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Digital Transformation in Technical and Vocational Education and Training (TVET): A Comparative Analysis of Indonesia, China, and South Korea

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A B S T R A C T

Digital transformation in Technical and Vocational Education and Training (TVET) has become a strategic priority to enhance the relevance of education to the needs of industry and the digital economy. This article conducts a comparative analysis of digital transformation in TVET in Indonesia, China, and South Korea through a comparative literature review using a qualitative descriptive design. The findings indicate that Indonesia emphasizes the "link and match 8+i" approach through collaborative curricula, teaching factories, internships, and industry certification. China is driven by state policies, the integration of information technology, artificial intelligence, digital learning platforms, and technology-based curriculum reform. South Korea stands out through its Digital New Deal, Smart Learning, AI Digital Textbooks, and the integration of 5G and cloud computing. All three countries emphasize that the success of TVET digital transformation depends on the synergy of policies, curricula, educators, infrastructure, and industry collaboration in preparing future graduates.

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INTRODUCTION

Digital transformation has become a central issue in the development of Technical and Vocational Education and Training (TVET) in various countries (Ercoli et al., 2024; Nurlaela et al., 2025; Yoto et al., 2024). This change is no longer interpreted merely as the addition of technological tools to learning, but as a restructuring of the curriculum, pedagogy, institutional governance, and the relationship between vocational education and the needs of industry and the labor market. In the TVET literature, digital transformation is understood as a process that drives learning to become more flexible, personalized, and relevant to the world of work, yet simultaneously demands readiness in curriculum, educator competencies, and equitable access to digital resources (Ercoli et al., 2024; Parua & Yang, 2024; Zhou et al., 2023).

In this context, Indonesia, China, and South Korea present three equally important pathways of transformation that warrant comparative analysis. Indonesia focuses its TVET transformation on strengthening links with the business and industrial sectors through the revitalization of vocational education and the "Link and Match 8+I" policy (Khomsah et al., 2025). This approach aims to reduce skills mismatches, enhance graduate relevance, and boost labor market absorption through collaborative curricula, teaching factories, field work placements, and competency certification (Saryadi et al., 2024). However, research findings also indicate that Indonesia's challenges remain in the quality of instructors, facilities, infrastructure, and the consistency of implementing industry partnerships in practice (Irwanto, 2021; Khomsah et al., 2025; Triyono & Moses, 2019; Wahjusaputri et al., 2020).

Unlike Indonesia, which emphasizes the "link and match" agenda, China has undergone a digital transformation of vocational education that is strongly driven by state policies and educational technology reforms (Pan & Filippova, 2024; Zhou et al., 2023). A literature review on China indicates that the government is actively promoting the digitalization of vocational education through the integration of information technology into the curriculum, the use of artificial intelligence, the development of digital learning platforms, and technology-based curriculum reform (H. Zhang, 2025a). These changes are also shifting learning models toward more flexible, interactive, and innovative approaches through online learning, digital simulations, and virtual laboratories. Nevertheless, implementation in China still faces challenges related to digital infrastructure, teacher readiness, regional access gaps, and the need for stronger integration between the curriculum and the demands of the digital industry (Guo et al., 2021; Ma et al., 2025; Wang & Xia, 2025).

Meanwhile, South Korea has demonstrated a more consolidated pattern of digital transformation through the synergy between national policies and the modernization of vocational education (OECD, 2024). Through the Digital New Deal, the South Korean government is promoting the integration of artificial intelligence, 5G, and digital ecosystems into various sectors, including education. At the vocational high school level, this transformation is evident in the development of Smart Learning, AI Digital Textbooks, hybrid learning models, and the use of e-learning to expand personalized learning (Korea, 2024).

However, the literature also indicates that vocational schools in South Korea continue to face challenges such as curriculum misalignment with Industry 4.0 changes, high costs of laboratory upgrades, gaps in teachers' digital competencies, and the risk of a digital divide between urban and rural areas (Asim et al., 2023; Ismail & Mupita, 2024; Waleed et al., 2023).

When compared, these three countries share a common orientation—preparing vocational graduates who are better equipped to navigate the digital economy—but with differing policy priorities. Indonesia emphasizes strengthening school-industry partnerships and graduates' employability; China focuses on technology-driven systemic reforms and robust digital policy support; while South Korea demonstrates a more advanced transformation model through the integration of cutting-edge technology and smart learning ecosystems. These differences are significant because they demonstrate that the digital transformation of TVET does not follow a single model, but is heavily influenced by policy capacity, infrastructure readiness, industrial development orientation, and the strength of collaboration between education and the economic sector.

Based on the above discussion, a comparative study of the digital transformation of TVET in Indonesia, China, and South Korea is essential. A comparison of these three countries can provide insight into how policies, curricula, learning models, and industry partnerships are shaped in different contexts, while also identifying strategic lessons relevant to strengthening vocational education in the digital age. Therefore, this article aims to analyze digital transformation in TVET in Indonesia, China, and South Korea to understand the direction of change in the vocational education system and formulate learning approaches that can enhance the relevance, flexibility, and competitiveness of future graduates.

METHODOLOGY

This study employs a comparative literature review approach with a qualitative descriptive design to analyze digital transformation in Technical and Vocational Education and Training (TVET) in Indonesia, China, and South Korea. This approach was chosen because it allows for a comparison of policies, curricula, learning models, and the relationship between vocational education and the industrial sector in these three countries. This comparative analysis aims to identify similarities and differences among the three countries regarding the application of digital technology in vocational education, as well as to uncover the factors influencing the success of digital transformation in each country.

The research data consists of secondary sources collected from various international journal articles, conference proceedings, policy reports, official documents from governments and educational institutions, as well as previous studies relevant to the research theme. The collected data was then analyzed using thematic analysis techniques to identify key themes related to policies, curricula, learning methodologies, as well as the challenges and opportunities faced by each country in implementing digital transformation in TVET. As part of the data collection process, a literature map was also used to visualize the

relationships among relevant articles and to identify trends and recent developments in TVET digital transformation across the three countries.

The analysis process was conducted through the following steps: first, the selection of relevant sources; second, the grouping of articles by theme and country; third, the comparison and analysis of content related to policy, curriculum, and the strengthening of industry collaboration; and fourth, the synthesis of analysis results to formulate conclusions regarding strategic lessons from each country that can be applied to strengthen vocational education in the digital era. This method enables a holistic overview of the development of digital transformation in TVET in Indonesia, China, and South Korea, as well as providing recommendations that can strengthen the relevance and quality of vocational education in these three countries.

This research method was chosen to ensure that the comparative analysis is based on valid and detailed data, and can provide useful insights for policymakers and education practitioners in addressing the challenges of digital transformation in the vocational education sector.

RESEARCH RESULT

Digital Transformation of TVET in Indonesia

In Indonesia, the digital transformation of TVET focuses on the "Link and Match" policy between the education sector and the industrial sector. One of the key initiatives is the 8+i program, which integrates industry-aligned curricula, real-world industry projects, structured internships, and industry-based certification (Ali et al., 2020; Khomsah et al., 2025). This program aims to ensure that vocational education in Indonesia produces competent and work-ready graduates with skills relevant to current industry needs. However, the implementation of this program still faces challenges, particularly regarding gaps in infrastructure quality and educator competencies, which need to be further improved to effectively integrate technology into learning (Irwanto, 2021; Mara et al., 2025).

Additionally, Indonesia has adopted the teaching factory model and industry-based field work practices as part of the digital transformation in vocational education (Fattah et al., 2021; Komara & Iskandar, 2025). Existing curricula are beginning to be aligned with industrial developments; however, there remains a mismatch between industry needs and current vocational education curricula, particularly regarding the application of rapidly evolving advanced technologies. Therefore, to accelerate digital transformation in TVET, efforts are needed to improve educator quality, digital facilities, and enhance collaboration between educational institutions and industry.

Despite these challenges, Indonesia has demonstrated progress in strengthening industry collaboration and competency certification relevant to Industry 4.0 developments (Aqsha et al., 2020; Oktafiyah, 2020; Pratiwi, 2019; Purnamawati & Yahya, 2019). One key aspect that requires attention is the improvement of digital infrastructure in remote areas, which remains a major barrier to the implementation of digital transformation. By continuing to foster collaboration among the government, vocational education, and the industrial sector, Indonesia has the potential to accelerate the implementation of the Link

and Match policy and overcome existing challenges, thereby producing graduates who are ready to compete in the workforce.

Digital Transformation of TVET in China

China has made extensive use of digital technology in its vocational education by adopting various digital learning platforms, artificial intelligence (AI), and other advanced technologies as part of the vocational education curriculum (Z. Chen et al., 2025; H. Zhang, 2025b). The Chinese government strongly supports this digital transformation through policies and initiatives that integrate information technology into vocational education, with the aim of creating a competent workforce ready to face Industry 4.0 (Wu & Zhong, 2025; Zeng et al., 2024). The implementation of these technologies enables learning to become more flexible, innovative, and efficient, including through the use of digital simulations, virtual laboratories, and online learning (X. Chen & Chan, 2024; Lin & Pang, 2024).

However, despite strong support from government policies and rapid technology adoption, the digital infrastructure gap and educators' competencies in rural areas remain major challenges facing China (Mustaffa et al., 2024; F. Zhang et al., 2025). In many cases, the quality of vocational education in rural areas remains limited by a lack of access to advanced technology and digital learning tools (Ding et al., 2025; Xinyan et al., 2025). Therefore, to accelerate the implementation of digital transformation in TVET, China needs to address the issue of equitable digital access across all regions, as well as provide intensive training to educators to optimize the use of technology in learning.

China also faces challenges in aligning its curriculum with the rapid pace of industrial development (P. Chen et al., 2024; Jiang et al., 2024). Although efforts have been made to update the curriculum in line with the needs of the digital industry, there remains a mismatch between what is taught in vocational schools and the skills required by industry (Dai et al., 2024; Mante et al., 2025). Therefore, although China has succeeded in adopting advanced technologies in vocational education, further steps are needed to ensure that curricula and instruction consistently keep pace with industrial developments and labor market needs.

Digital Transformation of TVET in South Korea

South Korea has become one of the leading countries in implementing digital transformation in vocational education, thanks to the Digital New Deal policy that supports the use of AI, 5G, cloud computing, and smart learning in education (Hadi et al., 2025; Mustaffa et al., 2024; Rajamanickam et al., 2024). Through this policy, South Korea has successfully created a vocational education ecosystem based on advanced technology, enabling more personalized and adaptive learning (Zaid & Kamin, 2024). AI-powered digital textbooks and digital learning platforms have become an integral part of South Korea's vocational education system, allowing students to learn in a more interactive and flexible manner while acquiring skills relevant to the needs of the digital industry (Bang & Park, 2021; Genene, 2025).

However, although South Korea has implemented technology very effectively in vocational education, there are several challenges that must be addressed, particularly regarding the misalignment of the curriculum with rapid

industrial developments (Mbanga & Mtembu, 2020; Raihan & Shamim, 2013). Although vocational education in South Korea is already quite advanced, some industrial sectors still struggle to align skill requirements with the curricula taught in vocational schools (Kovalchuk et al., 2023). Therefore, it is crucial to continuously update and align the curriculum with the latest technological advancements, as well as enhance industry involvement in the curriculum design process and skill development.

Additionally, teacher training remains a major challenge in implementing digital transformation in TVET. Many educators are still inadequately trained in using the latest technologies in their teaching, which can hinder the effectiveness of digital learning. Therefore, South Korea needs to provide more training and support to educators to effectively integrate technology into the teaching and learning process (Raihan & Shamim, 2013). Nevertheless, with the successful implementation of the Digital New Deal policy and the development of advanced technology in vocational education, South Korea has become a model worth emulating in terms of the application of digital transformation in TVET.

DISCUSSION

From a comparison of the three countries, it is evident that although Indonesia, China, and South Korea have different approaches to implementing digital transformation in TVET, they all share the same goal: to produce a competent workforce ready to face the challenges of Industry 4.0. Indonesia focuses on strengthening industry collaboration, internships, and certification, while China emphasizes technology-based curriculum reform and the use of AI to create a more digitally ready workforce. South Korea implements smart learning, AI Digital Textbooks, and 5G to create a more adaptive and relevant learning experience.

Table 1. Strategic Map

Aspect	Indonesia	China	South Korea
Digital Policy	Link and Match 8+i, vocational high school revitalization, collaborative curriculum, structured internships, industry certification	Integration of technology into the curriculum, use of AI and digital platforms, government policy support	Digital New Deal, AI, 5G, Smart Learning, Digital Textbooks
Pedagogical Approach	Teaching factory, industry-based fieldwork, industry-based curriculum	Online learning, digital simulations, virtual labs, technology-based learning	Hybrid learning, AI-powered digital textbooks, use of advanced technology for

Aspect	Indonesia	China	South Korea
			personalized learning
Key Challenges	Infrastructure gaps, educator competencies, limited industry partnerships	Digital infrastructure gaps, limited teacher competencies, access gaps in rural areas	Curriculum misalignment with industry needs, challenges in teacher training, digital divide in rural areas
Success Models	Strengthening industry collaboration, developing competency certifications, industry-based curriculum	Technology-based curriculum reform, collaboration between education and industry	Successful implementation of Smart Learning, collaboration with industry, technology-based curriculum updates
The Role of Industry	Collaboration with the business sector in curriculum development and internship implementation	Close collaboration between vocational education and industry, particularly in the development of digital platforms	Industry partnerships in curriculum development, the critical role of industry in curriculum updates and educational technology
Digital Infrastructure	Infrastructure limitations in rural areas, need for improved digital facilities to support learning	Digital infrastructure is developing rapidly, although there remains a gap between urban and rural areas	Advanced digital infrastructure with government support, a focus on 5G and AI in education
Flexibility in Learning	Flexible curriculum with internships and real-world industry projects, competency-based curriculum development	Learning is more flexible with digital platforms, virtual labs, and online learning	Hybrid learning models enabling flexibility and personalization through AI and 5G technology

The key commonality found in these three countries is the importance of collaboration with industry to align industry needs with vocational education curricula. However, the challenges faced by these three countries are also similar, namely regarding educator competencies, digital infrastructure, and difficulties in synchronizing curricula with industry developments. By addressing these challenges, these three countries have the opportunity to enhance the effectiveness of TVET digital transformation through improving educator quality, investing in infrastructure, and refining curricula to be responsive to industry developments.

CONCLUSION

Although the three countries have different approaches to implementing TVET digital transformation, their primary goal is the same: to produce competent, work-ready graduates who are relevant to industry needs in the digital age. Indonesia focuses on strengthening partnerships with industry and updating curricula based on business needs; China leverages high-tech solutions such as AI and digital learning platforms to strengthen its vocational education system; while South Korea integrates advanced technology through its Digital New Deal policy and focuses on smart learning and AI-powered digital textbooks.

However, the challenges faced by all three countries are similar, namely regarding the quality of digital infrastructure and the need to improve educators' competencies. Therefore, strengthening infrastructure, training educators, and fostering closer collaboration with industry are key to overcoming these challenges and driving the success of TVET digital transformation in all three countries.

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