

Investigating the Structural Relationships of Vocational Teachers' Digital Literacy for Blended Learning

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ABSTRACT

The proliferation of mobile and blended learning increases demand for teachers' digital literacy. This study focuses on the pressing challenges in integrating technology into practical teaching within vocational education. Investigating in-service vocational teachers in China, structural equation modeling (SEM) analyzed the interrelationships among five digital literacy dimensions: digital awareness, digital knowledge and skills, digital application, digital social responsibility, and professional development. Results uncover a sequential pathway: digital awareness fosters digital knowledge and skills, which robustly enhance digital application. Crucially, digital application acts as the key mediator, directly driving professional development, yet it is the lowest-rated dimension, confirming the gap. Based on the findings, the authors propose targeted strategies including blended training, incentive mechanisms, and subject-specific tool development to strengthen digital application capabilities, better equipping vocational teachers for efficient blended and mobile learning environments.

KEYWORDS

Digital Literacy, Vocational Teachers, Structural Equation Modeling, Blended Learning, Digital Application Competence

INTRODUCTION

The 21st century has witnessed the accelerating iteration of new-generation digital technologies, such as the internet of things, artificial intelligence, and 5G (Fernández-Otoya et al., 2024; Uy et al., 2025). These technologies have not only reshaped the patterns of social production and daily life, but also exerted a revolutionary impact on teaching formats, resource provision, and talent cultivation goals in the field of education (Falloon, 2020). In the synchronous evolution of the educational paradigm, teachers have become the forefront of this change. As the main promoters of learning, teachers need to effectively integrate these technologies to improve teaching quality and learning outcomes (Trixa & Kaspar, 2024). Therefore, fundamentally speaking, improving education begins with empowering teachers, and improving teachers' digital literacy is very important for improving the overall teaching quality (Roh et al., 2025).

Recognizing this, global and national policies, such as the European Union's Digital Education Action Plan and China's Outline for Enhancing Digital Literacy, have positioned teacher competencies as central to digital talent cultivation. However, the digital application gap is still significant in

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vocational education. Especially during the COVID-19 pandemic, many vocational teachers devoted themselves to transforming available digital tools into effective online practical skills training. It was found that more than 65% of teachers feel inadequately prepared, which significantly hinders students from preparing for the labor market (Jiang, 2025; Sánchez-Cruzado et al., 2021). Recent international studies further emphasize the transformative role of artificial intelligence-enhanced Information and Communications Technology (ICT) and cloud-based learning environments in reshaping teacher competencies and lifelong learning pathways (Papadakis et al., 2024; Papadakis et al., 2023). These perspectives extend the understanding of digital literacy beyond technical skills to include adaptive, data-driven, and innovation-oriented teaching capabilities, thereby strengthening the global relevance of this study. This “digital application gap” directly damages students' skill acquisition and makes them unprepared for the modern labor force.

Our research found that the existing research on teachers' digital literacy mainly focuses on general education or pre-service teacher training and lacks empirical analysis and targeted paths for in-service teachers under the context of higher vocational education in China (X. Wang et al., 2023; J. Zhang, 2023a). Therefore, this study investigates the digital literacy of in-service higher vocational teachers. Based on the national standards, this paper analyzes the competency level using empirical investigation and structural equation modeling (SEM), discusses the relationship between the five core dimensions of competency, and puts forward some strategies to support the digital transformation of vocational education.

LITERATURE REVIEW

The Evolution of Digital Literacy Concepts and Core Frameworks at Home and Abroad

The concept of digital literacy, first put forward by Israeli scholar Yoram Eshet-Alkalai, has changed from focusing on the basic survival skills in the digital environment to focusing on the ability to acquire, evaluate, and integrate online information (S. Wang, 2023). In terms of its development, there are various research perspectives, and the skill-oriented view is the most popular among teachers, affecting training strategies (List, 2019). Internationally, the European Union Digital Competence Framework for Educators (DigCompEdu), the International Society for Technology in Education (ISTE) Standards from the United States, and Norway's Professional Digital Capability Framework all emphasize the multidimensional nature of digital literacy, despite each framework having distinct core priorities. To further broaden the theoretical foundation, recent Western studies have critically examined these frameworks; for instance, McGarr (2024) questioned the contextual assumptions embedded in teacher digital competence frameworks, calling for greater sensitivity to local teaching conditions.

With the integration of digital technology in education, people now understand digital literacy not as a “digital skill” but as a “digital literacy,” which emphasizes the comprehensive ability to solve complex problems by using technical tools in the digital environment (Chen et al., 2025). Heine et al. (2023) found through systematic review that the definition of “digital resources” in existing studies is obviously inconsistent: some studies equate it with “digital teaching tools,” while others emphasize its “teaching adaptability.” This ambiguity leads teachers in vocational colleges to fall into the misunderstanding of “tool orientation” when choosing and applying digital resources, ignoring the consistency between resources and actual teaching objectives, which further highlights the necessity of clarifying the connotations of digital literacy. Moreover, cross-national comparative studies (Scherer et al., 2019) have revealed that the relationship between digital literacy and self-efficacy varies across educational systems, underscoring the need for context-specific models rather than one-size-fits-all frameworks.

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