

education through policy-making, addressing socioeconomic inequalities and providing opportunities for personal development.

Policies drive innovation in vocational education talent cultivation models. To meet the demands of economic and social development, the Chinese government encourages vocational institutions to adopt diverse talent development models through policy initiatives. The introduction of policies such as the "Opinions on Promoting High-Quality Development of Modern Vocational Education" signifies China's expectation to enhance the future of vocational education by strengthening the cooperation model between vocational schools and enterprises, thereby promoting the integration of industry and education. These policies encourage the integration of vocational education with industry, general education, and continuing education, thus broadening the development path of vocational education.

Qin Qingsong from Qingdao Technical College mentioned that, in response to national policies, the college launched the Exemplary Craftsman Training Program. This program relies on four provincial on-site studios and uses the modern apprenticeship system as a platform to innovate educational mechanisms and reform cultivation models. As a result, over 20 % of the program's graduates are employed by Fortune Global 500 companies, China's top 500 enterprises, and leading companies in Qingdao's key industrial chains.

Yu Zhongwu, President of Tianjin Maritime College, also noted that to support the integration of the Tianjin port, city, and industry, the coordinated development of the Beijing-Tianjin-Hebei region, the strategy of building a strong transportation and maritime nation, and the Belt and Road Initiative, the college has aligned its professional courses with industry needs. The school conducts full-order training for students throughout the entire career cycle in maritime professions, effectively enhancing the competency of seafarers in their roles.

2.2 Digitalization Driving the Transformation of Vocational Education Towards Lifelong Learning

In September 2024, the United Nations General Assembly adopted the "Global Digital Compact", highlighting how digital technology is rapidly transforming our world. During this conference, various countries emphasized the crucial role of digital technology in the development of vocational education and recognized the digitalization of vocational education as a shared vision for its future development. Specifically, the role of digital technology in advancing vocational education is mainly reflected in the following aspects.

Digital innovation is transforming educational and teaching models. Professor Li Kam-cheong from Hong Kong Metropolitan University and Vice President Santhi Raghavan from Open University Malaysia both noted that digital

technology not only provides learners with the latest, ubiquitous, and easily accessible learning content, fostering a collaborative and friendlier learning environment, but also offers more convenient electronic certification. These changes make vocational education more flexible and provide strong technical support for lifelong learning for all. Additionally, the Open University Malaysia has applied digital technology in online courses, using generative AI to create customized educational chatbots, enhancing the appeal of online learning content and improving student learning outcomes, which has earned international awards.

Ritesh Tularam, Deputy Chief Education Officer of the Ministry of Education in Guyana, also believes that digital technology has transformed the educational landscape, greatly promoting educational equity. The Democratic Republic of the Congo mentioned plans to equip over 60 % of schools nationwide with digital technology equipment by 2029 to facilitate interactive learning that meets contemporary needs. Ma Yuxia from Zhengzhou Railway Vocational & Technical College in China stated that the establishment of a national high-speed rail virtual simulation base has significantly improved the efficiency of teaching and training.

Digitalization enriches teaching resources. Wang Qiming from the Open University of China mentioned that the university has built an online learning platform that aggregates over 1.03 million course resources, providing personalized learning services for more than 65 million lifelong learners from 20 countries and regions around the world. This initiative strongly supports lifelong learning empowered by digital technology. Guyana, in collaboration with the World Bank, is developing a digital platform for vocational education to help students and job seekers better understand and access training resources related to digital skills. This effort aims to align talent with market demands, thereby promoting employment and economic development in the digital sector.

Digitalization enhances the efficiency of educational management. Wuhan Open University in China has implemented the “5,331” plan, actively exploring digital empowerment in integrating continuing and vocational education. Zhengzhou Railway Vocational & Technical College has established a national high-speed rail virtual simulation training center as a digital training center. They have developed an O2O training platform that involves collaboration among governments, industry, schools, and enterprises, offering customized resource packages for integrated online and offline modular learning assessments. This initiative has built a digital service system compatible with lifelong learning.

2.3 Industry-Education Integration Enhancing the Quality of Talent Cultivation in Vocational Education

Li Kam-cheong from Hong Kong Metropolitan University noted that 80 % of future jobs will be partially or completely replaced by AI. In this context, how can we enhance and reshape students' skills? Industry-education integration is an excellent choice. Wang Xihua, Party Secretary of Tianjin Railway Technical and Vocational College, believes that through the integration of industry and education, it is possible to unite diverse and interrelated stakeholders to form a community of shared interests, achieving an effective co-governance and win-win governance model. Alison Dell, Minister-Counsellor (Education and Research) at the Australian Embassy in Beijing, specifically pointed out that one of the reasons for the success of Australia's Vocational Education and Training (VET) system is its deep integration with industry, allowing it to continuously adjust according to changing industry demands. This characteristic ensures that it provides individuals with practical skills and knowledge relevant to specific job roles, meeting the needs of industries and enterprises, enabling learners to learn and apply quickly, and effectively enter the labor market. Currently, methods of industry-education integration primarily include school-enterprise cooperation and the establishment of industry colleges.

For example, Quanzhou College of Technology in China has built a trilateral dual-qualified teacher team (comprising industry masters, enterprise technicians, and excellent teachers from higher education institutions) to construct a practical training base for industry-education integration, including enterprise workshops, model worker innovation studios, and skill master studios. This provides a strong faculty support for the development of vocational education in the school. Tianjin Maritime College in China has formed a close linkage between its major clusters and industries, enabling students to directly enter relevant positions upon graduation. The school adopts a phased training approach based on the entire career cycle of navigation, effectively enhancing the job performance capabilities of seafarers and achieving multi-dimensional development of their careers.

The Solomon Islands National University, the University of the South Pacific, and vocational training centers collaborate to design and update courses based on feedback and demands from different industries. This promotes a close integration of vocational and technical education with industry needs and improves learning efficiency. The Ministry of Education and the Ministry of Vocational Training of the Democratic Republic of the Congo, along with relevant institutions, have established cooperation to organize appropriate continuing education and training programs both within and outside schools, centered on national needs. This ensures the improvement of labor employability. Guyana has enhanced the

alignment of students' skills with market demands by adding market-oriented courses in schools, strengthening the construction of practical teaching faculty, and implementing reforms in vocational education curricula and teaching methods.

Professor Olivier Drouard-Pascarel, head of the Département Techniques de Commercialisation at the Université Toulouse-Jean Jaurès, believes that joint curriculum development and teaching participation by enterprises and schools can improve students' vocational and practical skills, and promote a smooth connection between vocational education and employment. In France, the proportion of external personnel teaching outside the school can reach 30 %–40 %.

Examples of industry colleges include Qingdao Technical College in China, which has developed an integrated collaboration model and established strong partnerships with 455 enterprises, jointly building 17 industry colleges. Following the concept of aligning academic programs with industry needs, the college integrates professional clusters into industrial clusters, implementing the "1 + 1 + N" school-enterprise cooperation and industry-education integration initiative to deepen collaboration between education and industry.

2.4 Institutional Development Facilitating the Transition from Vocational Education to Lifelong Learning

A comprehensive qualification framework guides the transition from vocational education to lifelong learning. Mr. Kaiser Abdukerim, Vice Chairman of Xinjiang Uygur Autonomous Region government, believes that building a robust vocational education and lifelong learning system, along with vigorously promoting the development of a credit bank, can facilitate the mutual integration of vocational, general, and continuing education. This approach encourages industry-education integration and school-enterprise cooperation, thereby enhancing the quality of vocational education and talent cultivation.

A successful example is Australia's Vocational Education and Training (VET) system along with the Australian Qualifications Framework (AQF), which establishes unified qualification standards and quality assurance across different education and training sectors. This framework ensures coherence and consistency in education and training, promoting the development of lifelong learning. Another case is Hong Kong's PEAK, which serves as a central examination and certification hub, integrating master's, bachelor's, and professional degree programs with various short-term training courses and certifications. After achieving their initial educational goals, learners can continuously pursue lifelong learning through PEAK.

Regulatory bodies for vocational education provide quality assurance for vocational training. For example, the Solomon Islands has established the Solomon Islands Tertiary Education and Skills Authority (SITESA) to lead and promote the development of higher education and vocational skills training. This authority is responsible for promotion, planning, capacity development, and coordination, aiming to provide education and training that meet the future demand for a highly skilled workforce in the country. Its responsibilities include implementing relevant policies, managing the national qualifications framework and quality assurance systems, promoting the development of professional standards, and managing budgets.

In Australia, the Australian Skills Quality Authority (ASQA), the national regulator for vocational education and training (VET), oversees education quality. ASQA is primarily responsible for registering training institutions, accrediting courses, and ensuring that vocational education providers comply with the VET Quality Framework. During the accreditation process, multiple factors are considered, including compliance with industry standards for registered training organizations, alignment with the Australian Qualifications Framework (AQF), suitability criteria, financial viability risk assessments, and data reporting requirements. These measures ensure that more individuals have access to high-quality skills training. National legislation also mandates that only government-certified training institutions are authorized to provide nationally accredited training programs, further reinforcing the quality and credibility of vocational education.

2.5 International Cooperation Facilitating the Exchange and Sharing of Vocational Education Resources

Kong Ravuth, Vice President of the National Polytechnic Institute of Cambodia, emphasized that international cooperation is an essential means of improving the quality of vocational education. Different countries have their unique strengths in teaching philosophies, and through global collaboration, vocational institutions can adopt these educational concepts and methodologies, jointly develop course resources, and share faculty expertise.

For example, the Lancang-Mekong Vocational Education Training Center and the Cambodia Luban Workshop were established in collaboration with Tianjin, China, in 2018. These projects provide vocational skills training in five key areas, including electric power, telecommunications, smart building technology, and tourism management. Qingdao Technical College in China has enhanced its educational standards by integrating high-quality educational resources from New Zealand and Germany. Meanwhile, Xinjiang Agricultural Vocational and Technical University in China collaborates with multiple Central Asian countries on

saline-alkali land improvement, land optimization, and comprehensive soil utilization. The Université Toulouse-Jean Jaurès in France has partnered with numerous international institutions to enhance students' global competencies. The Solomon Islands collaborates with international partners such as the Australian government to receive support from projects like the Australia Pacific Training Coalition, jointly developing curricula and training faculty to enhance the level of vocational and technical education and training.

Additionally, particularly in China, the advancement of national strategies such as the Belt and Road Initiative, has led to a boom in infrastructure projects in countries along the route, providing opportunities for extensive international cooperation. For example, Qingdao Technical College, in partnership with Haier, established the Smart Building Global Services College and launched 14 overseas employee skill enhancement programs, training over 800 overseas employees. Additionally, the college collaborated with Mitsubishi to establish the Haier Academy, aligning with the company's production base layout in Southeast Asia, and partnering with local schools to develop shared resources for employee training.

More importantly, with the support of the Aviation Industry Corporation of China (AVIC International), the college has conducted vocational education faculty training and developed curriculum standards for countries such as Gabon, Côte d'Ivoire, and Kenya, creating 25 influential professional and curriculum standards. In the construction of the Laos-China Railway, Chinese vocational education institutions can train local professionals in Laos in railway construction, operation, and maintenance, ensuring the smooth implementation of projects. This also provides human resource support for Chinese enterprises growing overseas and strengthens economic ties between China and countries along the route.

3 Challenges and Strategies for the Future Development of Vocational Education

3.1 Enhancing the Efficiency of Digital Learning in Vocational Education

Currently, in terms of digitalizing education, some countries have made very proactive explorations by developing numerous digital courses and offering various teaching models. However, more efforts are needed to ensure these courses genuinely enhance student learning.

Firstly, there is the issue of how digital resources can expand accessibility. In some remote areas, poor Internet connectivity or limited family economic

conditions prevent students from having adequate computers or tablets. For instance, online live courses might suffer from network lags, causing students to miss important explanations, thereby affecting learning efficiency.

Secondly, there's the question of how to design teaching content. Teachers cannot simply transfer offline teaching content directly online; they need to redesign the teaching process. For example, in online discussion sessions, teachers must consider how to engage students to avoid awkward silences or off-topic discussions, which would otherwise waste students' learning time.

Thirdly, students need to enhance their self-directed learning abilities. In a digital learning environment, students require stronger self-management skills. Without the direct supervision of teachers, students can easily become distracted. Studies have shown that without proper supervision and self-discipline, students are significantly more likely to view non-educational content while learning, which severely impacts learning efficiency. Additionally, varying levels of digital literacy among students can affect their ability to use digital learning tools effectively.

Fourthly, the challenge is how to provide personalized learning guidance. In a digital environment, where students' learning progress and methods are more diverse, it is difficult for teachers to offer personalized guidance to each student as they would in a traditional classroom. For example, in large-scale online courses, teachers may be unable to address each student's specific questions and problems, leading to delays in overcoming learning obstacles and affecting learning efficiency.

When discussing response strategies, Professor Santhi Raghavan, Vice President of Open University Malaysia, mentioned nine aspects. First, learning outcomes should be clear and measurable. The content should be more engaging and broken into smaller, manageable modules. Assessment methods should be flexible. There should be a focus on learning strategies and integrated technology. A supportive learning environment is crucial, along with continuous progress tracking. Encouraging self-directed learners by offering additional resources, such as workshops and seminars, allows them to explore knowledge more deeply.

Professor Li Kam-cheong from the School of Professional and Continuing Education at Hong Kong Metropolitan University believes that providing the latest industrial and corporate technology education through digital platforms, along with fostering a collaborative and friendlier learning environment, makes vocational education more flexible. Additionally, the availability of ubiquitous and easily accessible learning content, easily searchable learning support, and electronic certificates and micro-credentials can enhance the efficiency of digital learning.

3.2 Institutional Issues in the Integration of Vocational and General Education

The integration of vocational and general education is an educational concept and practice model aimed at breaking down the barriers between vocational and general education, creating a "bridge" for talent development. It is an important measure for achieving lifelong learning, yet there are still some challenges in practice.

Firstly, there is the issue of curriculum alignment. The curriculum standards for vocational and general education are established based on different objectives. General education focuses on the systematic transmission of academic knowledge, primarily oriented towards further studies, while vocational education focuses on developing vocational skills and employment. Currently, there is a lack of unified standards to coordinate these two quite different curriculum systems, leading to difficulties in curriculum alignment for the integration of vocational and general education.

Secondly, there is the issue of credit recognition. Successful integration requires the establishment of a reasonable credit recognition system, but this aspect is still underdeveloped. In practice, general schools and vocational schools calculate course credits differently. Due to the absence of unified credit recognition rules, when students switch learning paths between different types of education, the credits from previously completed courses are difficult to transfer effectively, increasing students' learning costs.

Australia suggests addressing these challenges by establishing a highly flexible qualifications framework that integrates different levels of post-K12 education. This framework allows for smoother transitions between vocational education and academic qualifications, making it a crucial component in the future development of vocational education and skills training.

3.3 Elderly Education and Lifelong Learning

Lifelong learning emphasizes continuous knowledge acquisition throughout an individual's life. As global aging accelerates, elderly education is gaining increasing attention. To ensure that individuals continuously receive vocational education throughout their careers, addressing the issue of elderly education is essential.

To tackle this issue, the Open University of China has pioneered new pathways for the development of elderly education by establishing a university for the aged. In 2023, the National University for the Aged was officially founded, and it now operates 55,000 learning centers across the country, serving 22.14 million elderly learners. It has also built a national public service platform for elderly education, aggregating 437,000 courses. Additionally, the Proactive Health School has been

established with the aim of replacing a hospital bed with a university desk, offering a series of activities and quality courses that have reached 119 million elderly individuals.

3.4 Other Challenges

For example, how to enhance the efficiency of administrative management in digital education models while reducing costs is a key concern. Currently, as the digitalization process advances, there is an increasing demand for personnel skilled in digital technologies, as well as for software and apps. This demand has led to rising prices and higher wages.

4 Summary

After an afternoon of in-depth discussions, education representatives from various countries jointly explored the pathways, challenges, and opportunities for integrating vocational education with lifelong learning in the digital age, sharing successful experience worldwide. The key practices discussed primarily included policy guidance, digital empowerment, industry-education integration, institutional refinement, and international cooperation. Future focal issues include the misuse of digital technology, difficulties in optimizing systems, and elderly education. In conclusion, this conference has provided valuable insights and references for promoting the innovative development of vocational education and lifelong learning.