

## **An International Perspective on the Connotation, Framework, and Development Strategies of Teacher Digital Literacy**

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**Abstract:** *With the rapid advancement of technology, digital competence has become a crucial aspect of professional development for educators. This article reviews relevant literature and summarizes the connotation, framework, and development strategies of teacher digital literacy in different countries. The aim is to promote the professional growth of teachers in the digital age, encouraging each educator to continually strive for “Excellence in teaching”. Furthermore, this research seeks to identify digital literacy development strategies and practices for various types of teachers.*

**Keywords:** digital literacy, digital transformation, teacher development, ICT-CFT, ISTE, IBSTPI

## **1. Introduction**

Given the swift progress of digital technology, digitization has profoundly influenced the global education sector. The development of digital education has become a core topic in educational reform. Grasping the direction of the digitalization and intelligent transformation of education, focusing on the upgrade of various elements within education system, and integrating emerging technologies to reshape the talent development system are essential missions in the current landscape of educational development.

Teachers are the primary driving resource behind the transformation of educational digitization and are pivotal in deepening reforms. Cultivating teachers' digital literacy is a fundamental prerequisite for constructing a talent development system in the digital age and a natural pathway to leverage digital technology for educational innovation. Digital technology has become an integral part of the classroom environment, altering traditional teaching methods and teachers' roles and capabilities (Han, Diao, & Yang, 2021).

Therefore, the development of teachers' digital literacy has become a key focus in educational research and practice. This competence extends beyond technical skills and encompasses the ability to integrate technology into teaching, manage digital re-sources, and promote digital citizenship among students. It also involves teachers proficiently using technological tools and platforms, designing and implementing digital teaching activities, and effectively engaging with students online.

Numerous researchers have extensively explored the essence of teacher digital literacy, addressing the integration of technology into pedagogy for improved student outcomes. International professional organizations

have introduced standards and strategies, including training and resource development, to enhance educators' digital literacy. Our research aims to synthesize global standards, best practices, and case studies, offering insights and guidance to clarify key aspects of teacher digital literacy, providing targeted recommendations for educational institutions and policymakers, ultimately supporting effective teaching practices in the digital age.

## **2. Connotation of Teacher Digital Literacy**

Teacher digital literacy has a diverse connotation due to various perspectives. Discussing the conceptual aspect of digital literacy is intrinsically linked to the effective use of technology. However, currently, there are various terms used to describe these skills and abilities, leading to complexity in defining and conceptualizing digital literacy. Aesaert et al. (2013) referred to these diverse terms as a "tangled ball of concepts" and questioned whether these varied terms hinder interpretation and subsequent implementation in the education system. Different countries have distinct definitions of digital literacy within their curricula, leading to discrepancies such as digital skills, digital competencies, digital literacy, ICT competencies, etc.

By analyzing the fundamental rationale, these terms encompass perspectives from two primary categories: teachers' instructional identities and social identities.

From the lens of teachers' instructional identities, according to Vlasenko et al. (2021), teacher digital literacy is rooted in the adept use of digital technology to enrich the teaching and learning processes. This proficiency goes beyond technical skills; it includes the ability to seamlessly integrate technology into teaching, effectively manage digital resources, and foster digital citizenship among students.

Kolodyazhna (2023) suggests that teacher digital literacy profoundly impacts teaching effectiveness and student outcomes. Future teachers should be both researchers and practitioners, organizers and implementers, managers and analysts, programmers and psychologists. Digital literacy is inseparable from the realities of post-industrial society and digital industrialization, as well as cross-disciplinary competencies to address future challenges. Angeli and Valanides (2009) propose that teacher digital literacy comprises identifying subjects, recognizing representations, identifying teaching strategies, selecting appropriate ICT tools, and recognizing appropriate classroom technology integration strategies. Chen et al. (2017) divides the composition of digital competencies into motivation and values, cognitive awareness of technology and methods, application of technology methods, and reflective evaluation.

From the perspective of teachers' social identities, more attention is given to the transformation of teachers' roles and information ethics in the digital age. For instance, Gilster (1997) introduced the concept of digital literacy, defining it as the ability to understand and use information from various digital sources. Later, researchers expanded this concept to include not only technical skills but also cognitive and socio-emotional skills related to using digital technology. A study in Indonesia which assessed primary school teachers' digital literacy levels, categorizes digital literacy into three dimensions: technical, cognitive, and ethical (Atmojo et al, 2022). The European Commission proposed a digital competence framework that includes not only technical skills but also skills related to information management, communication, problem-solving, and security. Recently, the focus has shifted toward the ethical and responsible use

of digital technology, reflecting the growing concern for issues like data privacy and digital citizenship. A study in Thailand integrated the concepts of digital citizenship literacy and interdisciplinary community-based learning, proposing guidelines to promote digital citizenship literacy among preservice teachers. It identified key digital competencies, including digital access, digital literacy, digital business, digital security and resilience, digital participation and agency, digital emotional intelligence, digital innovation and creativity, digital communication, digital ethics, and digital health and well-being (Jarupongputtana et al., 2022).

### **3. Standard Framework for Teachers' Competencies in the Digital Age**

The keynote "Teachers at the heart of education recovery" echoed prominently during World Teachers' Day in 2021, highlighting their significance at this critical juncture in the history of education (UNESCO, 2021c). As the world grappled with the aftermath of the COVID-19 pandemic, a report titled "Reimagining our Futures Together: A New Social Contract for Education", commissioned by United Nations Educational, Scientific and Cultural Organization (UNESCO, 2021a), underscored the ongoing reconfiguration of education for recovery. This underscores the urgency to address essential questions: Can teachers worldwide effectively adapt to the post-pandemic era and the evolving educational landscape? Do they possess the necessary capabilities in teaching, psychology, and technology to innovate and excel?

A 2021 global survey conducted by UNESCO, United Nations International Children's Emergency Fund (UNICEF), the World Bank, and the Organization for Economic Co-operation and Development

(OECD) offers valuable insights into the digital competencies of teachers worldwide. The survey highlighted that, as of 2020, in 40% of countries, only three-quarters or more of teachers had received training in remote teaching methods and effective technology utilization (UNESCO, 2021b). Despite the two-decade existence of remote and blended learning, the current statistics present a less optimistic picture. They underscore the critical need for significant advancements in adequately preparing teachers for digital transformation. Given the rapid emergence of empowering technologies, teachers urgently need to upgrade their expertise and pedagogical knowledge to fully leverage technological advancements.

The pervasive influence of digital technology has ushered in significant changes across various aspects of individuals' lives, from interpersonal communication to work life and knowledge construction. Simultaneously, it has revolutionized people's behaviors

and thought processes. For educational professional, possessing an adequate level of digital literacy is imperative. This literacy enables them to unlock the full potential of digital technology, enrich information-based teaching and learning, and effectively equip students for life and work in the digital age. For this purpose, we have made a comparative analysis of three representative standards for educators' digital literacy (Table 1). They are the International Society for Technology in Education 2017 Educator Standards (ISTE, 2017), the UNESCO Information and Communication Technology Competency Framework for Teachers (UNESCO, 2018), and the International Board of Standards for Training, Performance, and Instruction General Teacher Competencies for Face-to-Face, Online, and Blended Learning Environments (IBSTPI, 2004). These frameworks provide crucial foundations for enhancing educators' digital literacy, offering essential guidelines to prepare them effectively for the digital shift in education.

**Table 1**

*Comparative analysis of teacher digital literacy standards*

<b>Standards</b>	<b>ISTE</b>	<b>ICT-CFT</b>	<b>IBSTPI</b>
Background information	In 1996, the United States articulated its aspiration to establish world-class education standards. Subsequently, ISTE promulgated standards in the years 1998, 2000, and 2002. In 2017, the focus shifted towards technology-driven innovative pedagogy with the release of the Educator Standards.	UNESCO embarked on research concerning teacher ICT competency standards in 2007, issued the initial version in January 2008. The third edition of ICT-CFT was announced in 2018.	The standards for face-to-face, online, and blended teaching environments in 2004. These standards address the impact of technology on the educational landscape and outline the teaching competencies for three distinct environments.

Components	Seven dimensions: learners, leaders, citizens, collaborators, designers, facilitators, and analysts, along with a total of 24 specific indicators.	Three stages: acquiring knowledge, deepening knowledge, and creating knowledge. Six dimensions: understanding educational technology, curriculum and assessment, pedagogy, digital skills application, organization and management, and teacher professional development.	Five competency dimensions, 18 competency indicators, and 97 performance indicators: (1) professional foundations; (2) planning and preparation; (3) teaching methods and strategies; (4) assessment and Evaluation; (5) classroom management.
Characteristics	(1) focus on the development of students' core competencies; (2) are based on TPACK (3) highlight digital citizenship literacy; (4) reflect foresight ahead of its time.	(1) utilize ICT to cultivate students' knowledge society skills; (2) establish project-based learning communities; (3) employ digital tools for ubiquitous learning (4) encourage innovative teachers in the digital age.	(1) emphasize digital teaching environments, addressing online, offline, and hybrid scenarios (2) originate from and guide practice. (3) built on a substantial foundation of research.
Usage scope	For all educators.	For teachers from over 100 countries and regions worldwide.	For teaching competencies across various fields and industries.

### 3.1. ISTE

ISTE, a non-profit professional organization in the educational technology field, boasts a significant membership base. Through its emphasis on the application of technology in teaching, solution creation, and the ISTE standards, ISTE aims to enhance learning opportunities for all. The organization envisions empowering educators to leverage technology for innovative teaching and inspire learners to achieve their utmost potential. Within the ISTE Standards Community, educators can connect with peers and grasp insights on implementing the ISTE Standards for Educators in their classrooms. In June 2017, ISTE updated and released the Educator Standards (ISTE, 2023), striving to deepen educators' practice, promote collaboration with peers, challenge educators to rethink traditional approaches and help educators

prepare students to drive their own learning.

The ISTE standards underscore the centrality of students' core competencies, aligning with the TPACK model and placing a strong emphasis on digital citizenship literacy. They serve as a roadmap, enhancing students' learning capabilities, promoting collaboration, challenging traditional approaches, and preparing students for self-driven learning. Upon analyzing ISTE's educator standards, it becomes evident that ISTE not only advocates for integrating digital technology into education but also champions a forward-thinking educational philosophy. Considering the evolution of artificial intelligence, educators are critical stakeholders in driving educational transformation through digital technology. This raises the essential question of whether educators are suitably prepared for

the future integration of AI in teaching.

### **3.2. UNESCO ICT-CFT**

In 2007, UNESCO partnered with Microsoft, Intel, Cisco, ISTE, Virginia Tech, and other stakeholders to launch “The Next Generation of Teachers Project.” The project’s objective was to research ICT competency standards for teachers across 100+ countries and regions globally. UNESCO introduced the “UNESCO ICT Competency Standards for Teachers,” outlining comprehensive indicators, dimensions, and relevant resources. These guidelines aimed to assist all teachers, particularly in designing teacher education programs and training materials, enabling them to significantly contribute to the development of technologically proficient students. Drawing on insights from experts and users worldwide, UNESCO unveiled the “UNESCO ICT Competency Framework for Teachers” during the 36th General Conference in November 2011. In 2018, a collaborative effort involving organizations such as the International Federation for Information Processing (IFIP), Microsoft, European Schoolnet, and the European Center in Seville led to the iteration of the third edition of the ICT-CFT Framework (UNESCO, 2018). This updated edition provided explicit standards and guidance to help teachers enhance their digital competencies. It categorized teachers’ ICT use into three progressive levels: knowledge acquisition, deepening knowledge, and creating knowledge, each further subdivided into six practice dimensions: understanding policies on the application of digital technology in education, curriculum and assessment, teaching methods, digital skills application, organization and management, and teacher professional learning. Overall, the third edition introduced 18 competency indicators. It underscored that teachers should not only possess ICT application

competencies but should also effectively utilize ICT to nurture collaborative, problem-solving, creative learners, and innovative societal contributors. UNESCO conducted a survey on the implementation of the second edition of the framework, revealing its direct influence on national policies concerning ICT education application, teacher standards, ICT application competency assessment standards, curriculum design, and the development of teacher professional development courses. It has proven to be immensely instructive in enhancing teachers’ teaching abilities in the information age.

Despite subsequent iterations, the foundational set of 20 modules remained unchanged, encompassing five critical aspects: curriculum, teaching, information literacy, organizational management, and professional development. Primarily, the framework categorizes and defines teacher teaching competency standards from the perspective of teaching activities, concentrating on teachers’ comprehension and mastery of curriculum and teaching. The goal of the framework is to bolster teachers’ understanding of ICT, leverage ICT to cultivate students’ skills for the knowledge society, establish project-based learning communities, utilize digital tools for ubiquitous learning, promote teachers’ information leadership, and facilitate their transformation into innovative educators in the information age. These aspirations serve as inspiration for enhancing teachers’ competence in information technology education (Yang & Diao, 2021).

### **3.3. IBSTPI**

The IBSTPI first published these standards in 2004. The standards mark a crucial shift from the traditional “teaching profession” to a more professionalized approach, playing a pivotal role in enhancing the stature and

professionalism of educators. IBSTPI had previously released two sets of teacher literacy standards in 1988 and 1993, tailored for “face-to-face” teaching scenarios. However, the 2004 version recognized the evolving teaching landscape shaped by technology, placing a significant emphasis on teachers’ digital teaching capabilities and related digital literacy (IBSTPI, 2004).

The updated edition integrated new educational technology content, featuring 98 indicators, with 13 dedicated to information technology application. The description of competency content included educational technology behaviors. These standards, spanning from competency and performance indicators to behavioral expectations, are highly practical and directly relevant to effective teaching. They underscore how teachers should adeptly apply technology in instruction and make informed decisions regarding its appropriateness throughout the teaching process.

### ***3.4. Comparative analysis of teacher development frameworks***

The endeavor to comprehensively understand and evaluate teacher development frameworks is critical for advancing educational practices and ensuring effective pedagogical strategies. In this analysis, we closely examine three prominent frameworks, seeking to elucidate how these frameworks converge and diverge in their approach to enhancing teacher development and, consequently, shaping the landscape of modern education.

In the realm of shared objectives, all three standards emphasize the crucial role of technology in optimizing teaching methodologies from a learner-centric perspective. They advocate for the customization of learning environments and

resources to suit the diverse backgrounds and learning styles of students. This pedagogical approach aligns coherently with constructivist educational philosophies, placing students at the center of the learning experience and resonating with contemporary educational paradigms.

Despite variations in granularity and articulation, the standards converge on fundamental competency dimensions. These include fostering self-directed learning, honing communication proficiency, cultivating collaborative aptitude, encouraging innovative thinking, and developing adeptness in problem-solving. Furthermore, they uniformly recognize professional development in teaching (teacher learning) as a foundational competency dimension, reaching a consensus on the professionalization of educators.

In the domain of technological integration, the trinity of standards positions technological proficiency and awareness as foundational baseline competencies, which represents a significant shift from traditional teaching to a more professionalized approach. They intricately analyze curriculum design, development, application, management, and evaluation through the lens of technology-empowered pedagogy. Notably, they accentuate the key role of innovation and creativity in educational technology integration.

While these frameworks converge on multiple facets, they also bear unique hues that deserve our thoughtful consideration.

Shifting focus towards distinctive attributes, the ISTE standard initiates a discourse on the societal role attributes of educators in the digital age. It engages in an inductive approach, delineating the normative state of educators from fundamental logical categorizations. The ISTE standard’s ambit

is extensive, imparting high applicability and flexibility, particularly suited for frontline educators and educational institutions.

On the other hand, the ICT-CFT framework extensively elaborates on diverse competency dimensions that educators should embody within the sphere of educational practice. Noteworthy for its logical clarity, this standard facilitates institutions in executing teacher evaluation and training initiatives. Its broad applicability renders it highly versatile. Additionally, the standard undergoes frequent updates, serving as a pragmatic guide and reference for the formulation of relevant standards and policy decisions in numerous developing nations. Examples include China's Information Technology Application Competency Standards for Primary and Secondary School Teachers and Information Technology Teaching Competency Standards for Normal College Students.

Lastly, the IBSTPI Standard places greater emphasis on specific implementation indicators, especially in evaluating teachers' blended teaching proficiencies in both online and offline settings, and the development of relevant teacher learning resources. It holds significant reference value, particularly as blended learning has become the norm and trend in education. Therefore, if this standard undergoes subsequent up-dates and iterations, it is poised to yield even greater benefits.

In summary, the three competency standards represent a collective effort to promote digitalization in education and elevate the professionalization of teachers globally. The shared emphasis on essential competencies and the integration of technology reflects a unified vision to equip educators with the tools and skills necessary to navigate the ever-changing educational context effectively. This analytical exploration of commonalities and specificities offers a nuanced understanding of

the features characterizing these frameworks for teacher development. This comprehension is beneficial in tailoring effective teacher training and development initiatives to suit diverse educational contexts and requirements.

#### **4. Development Strategies to Enhance Teacher Digital Literacy**

In the preceding discussion, we thoroughly explored the essence of teacher digital literacy and delved into an analysis of three prominent standards. In fact, the theme of enhancing teacher digital literacy has garnered significant attention from major international organizations, regional entities, and national institutions. Moreover, these organizations have accorded a high priority to advancing teacher digital literacy, undertaking proactive measures and engaging in corresponding practical initiatives to support the digital transformation of teaching capabilities.

##### **4.1. International level strategies**

UNESCO, a key advocate for improving global education, has strategically established organizational structures to elevate teachers' teaching abilities. UNESCO launched the UNESCO Teacher Education Center (UNESCO TEC) in Shanghai, which aims to facilitate global teacher education, with a particular focus on supporting developing countries in Asia-Pacific and Africa to improve teacher quality and educational standards. Supported by UNESCO, TEC aspires to become a global service provider, standard-setter, and research and resource management center in the field of teacher education, encompassing four major functions: knowledge production, capacity building, technical services, and information sharing (Shanghai, 2023).

Additionally, UNESCO Regional Bureau

for Education in Latin America and the Caribbean (OREALC/UNESCO Santiago) has implemented a regional strategic policy targeting teacher education. This initiative aims to encourage the formulation of teacher professional policies in Latin American and Caribbean countries by generating and disseminating specialized knowledge. The strategy is supported by the Center for Education Policy and Practice Research (CEPE) at the Catholic University of Chile (UNESCO, 2015).

Furthermore, the Joint International Labour Organization (ILO)-UNESCO Committee strongly advocates for considering ICT competence as a foundational component of the teaching profession. Member states are urged to integrate ICT competence development for teachers across all levels. The Joint Committee emphasizes the need for ICT-rich teaching methods in both pre-service and in-service teacher education programs and institutions. The Joint Committee also calls upon labor organizations, the ILO, UNESCO, member states, higher education institutions, and relevant organizations to collaboratively organize platforms to share experiences and offer recommendations. Moreover, the committee places a significant emphasis on upholding professionalism within higher education teaching. This extends from entry into the profession to lifelong professional development. It emphasizes the need for higher education faculty to develop new teaching skills, particularly for online courses, supported by enhanced guidance for junior faculty. Nations are encouraged to cultivate teaching skills within higher education through courses, workshops, and dedicated centers. This involves creating platforms to share best practices, promoting collaboration between junior and senior educators, and establishing mechanisms to retain exceptional teachers in the classroom (Hilsdon & Randell, 2012).

Supported by the Global Partnership for Education (GPE), UNESCO and Education International (EI) jointly executed collaborative project titled *Improving Teacher Support and Participation in Local Education Groups*. This initiative was designed to tackle the obstacles and challenges outlined earlier, with a specific focus on enhancing teachers' capacity and their representatives to actively engage in social dialogue and policy processes, particularly within Local Education Groups (LEGs). Many third-world countries were involved in the project and this collaboration exemplifies the practical engagement of the GPE in advancing teacher capabilities and promoting their active participation in educational initiatives (Shanghai Normal University, 2023).

#### ***4.2. Regional level strategies***

In a bid to standardize vocational education across diverse systems in Southeast Asian nations and facilitate a shared understanding of proficient vocational teachers in the digital era, the Southeast Asian Ministers of Education Organization Regional Centre for Vocational and Technical Education and Training (SEAMEO VOCTECH) and Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) launched the updated "Regional TVET Teachers Standard for ASEAN" in 2020. This standard delineates competency requisites for vocational educators, encompassing personal, social, and comprehensive competences like vocational research and teaching methods. (SEAMEO VOCTECH and GIZ, 2020).

The Regional TVET Teacher Standard for ASEAN (Association of Southeast Asian Nations) is a crucial tool that defines essential competencies for TVET educators in the region. It acts as a reference and benchmark for the skills and knowledge TVET teachers

should possess. By establishing core competencies, the standard ensures TVET educators adequately pre-prepare their students for the professional world. Possessing this standard is significant for TVET educators in ASEAN as it verifies that they possess the necessary qualifications and competencies to equip their students effectively for the workforce. The accompanying recommendations guide the successful implementation of this standard, reinforcing the importance of TVET instructors possessing the requisite qualifications and competencies for efficient student preparation. Overall, this standard is a pivotal stride in ensuring TVET teachers in ASEAN deliver high-quality education, enhancing the region's workforce readiness.

#### **4.3. National level strategies**

At the national level, governments formulate specific policies to bolster teacher digital literacy. For instance, China has implemented a development strategy for vocational education teachers. The Chinese Ministry of Education emphasize that vocational education holds a strategic position within the country's educational framework, with teachers being central in this regard. Therefore, to align with the spirit of the National Education Conference and implement the National Vocational Education Re-form Implementation Plan, the 13th Five-Year Plan for Educational Informatization and the Educational Informatization 2.0 Action Plan, Ministry of Education of China (2020) issued the Vocational College Digital Campus Standard. This initiative aims to promote the development of "Internet + Vocational Education" and to standardize and guide information technology efforts within vocational colleges in response to the evolving educational landscape. The standard focuses on five dimensions: information awareness

and attitudes, information knowledge and skills, information technology application and innovation, information technology research and development, and responsibilities in an information society. This framework under-scores the teacher's perspective on instructional activities and competence in vocational education.

#### **5. Conclusion**

The comprehensive comparative analysis undertaken in this research sheds light on the multidimensional aspects of teacher digital competence. The exploration into the connotation, frameworks, and strategies across the globe, has highlighted the ever-changing environment of education due to technological advancements. The findings highlight the imperative for teachers to continually enhance their digital skills to effectively navigate modern educational paradigms. Moreover, the analysis accentuates the role of standardized frameworks and tailored strategies in aligning educational objectives with the digital age, thus ensuring that educators remain proficient in their pedagogical endeavors.

By delving into international, regional, and national initiatives, this research stresses the importance of a global perspective in understanding the trajectory of teacher digital competence. It illustrates the collaborative efforts required across different scales to foster a conducive environment for educators' growth and consequently, the advancement of educational systems at large. Additionally, the analysis emphasizes the need for flexibility and adaptability in strategies to cater to diverse educational landscapes and contexts. A one-size-fits-all approach is inadequate in a world where educational disparities and unique circumstances prevail.

Furthermore, this comparative analysis

has broader implications for educational stakeholders and policy makers. It provides valuable insights into the effective integration of technology into pedagogical practices, ensuring a harmonious blend that optimizes student learning outcomes. It serves as a foundational guide for developing teacher training programs, policies, and initiatives that focus on enhancing digital competence. Ultimately, this research serves as a catalyst for informed decision-making and proactive measures to keep pace with the digital transformation sweeping the educational realm.

In summary, this comparative analysis is not only an academic endeavor but a roadmap for the educational community. It illuminates the way forward, emphasizing the critical role of teachers and the need for a collective effort to empower them with the requisite digital competence. As technology continues to evolve, so too must the strategies and frameworks in education. This research invites educational stakeholders to consider and implement the necessary changes, ensuring that education remains a beacon of enlightenment and growth in this digital age.

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