

Understanding Teacher Digital Literacy Development: The Effects of Cultural Capital, Digital Capital, and Training Participation

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ABSTRACT:

Teacher digital literacy has become increasingly important for enhancing educational quality and advancing educational digitalization. However, existing research has focused primarily on measuring teachers' digital competencies, with limited attention given to the mechanisms underlying their development. Drawing on Cultural Capital Theory and Digital Capital Theory, this study examined the effects of cultural capital, digital capital, and training participation on teacher digital literacy and explored the mediating role of training participation. A quantitative research design was adopted, and data were collected from 549 primary school teachers in Hunan Province, China. Structural Equation Modeling (SEM) was employed to test the proposed conceptual framework. The results indicated that cultural capital ($\beta = .277, p < .001$), digital capital ($\beta = .239, p < .001$), and training participation ($\beta = .313, p < .001$) had significant positive effects on teacher digital literacy. In addition, cultural capital ($\beta = .243, p < .001$) and digital capital ($\beta = .280, p < .001$) significantly predicted training participation. Bootstrap analysis further confirmed the mediating role of training participation in the relationships between cultural capital and teacher digital literacy and between digital capital and teacher digital literacy. These findings suggest that teacher digital literacy develops through a process of resource accumulation and capital conversion, in which cultural and digital resources are transformed into professional digital competencies through participation in training. The study contributes to a deeper understanding of teacher digital literacy development and offers practical implications for teacher professional development and educational digitalization policies.

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1. Introduction

The rapid advancement of digital technologies has transformed educational systems worldwide. Digital tools are increasingly integrated into teaching, learning, assessment, communication,

and school management, creating new opportunities for educational innovation. In response, international organizations have emphasized the importance of preparing teachers for digitally enriched learning environments. The

United Nations (2015) highlighted the role of digital skills in achieving inclusive and equitable quality education, while UNESCO (2018) emphasized teachers' capacity to integrate technology into teaching and professional learning. Similarly, the European Commission developed the DigCompEdu framework to support educators' digital competence development (Redecker, 2017), and the OECD (2023) identified teachers as a key driver of successful educational digital transformation. As educational systems increasingly adopt artificial intelligence, online learning platforms, and data-driven practices, teacher digital literacy has become an essential requirement for effective teaching and sustainable educational development.

Teacher digital literacy involves more than the ability to use digital tools. It includes the capacity to evaluate digital resources, integrate technology into pedagogical practices, support students' digital learning, and engage in continuous professional development. Reflecting these developments, China's Ministry of Education issued the Digital Literacy of Teachers Standard (JY/T 0646–2022), which conceptualizes teacher digital literacy as a multidimensional construct comprising digital awareness, digital knowledge and skills, digital application, digital social responsibility, and digital professional development (MOE, 2022). Based on this framework, Peng and Zhu (2024) developed and validated a localized measurement instrument widely used in studies of Chinese teachers. Despite growing scholarly attention, existing research has focused primarily on assessing teachers' digital competence or identifying factors associated with digital literacy development (Yang et al., 2023). Comparatively less attention has been devoted to understanding how teacher digital literacy develops and what mechanisms support this process. Teacher digital literacy is often treated as an individual competency outcome, while the broader social and resource conditions that shape its development remain underexplored.

Resource-based perspectives provide a useful framework for addressing this gap. Cultural

Capital Theory emphasizes the role of educational experiences, knowledge, and cultural resources in shaping learning opportunities and achievement (Bourdieu, 1986). Digital Capital Theory extends this perspective by highlighting the importance of digital access, digital skills, and technology-related resources in contemporary society (Ragnedda & Rui, 2020). Previous studies have shown that both cultural capital and digital capital contribute to educational participation and digital engagement (Addeo et al., 2023; Calderón Gómez, 2020). However, limited research has examined how these two forms of capital jointly influence teacher digital literacy. In addition, although professional training is widely regarded as an important means of enhancing teachers' digital competence, little empirical evidence has explored its mediating role between capital resources and digital literacy.

To address these gaps, this study investigates the relationships among cultural capital, digital capital, training participation, and teacher digital literacy among primary school teachers in China. Drawing on Cultural Capital Theory and Digital Capital Theory, the study develops and tests a structural model using Structural Equation Modeling (SEM). The findings contribute to the literature by explaining the mechanisms underlying teacher digital literacy development, integrating cultural and digital capital within a unified framework, and identifying training participation as an important pathway through which resources are transformed into professional digital competencies.

2. Literature Review

2.1 Teacher Digital Literacy

Teacher digital literacy has become a central concept in contemporary educational research as digital technologies are increasingly integrated into teaching, learning, assessment, and professional collaboration. Although the concept is widely used, its definition remains inconsistent across studies. Related terms such as digital literacy, digital competence, ICT competence, technological literacy, and digital skills have often been used interchangeably, resulting in conceptual ambiguity and measurement

inconsistencies (Pettersson, 2018). Existing literature generally agrees that teacher digital literacy extends beyond technical proficiency and includes the ability to critically evaluate digital information, integrate technology into pedagogical practices, support student learning in digital environments, and engage in continuous professional development (Falloon, 2020). It is therefore increasingly viewed as a multidimensional professional competence involving technological, pedagogical, cognitive, ethical, and reflective dimensions (Pettersson & Näsström, 2020).

An important contribution to this field was made by Ferrari (2012), who defined digital competence as the combination of knowledge, skills, attitudes, strategies, and awareness required for the effective, critical, and responsible use of digital technologies. Subsequent studies emphasized that teachers require context-specific digital competencies that support educational innovation and adaptation to changing technological environments (Gisbert & Caena, 2022). Research has also shown that differences in access to technological resources, institutional support, and professional learning opportunities may contribute to disparities in teachers' digital literacy development (Özdemir et al., 2023).

To support the assessment and development of teacher digital literacy, several frameworks have been proposed. Internationally, DigCompEdu provides a comprehensive framework for educators' digital competence across multiple domains of professional practice. At the policy level, UNESCO and the World Bank (2021) emphasized that strengthening teachers' digital competencies is essential for promoting educational digital transformation and ensuring equitable learning opportunities. In China, the Ministry of Education issued the *Digital Literacy of Teachers Standard* (JY/T 0646–2022), which conceptualizes teacher digital literacy as comprising five dimensions: digital awareness, digital knowledge and skills, digital application, digital social responsibility, and digital professional development (MOE, 2022). Based on this framework, Peng and Zhu (2024) developed and validated a measurement

instrument that has been widely applied in studies of Chinese teachers.

Despite substantial progress in conceptualization and measurement, existing research has focused primarily on assessing teachers' digital literacy and identifying related factors, while relatively limited attention has been given to understanding the resource-based mechanisms underlying its development. From the perspective of the third-level digital divide, inequalities increasingly emerge in the outcomes and benefits individuals derive from digital technologies rather than merely in access or usage (van Dijk, 2020). This perspective highlights the need for further research examining how educational and social resources contribute to teacher digital literacy development.

2.2 Cultural Capital and Teacher Digital Literacy

Cultural Capital Theory, developed by Bourdieu (1986), has been widely used to explain differences in educational opportunities, learning outcomes, and professional development. Cultural capital refers to the knowledge, skills, dispositions, values, and cultural resources acquired through socialization and educational experiences. Unlike economic capital, cultural capital shapes how individuals perceive, interpret, and respond to opportunities within particular social and institutional contexts. Bourdieu (1986) identified three forms of cultural capital: embodied cultural capital, which includes knowledge, dispositions, and competencies; objectified cultural capital, which refers to cultural goods and educational resources; and institutionalized cultural capital, which consists of formally recognized qualifications and credentials. Together, these forms of capital influence individuals' capacity to acquire knowledge, adapt to change, and participate effectively in professional activities. Subsequent studies further emphasized that cultural capital is reflected not only in educational qualifications but also in cultural participation, knowledge acquisition, and learning dispositions that facilitate educational success (Sullivan, 2001). Moreover, cultural capital enables individuals to navigate

institutional environments and effectively utilize educational resources, thereby generating advantages in learning and professional development (Lareau & Weininger, 2003).

Although originally developed to explain educational inequality among students, Cultural Capital Theory has increasingly been applied to teachers' professional development. Teachers with higher levels of cultural capital are often characterized by stronger learning habits, broader educational experiences, and richer professional knowledge, all of which may facilitate adaptation to educational innovation and digital transformation. Previous studies have shown that cultural capital contributes to educational achievement and competence development. Empirical evidence has consistently demonstrated that cultural capital contributes to educational achievement and competence development by facilitating access to learning resources and opportunities (Dumais, 2002). Breinholt and Jäger (2020) argued that cultural capital influences performance not only through knowledge and skills but also through learning dispositions that support continuous competence acquisition. Similarly, Shani and Bar-Haim (2025) found that cultural capital remains an important mechanism shaping access to valued knowledge and learning opportunities. These advantages may strengthen teachers' capacity to engage with new technologies and develop digital competencies. Recent studies have also highlighted the relationship between cultural resources and digital development. Pitzalis and Porcu (2024) argued that digital competencies cannot be fully understood without considering the broader cultural and educational resources available to individuals. Although digital capital and cultural capital are distinct constructs, digital competencies are closely connected to the cultural experiences and learning resources that shape how individuals use and benefit from technology. In the context of teacher digital literacy, teachers with richer cultural resources may possess stronger self-directed learning abilities, greater confidence in acquiring new knowledge, and more opportunities to participate in professional learning activities. Consequently,

teacher digital literacy can be understood not only as a technological competence but also as an outcome of accumulated cultural resources and learning experiences. Based on these theoretical and empirical arguments, this study proposes that cultural capital positively contributes to teacher digital literacy.

2.3 Digital Capital and Teacher Digital Literacy

Digital capital has emerged as an important concept for understanding inequalities in digital engagement and outcomes. Building on Bourdieu's theory of capital, Ragnedda (2018) conceptualized digital capital as a distinct form of capital consisting of digital technologies and digital competencies that individuals accumulate and mobilize to achieve desired outcomes. Unlike cultural capital, which reflects broader cultural knowledge and educational experiences, digital capital specifically captures an individual's capacity to access, use, and benefit from digital technologies. Ragnedda et al. (2019) further operationalized digital capital as a multidimensional construct comprising digital access and digital competence, while Ragnedda and Rui (2020) demonstrated how digital capital functions as a bridge between online experiences and offline opportunities. From this perspective, digital capital represents not only technological resources but also a strategic asset that can be accumulated and converted into social and professional advantages. The growing significance of digital capital is closely related to research on the third-level digital divide. While early studies focused on inequalities in access to technology and digital skills, more recent research has emphasized differences in the benefits individuals obtain from digital engagement. Van Deursen and Helsper (2015) argued that individuals with similar levels of access and skills may nevertheless achieve very different outcomes from digital participation. Similarly, Cruz-Jesus et al. (2012) demonstrated that disparities in digital resources and competencies contribute to unequal digital outcomes. Building on this perspective, Calderón Gómez (2020) proposed that digital capital serves as a mechanism through which economic, cultural, and social resources

are transformed into digital advantages. Villar-Onrubia et al. (2022) further argued that digital capital provides a useful framework for understanding how digital resources are accumulated and converted into educational and professional opportunities. Likewise, Addeo et al. (2023) found that individuals with higher levels of digital capital are more capable of using digital technologies effectively and deriving meaningful benefits from their digital experiences. These findings suggest that digital capital plays a key role in determining how individuals convert digital opportunities into valuable outcomes.

In educational contexts, digital capital may provide a crucial foundation for teacher digital literacy development. Teachers with greater access to digital technologies and stronger digital competencies are more likely to engage confidently with digital tools, explore innovative teaching practices, and adapt to changing educational environments. Digital capital also supports continuous professional growth by enabling teachers to access online learning resources, participate in professional networks, and integrate emerging technologies into instruction. Recent studies have similarly shown that digital capital contributes significantly to the development of digital competencies and technology-related learning outcomes (Nguyen & Habók, 2024; Meng et al., 2024). Rodríguez-Camacho et al. (2024) further highlighted the role of digital capital in generating social and professional advantages, while Pitzalis and Porcu (2024) argued that digital capital increasingly interacts with cultural capital in shaping educational opportunities and professional differentiation. Although digital capital is distinct from teacher digital literacy, it provides important resources that facilitate the development of digital literacy in educational settings. Therefore, teachers with higher levels of digital capital are expected to demonstrate stronger teacher digital literacy.

2.4 Training Participation and Teacher Digital Literacy

Training participation has long been recognized as an important mechanism for supporting

teachers' professional growth and improving instructional quality. As educational systems continue to evolve in response to technological innovation and changing learning needs, teachers are increasingly required to update their professional knowledge and competencies throughout their careers. Professional learning activities provide opportunities for teachers to acquire new knowledge, develop pedagogical skills, and adapt to emerging educational demands. Kennedy (2016) argued that effective professional development should move beyond the transmission of information and enable teachers to apply new knowledge in practice. Similarly, Sancar et al. (2021) described professional development as a lifelong learning process that supports the continuous acquisition of knowledge, skills, and professional competence. From this perspective, training participation represents an important pathway through which teachers engage in continuous learning and professional improvement. The effectiveness of training participation depends not only on attendance but also on the quality of professional learning experiences. Desimone (2009) proposed five core features of effective professional development: content focus, active learning, coherence, duration, and collective participation. These characteristics help teachers acquire relevant knowledge, reflect on practice, and sustain professional learning over time. Darling-Hammond et al. (2017) further argued that effective professional development should be sustained, collaborative, content-focused, and closely connected to teachers' instructional practice. Subsequent studies have consistently supported the importance of these features. Antoniou and Kyriakides (2013) emphasized that professional development is most effective when it addresses teachers' instructional needs and encourages collaboration and reflection, while Smylie (2014) highlighted the importance of continuous support and opportunities to apply newly acquired knowledge. Collectively, these perspectives suggest that training participation serves as a mechanism through which learning opportunities are translated into professional competence.

Training participation may also function as a resource-conversion mechanism. Reay (2004) argued that educational advantages emerge when individuals are able to mobilize and convert available resources into meaningful learning opportunities. Similarly, Hora and Blackburn Cohen (2017) suggested that participation in professional learning is influenced by individuals' prior knowledge, experiences, and access to educational resources. Teachers with richer cultural resources and stronger digital capacities are therefore often better positioned to identify, access, and benefit from professional learning opportunities. Through participation in training activities, these resources can be transformed into practical knowledge, instructional innovation, and enhanced professional capabilities. This role becomes particularly important in the context of educational digitalization, where teachers are expected to continuously update their digital knowledge and instructional practices. Professional learning activities provide opportunities to develop technology-related competencies, explore innovative pedagogical approaches, and gain confidence in the use of digital tools. Basilotta-Gómez-Pablos et al. (2022) similarly reported that targeted professional development programs play a significant role in strengthening teachers' digital competencies and technology integration practices. Tondeur et al. (2021) argued that the development of teachers' digital competencies requires adaptive and context-sensitive professional learning experiences rather than standardized training approaches. Similarly, Li et al. (2019) found that teachers demonstrate diverse professional learning needs regarding technology integration, highlighting the importance of targeted training opportunities. Martin et al. (2022) reported that participation in well-designed professional development programs significantly enhanced teachers' digital knowledge and technology integration capabilities. More recently, Mulaimović et al. (2025) showed that sustained professional learning opportunities facilitated the transfer of newly acquired digital competencies into educational practice. Likewise, Trixa and Kaspar (2024) found that participation in digital-focused professional learning activities

contributes positively to teachers' digital literacy development and technology-related self-efficacy. Collectively, these findings suggest that training participation not only contributes directly to teacher digital literacy but also serves as an important mechanism through which cultural and digital resources are transformed into professional digital competencies.

2.5 Conceptual Framework and Hypothesis Development

The literature reviewed in the preceding sections suggests that teacher digital literacy develops through the interaction of resource-based factors and professional learning experiences. Although previous studies have improved understanding of teachers' digital competencies, relatively limited attention has been devoted to explaining the mechanisms through which teacher digital literacy develops. To address this gap, the present study integrates Cultural Capital Theory, Digital Capital Theory, and teacher professional development literature to construct a conceptual framework of teacher digital literacy development.

The framework assumes that cultural capital and digital capital represent two important forms of resources that support teachers' professional growth. Cultural capital influences individuals' learning orientations, knowledge acquisition, and participation in educational activities (Bourdieu, 1986), while digital capital reflects access to digital technologies and the competencies required to use them effectively (Ragnedda & Ruiu, 2020). Teachers with higher levels of cultural and digital capital are generally better positioned to access learning opportunities, engage with educational innovations, and utilize digital resources in their professional practice. Therefore, both forms of capital are expected to contribute directly to teacher digital literacy.

However, resources alone may not automatically translate into professional competencies. Teacher professional development literature suggests that participation in professional learning activities plays an important role in transforming available resources into practical teaching capabilities (Desimone, 2009; Kennedy, 2016). Through training participation, teachers can acquire new

knowledge, strengthen instructional skills, engage in collaborative learning, and develop competencies required for effective technology integration. In the context of educational digitalization, training participation may therefore serve as a mechanism through which cultural and digital resources are converted into digital literacy outcomes.

Figure 1 presents the proposed conceptual framework. The framework assumes that cultural capital and digital capital exert direct effects on teacher digital literacy while also influencing training participation. Training participation, in turn, contributes to teacher digital literacy and potentially mediates the relationships between the two forms of capital and digital literacy. Based on this framework, the following hypotheses are proposed:

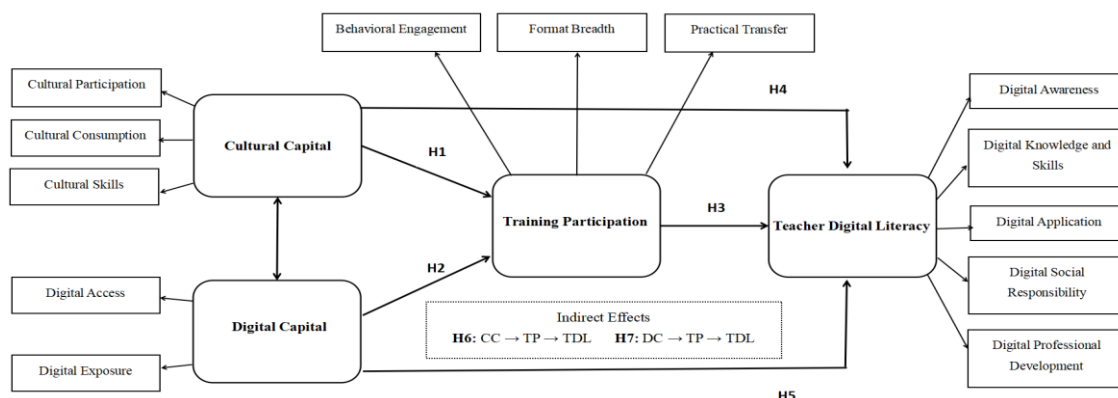


Figure 1: Conceptual framework of teacher digital literacy development

Note. CC = Cultural Capital; DC = Digital Capital; TP = Training Participation; TDL = Teacher Digital Literacy.

H1: Cultural Capital has a significant positive effect on Training Participation.

H2: Digital Capital has a significant positive effect on Training Participation.

H3: Training Participation has a significant positive effect on Teacher Digital Literacy.

H4: Cultural Capital has a significant positive effect on Teacher Digital Literacy.

H5: Digital Capital has a significant positive effect on Teacher Digital Literacy.

In addition to these direct relationships, the study further examines whether Training Participation functions as a mediating mechanism through which Cultural Capital and Digital Capital influence Teacher Digital Literacy. Accordingly, the following mediation hypotheses are proposed:

H6: Training Participation mediates the relationship between Cultural Capital and Teacher Digital Literacy.

H7: Training Participation mediates the relationship between Digital Capital and Teacher Digital Literacy.

3. Methodology

3.1 Research Design

This study adopted a quantitative research design to examine the relationships among cultural capital, digital capital, training participation, and teacher digital literacy. A cross-sectional survey was conducted among primary school teachers in Hunan Province, China. The quantitative approach was selected because the study aimed to test a theoretically derived framework and examine both direct and indirect relationships among multiple latent constructs. The research focused on assessing the effects of cultural capital, digital capital, and training participation on teacher digital literacy, as well as the mediating role of training participation.

Structural Equation Modeling (SEM) was employed to test the proposed conceptual framework. SEM enables the simultaneous assessment of measurement models and structural relationships among latent variables

while accounting for measurement error (Byrne, 2016; Hair et al., 2019). In addition, SEM is widely used to examine mediation effects and complex relationships among multiple constructs. Therefore, it was adopted to evaluate the hypothesized model and explain the mechanisms underlying teacher digital literacy development.

3.2 Research Context and Participants

This study was conducted among primary school teachers in Hunan Province, China. As a province actively promoting educational digitalization, Hunan provides an appropriate context for examining teacher digital literacy development. To enhance regional representativeness, participants were recruited from four cities located in different geographical regions of the province: Changsha, Hengyang, Changde, and Huaihua. These cities differ in terms of economic development, educational resources, and levels of digitalization, allowing the study to capture variation in teachers' cultural, digital, and professional contexts. A stratified sampling strategy was employed to ensure representation across different regions and educational settings. Data were collected through a structured online questionnaire. Participation was voluntary, and

respondents were informed of the purpose of the study and the confidential treatment of their responses.

A total of 600 questionnaires were distributed, of which 549 were retained after data screening and quality control procedures, resulting in a valid response rate of 91.5%. The final sample exceeded the recommended minimum sample size for Structural Equation Modeling (SEM) and was considered sufficient for testing the proposed framework and mediation effects (Hair et al., 2019).

3.3 Instrument

Data were collected using a structured questionnaire comprising four constructs: Cultural Capital (CC), Digital Capital (DC), Training Participation (TP), and Teacher Digital Literacy (TDL). The measurement items were adapted from established instruments that have demonstrated satisfactory validity and reliability in previous studies. All items were measured using a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Table 1 summarizes the constructs, dimensions, number of items, and original measurement sources employed in this study.

Table 1: Constructs, dimensions, and measurement sources

Construct	Dimensions	Items	Source
Cultural Capital (CC)	Cultural Participation; Cultural Consumption; Cultural Skills	14	Balboni et al. (2019)
Digital Capital (DC)	Digital Access; Digital Exposure	11	Addeo et al. (2023)
Training Participation (TP)	Behavioral Engagement; Format Breadth; Practical Transfer	9	Desimone (2009) Martin et al. (2022) Mulaimović et al. (2025)
Teacher Digital Literacy (TDL)	Digital Awareness; Digital Knowledge and Skills; Digital Application; Digital Social Responsibility; Digital Professional Development	30	Peng & Zhu (2024); MOE (2022)

The Cultural Capital scale was primarily adapted from the Scale of Cultural Capital developed by Balboni et al. (2019), with additional conceptual guidance from Vryonides (2007) regarding the operationalization of cultural capital in educational research.

The Digital Capital scale was adapted from the measurement framework proposed by Addeo et al. (2023) and informed by the theoretical conceptualization of digital capital developed by Ragnedda and Ruiu (2020). The measurement of Training Participation was based on Desimone's (2009) professional development framework and supported by subsequent studies on teacher professional learning and engagement (Martin et al., 2022; Mulaimović et al., 2025). Teacher Digital Literacy was measured using a scale adapted from Peng and Zhu (2024) and aligned with the Digital Literacy of Teachers Standard issued by the Ministry of Education of China (MOE, 2022).

Prior to the main survey, the questionnaire was reviewed by five experts in education, teacher professional development, and quantitative research methodology to assess content validity, item clarity, and contextual appropriateness. Based on their recommendations, several items were refined to improve wording precision and reduce potential conceptual overlap. A pilot study involving 53 primary school teachers was subsequently conducted to evaluate instrument clarity and preliminary reliability.

The results indicated satisfactory internal consistency across all constructs, with Cronbach's alpha values exceeding the recommended threshold of .70. These findings confirmed the adequacy of the instrument for large-scale data collection and subsequent statistical analysis. The complete questionnaire used in this study is provided in the Appendix.

3.4 Data Analysis

Data analysis was conducted using SPSS version 26 and AMOS version 24. SPSS was used for data screening, descriptive statistics, correlation analysis, and reliability assessment. Descriptive statistics were computed to summarize the study variables, while Pearson correlation analysis was performed to examine relationships among the constructs. Reliability and convergent validity were assessed using Cronbach's alpha, composite reliability (CR), and average variance extracted (AVE). AMOS was employed to conduct Confirmatory Factor Analysis (CFA) and Structural Equation Modeling (SEM). CFA was first performed to evaluate the measurement model, including construct reliability, convergent validity, and discriminant validity. After establishing an acceptable measurement model, SEM was used to test the hypothesized relationships among cultural capital, digital capital, training participation, and teacher digital literacy. Model fit was evaluated using commonly reported fit indices, including χ^2/df , CFI, TLI, and RMSEA (Byrne, 2016; Hair et al., 2019). The mediating role of training participation was examined using a bootstrap procedure with 5,000 resamples and bias-corrected 95% confidence intervals. Mediation effects were considered significant when the confidence intervals did not include zero.

4. Results and Findings

4.1 Respondents' Profile

The demographic characteristics of the respondents are presented in Table 2. A total of 549 valid responses from primary school teachers in Hunan Province were included in the analysis. Female teachers accounted for a larger proportion of the sample (59.7%) than male teachers (40.3%). Most respondents were between 36 and 55 years of age, and teachers with 10 years or less of teaching experience represented the largest group.

Table 2: Demographic characteristics of participants

Variable	Category	Frequency (n)	Percentage (%)
Gender	Male	221	40.3
	Female	328	59.7
Age	≤25 years	87	15.8
	26–35 years	119	21.7
	36–45 years	148	27.0
	46–55 years	140	25.5
	≥56 years	55	10.0
Teaching Experience	≤5 years	191	34.8
	6–10 years	140	25.5
	11–15 years	122	22.2
	16–20 years	66	12.0
	>20 years	30	5.5
Educational Qualification	Diploma	84	15.3
	Bachelor's Degree	226	41.2
	Master's Degree	160	29.1
	Doctoral Degree	55	10.0
	Other Qualifications	24	4.4
Professional Title	Third-grade Teacher	129	23.5
	Second-grade Teacher	134	24.4
	First-grade Teacher	119	21.7
	Senior Teacher	104	18.9
	Professor-level Senior Teacher	63	11.5

Note. $N = 549$.

Regarding educational qualifications, the majority of respondents held a bachelor's degree (41.2%), followed by a master's degree (29.1%). The distribution of professional titles was relatively balanced across different ranks. Overall, the sample reflected considerable diversity in demographic and professional characteristics, providing an appropriate basis for examining the relationships among cultural capital, digital capital, training participation, and teacher digital literacy.

4.2 Descriptive Statistics and Correlations

The descriptive statistics and correlations among the study variables are presented in Table 3. The mean scores ranged from 3.522 to 3.590, indicating moderate to relatively high levels of cultural capital, digital capital, training participation, and teacher digital literacy among the respondents. Digital capital recorded the highest mean score, whereas training participation showed the lowest.

Table 3: Descriptive statistics and correlations

Variable	Mean	SD	1	2	3	4
CC	3.543	0.795	1			
DC	3.590	0.817	.203**	1		
TP	3.522	0.815	.252**	.226**	1	
TDL	3.539	0.696	.381**	.288**	.355**	1

*Note. CC = cultural capital; DC = digital capital; TP = training participation; TDL = teacher digital literacy; N = 549. * $p < .01$.

Pearson correlation analysis revealed significant positive relationships among all study variables ($p < .01$). Cultural capital, digital capital, and training participation were each positively associated with teacher digital literacy. In addition, cultural capital and digital capital were positively related to training participation. These findings provide preliminary support for the proposed conceptual framework. None of the correlation coefficients exceeded the recommended threshold of .85, indicating that multicollinearity was unlikely to be a concern. Therefore, the data were considered suitable for subsequent structural equation modeling analysis.

4.3 Measurement Model

Before testing the structural relationships among the study variables, the measurement model was evaluated using Confirmatory Factor Analysis (CFA). The assessment focused on internal consistency reliability, convergent validity, and

overall model fit. Reliability was examined using Cronbach's alpha and Composite Reliability (CR), while convergent validity was assessed through standardized factor loadings and Average Variance Extracted (AVE).

As shown in Table 4, all dimensions demonstrated satisfactory internal consistency reliability. Cronbach's alpha values ranged from .839 to .906, exceeding the recommended threshold of .70. Similarly, CR values ranged from .839 to .907, indicating acceptable construct reliability. In addition, all standardized factor loadings exceeded .60 and were statistically significant ($p < .001$). Convergent validity was further supported by AVE values ranging from .511 to .689, all of which exceeded the recommended threshold of .50. These results provide evidence of satisfactory reliability and convergent validity for all measurement dimensions.

Table 4: Measurement model assessment

Construct	Dimension	α	CR	AVE
Cultural Capital	CCP	.839	.839	.566
	CCC	.876	.877	.588
	CCS	.875	.875	.602
Digital Capital	DA	.906	.907	.620
	DE	.887	.891	.628
Training Participation	BE	.839	.842	.641
	FB	.862	.863	.682
	PT	.854	.854	.689

Teacher Digital Literacy	DAW	.873	.874	.637
	DKS	.867	.869	.527
	DAP	.903	.904	.511
	DSR	.905	.906	.659
	DPD	.879	.880	.595

Note. α = Cronbach's alpha; CR = composite reliability; AVE = average variance extracted. All factor loadings exceeded .60 and were statistically significant ($p < .001$). Recommended thresholds: $\alpha > .70$, CR $> .70$, and AVE $> .50$.

The overall measurement model demonstrated a satisfactory fit to the data. The model yielded a chi-square to degrees of freedom ratio (χ^2/df) of 1.715, a Comparative Fit Index (CFI) of .932, a Tucker–Lewis Index (TLI) of .929, and a Root Mean Square Error of Approximation (RMSEA) of .036. All fit indices met the commonly recommended thresholds (Byrne, 2016; Hair et al., 2019), indicating that the measurement model adequately represented the observed data and was suitable for subsequent structural model analysis.

4.4 Structural Model and Hypothesis Testing

Following the validation of the measurement model, Structural Equation Modeling (SEM) was conducted to test the hypothesized relationships

among cultural capital, digital capital, training participation, and teacher digital literacy.

As presented in Table 5, cultural capital had a significant positive effect on training participation ($\beta = .243$, $p < .001$), supporting H1. Digital capital also positively influenced training participation ($\beta = .280$, $p < .001$), supporting H2. In addition, training participation exerted a significant positive effect on teacher digital literacy ($\beta = .313$, $p < .001$), supporting H3. The results further revealed that cultural capital had a significant positive effect on teacher digital literacy ($\beta = .277$, $p < .001$), supporting H4. Similarly, digital capital significantly predicted teacher digital literacy ($\beta = .239$, $p < .001$), supporting H5.

Table 5: Structural model results and hypothesis testing

Hypothesis	Path	β	C.R.	p	Result
H1	Cultural Capital $\rightarrow$ Training Participation	.243	3.840	$< .001$	Supported
H2	Digital Capital $\rightarrow$ Training Participation	.280	3.719	$< .001$	Supported
H3	Training Participation $\rightarrow$ Teacher Digital Literacy	.313	4.676	$< .001$	Supported
H4	Cultural Capital $\rightarrow$ Teacher Digital Literacy	.277	4.711	$< .001$	Supported
H5	Digital Capital $\rightarrow$ Teacher Digital Literacy	.239	3.538	$< .001$	Supported

Among the direct predictors of teacher digital literacy, training participation demonstrated the strongest standardized effect, followed by cultural capital and digital capital. Overall, all five

direct-effect hypotheses were supported, providing empirical support for the proposed conceptual framework.

4.5 Mediation Analysis

To examine the mediating role of training participation, a bootstrap procedure with 5,000

resamples and bias-corrected 95% confidence intervals was conducted. The results are presented in Table 6.

Table 6: Bootstrap mediation analysis results

Hypothesis	Indirect Path	Lower 95% CI	Upper 95% CI	Result
H6	CC → TP → TDL	0.040	0.171	Supported
H7	DC → TP → TDL	0.040	0.172	Supported

The findings indicated that training participation significantly mediated the relationship between cultural capital and teacher digital literacy as well as the relationship between digital capital and teacher digital literacy. The indirect effect of cultural capital on teacher digital literacy through training participation was significant (95% CI = [0.040, 0.171]), while the indirect effect of digital capital on teacher digital literacy through training participation was also significant (95% CI = [0.040, 0.172]). Since neither confidence interval included zero, both mediation hypotheses (H6 and H7) were supported.

Overall, the results suggest that training participation serves as an important mechanism through which cultural capital and digital capital contribute to teacher digital literacy development.

5. Discussion

5.1 Effects of Cultural Capital and Digital Capital on Teacher Digital Literacy

The findings indicate that both cultural capital and digital capital exert significant positive effects on teacher digital literacy. Cultural capital showed a positive effect on teacher digital literacy ($\beta = .277$, $p < .001$), while digital capital also significantly predicted teacher digital literacy ($\beta = .239$, $p < .001$). These results suggest that teacher digital literacy is shaped not only by access to digital resources and competencies but also by broader cultural and educational resources accumulated through learning experiences and professional development.

The positive influence of cultural capital supports Bourdieu's (1986) argument that knowledge, dispositions, and cultural resources shape individuals' capacity to acquire new competencies

and adapt to changing environments. Although Cultural Capital Theory was originally developed to explain educational inequality, the present findings suggest that it also provides a useful perspective for understanding teacher development in digital contexts. Teachers with higher levels of cultural capital may be more willing to engage in self-directed learning, pursue professional growth opportunities, and adopt innovative practices, thereby facilitating the development of digital literacy. These findings are consistent with Breinholt and Jæger (2020), who emphasized the role of cultural capital in competence development, and with Shani and Bar-Haim (2025), who highlighted the continuing importance of cultural resources in shaping learning opportunities and professional advancement. The results also confirm the importance of digital capital in explaining teacher digital literacy. Consistent with Digital Capital Theory (Ragnedda & Ruiu, 2020), teachers with stronger digital resources and competencies were more likely to demonstrate higher levels of digital literacy. This finding supports previous studies showing that digital capital enhances individuals' ability to transform digital opportunities into meaningful outcomes (Addeo et al., 2023; Calderón Gómez, 2020). An important finding is that cultural capital exerted a slightly stronger effect on teacher digital literacy than digital capital. This suggests that teacher digital literacy cannot be explained solely by digital access or technological resources. Instead, broader cultural and educational resources appear to play a foundational role in shaping how teachers acquire, utilize, and benefit from digital technologies. This finding aligns with Pitzalis and Porcu (2024), who argued that digital development is embedded

within wider processes of cultural resource accumulation.

Overall, the findings suggest that teacher digital literacy develops through the combined influence of cultural capital and digital capital. While digital capital provides the resources necessary for digital engagement, cultural capital shapes teachers' capacity to learn, adapt, and make effective use of those resources.

5.2 Effects of Cultural Capital and Digital Capital on Training Participation

The findings revealed that both cultural capital and digital capital exerted significant positive effects on training participation. Cultural capital positively predicted training participation ($\beta = .243$, $p < .001$), while digital capital demonstrated a slightly stronger effect ($\beta = .280$, $p < .001$). The positive relationship between cultural capital and training participation supports Cultural Capital Theory. Bourdieu (1986) argued that cultural capital shapes individuals' orientations toward learning, self-improvement, and knowledge acquisition. This finding is consistent with Breinholt and Jæger (2020), who emphasized the role of cultural capital in competence development, and with Park et al. (2016), who highlighted the influence of educational experiences, habitus, and accumulated cultural resources on teachers' professional growth.

Digital capital also emerged as an important predictor of training participation. According to Ragnedda and Ruiu (2020), digital capital comprises both access to digital technologies and the competencies required to use them effectively. As professional development increasingly relies on online platforms and technology-mediated learning environments, teachers with stronger digital capital are better positioned to identify, access, and benefit from these opportunities. This finding supports Addeo et al. (2023), who demonstrated that digital capital enhances participation in digitally enabled activities and facilitates the conversion of technological resources into meaningful outcomes. The slightly stronger effect of digital capital may reflect the growing digitalization of teacher professional

development. Contemporary training programs increasingly utilize online platforms, digital communication tools, and blended learning formats, making digital competencies an important prerequisite for participation. This interpretation is supported by Li et al. (2019), who found that teachers' professional development needs and engagement vary according to their digital experience, and by Martin et al. (2022), who reported that effective participation in digital learning initiatives depends heavily on teachers' ability to utilize digital tools and online resources.

The findings indicate that training participation is shaped by the combined influence of cultural and digital resources. Cultural capital strengthens teachers' motivation and learning orientations, whereas digital capital facilitates access to and engagement in technology-mediated learning opportunities. Consistent with Mulaimović et al. (2025), teachers possessing stronger cultural and digital resources appear more likely to participate actively in professional development and benefit from those experiences. Differences in training participation may therefore reflect broader inequalities in the distribution of cultural and digital resources among teachers.

5.3 Training Participation as a Mediating Mechanism

The bootstrap analysis confirmed that training participation significantly mediated the relationships between cultural capital, digital capital, and teacher digital literacy, supporting H6 and H7. This result highlights the importance of training participation in linking available resources with professional competency development.

The mediating role of training participation can be interpreted as a process of resource conversion. Possessing cultural or digital resources does not automatically lead to higher levels of digital literacy. Rather, these resources need to be activated and transformed through learning experiences before they can contribute to professional competencies. Similarly, teachers with stronger digital capital are better positioned to access online learning resources, participate in

technology-supported training, and benefit from digitally mediated learning environments. Through training participation, these resources are translated into practical knowledge, instructional skills, and technology-related competencies that strengthen teacher digital literacy. This interpretation is consistent with professional development research emphasizing that learning opportunities play a crucial role in transforming existing resources into professional competence (Desimone, 2009; Kennedy, 2016). It is also supported by studies showing that high-quality professional development enhances teachers' digital knowledge, technology integration capabilities, and instructional effectiveness (Martin et al., 2022; Mulaimović et al., 2025).

The findings extend existing research by integrating cultural capital, digital capital, and teacher professional development within a single explanatory framework. Rather than viewing these factors as separate influences, the results suggest that teacher digital literacy develops through a dynamic process in which resources are accumulated and subsequently converted into competencies through participation in professional learning. Training participation therefore functions as a bridge connecting resource possession with professional capability development, providing a more comprehensive explanation of how teacher digital literacy is formed and strengthened in digitally transforming educational contexts.

5.4 Understanding Teacher Digital Literacy Development

The findings contribute to a broader understanding of how teacher digital literacy develops in contemporary educational contexts. Rather than viewing teacher digital literacy as a static collection of technological skills, the results suggest that it is a developmental process shaped by the interaction of resource accumulation, professional learning, and competency formation. This perspective extends existing research that has primarily focused on measuring digital competence levels by emphasizing the

mechanisms through which digital literacy is acquired and strengthened over time.

The results indicate that cultural capital, digital capital, and training participation play distinct but interconnected roles in teacher digital literacy development. Cultural capital provides learning dispositions, educational experiences, and knowledge-oriented attitudes that encourage professional growth, whereas digital capital provides the technological resources and competencies required for effective participation in digital environments. This interpretation is consistent with Pitzalis and Porcu (2024), who argued that digital development is embedded within broader processes of cultural resource accumulation, and with Loh et al. (2023), who highlighted the role of digital resources in shaping educational opportunities and learning outcomes. The mediating role of training participation further demonstrates that resources alone are insufficient to produce professional competencies. Instead, professional learning serves as a mechanism through which cultural and digital resources are activated, mobilized, and converted into digital literacy. This finding aligns with Radulović et al. (2022), who emphasized the importance of educational processes in explaining how resources influence outcomes, and with Ferfolja (2008), who viewed professional learning as a key contributor to the accumulation of teacher capital.

The findings also reinforce the view that teacher development emerges through continuous interactions between personal resources and professional contexts. Park et al. (2016) argued that teachers' professional trajectories are shaped by the interplay of cultural capital, habitus, and educational fields. Similarly, the present study suggests that teacher digital literacy develops through ongoing engagement with professional learning opportunities that enable teachers to utilize and expand their accumulated resources. Viewed from this perspective, teacher digital literacy develops through an integrated pathway in which cultural capital and digital capital provide the necessary resources, while training participation facilitates their conversion into professional digital competencies. This resource-

based explanation offers a more comprehensive understanding of teacher professional growth in digitally transforming educational environments.

6. Conclusion

This study examined the relationships among cultural capital, digital capital, training participation, and teacher digital literacy among primary school teachers in Hunan Province, China. Drawing on Cultural Capital Theory and Digital Capital Theory, a structural model of teacher digital literacy development was proposed and tested using survey data from 549 teachers. The results indicated that cultural capital, digital capital, and training participation all exerted significant positive effects on teacher digital literacy. Cultural capital and digital capital also significantly predicted training participation, while bootstrap analysis confirmed the mediating role of training participation in the relationships between both forms of capital and teacher digital literacy. These findings suggest that teacher digital literacy develops through a process of resource accumulation and resource conversion in which cultural and digital resources provide the foundation for development, whereas professional learning facilitates the transformation of these resources into digital competencies. By integrating Cultural Capital Theory and Digital Capital Theory within a unified framework, this study extends existing research beyond the measurement of digital literacy and provides a resource-based explanation of its development. The findings highlight the importance of strengthening both resource conditions and professional learning opportunities to support teachers' digital literacy and promote sustainable educational digital transformation.

7. Limitations and Future Research

This study has several limitations. First, the cross-sectional design limits the ability to establish causal relationships among cultural capital, digital capital, training participation, and teacher digital literacy. Future longitudinal studies may provide stronger evidence regarding the developmental relationships among these variables. Second, the

study relied on self-reported questionnaire data, which may be influenced by subjective perceptions and social desirability bias. Future research could incorporate multiple data sources, such as classroom observations or performance-based assessments, to provide a more comprehensive evaluation of teacher digital literacy. Third, the sample was limited to primary school teachers in Hunan Province, China, which may restrict the generalizability of the findings to other educational contexts. Future studies may examine the proposed model in different regions, educational levels, or national settings. In addition, other contextual factors, such as school leadership, organizational support, and educational policies, may influence teacher digital literacy development and warrant further investigation.

8. Implications

This study contributes to the teacher digital literacy literature by providing a resource-based explanation of digital literacy development. By integrating Cultural Capital Theory and Digital Capital Theory, the study demonstrates that teacher digital literacy is influenced by both cultural and digital resources. In addition, the findings highlight the mediating role of training participation, suggesting that professional learning serves as an important mechanism through which resources are transformed into digital competencies.

The findings suggest that efforts to improve teacher digital literacy should extend beyond the provision of digital technologies. Educational policymakers and school leaders should strengthen teachers' access to cultural and digital resources while providing continuous and practice-oriented professional development opportunities. Particular attention should be given to encouraging active participation in training activities, as professional learning plays an important role in converting available resources into professional digital competencies. Such efforts may support the sustainable development of teacher digital literacy and educational digital transformation.

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10. Appendix: Survey Questionnaire

Section 1: Demographic Information

Age: ☐ Under 25 ☐ 26–35 ☐ 36–45 ☐ 46–55 ☐ Over 55

Gender: ☐ Male ☐ Female

Teaching Experience: ☐ Under 5 ☐ 6–10 ☐ 11–15 ☐ 16–20 ☐ Over 20 years

Professional Title: ☐ Third-level ☐ Second-level ☐ First-level ☐ Senior ☐ Professor-level Senior Teacher

School Location: ☐ Urban ☐ Rural

Section 2: Main Questionnaire

Scale: 1 = Strongly Disagree, 2 = Disagree, 3 = Slightly Agree, 4 = Agree, 5 = Strongly Agree

Code	Item
The following statements describe competencies that may reflect your digital literacy as a teacher. Indicate the extent to which you agree or disagree with each statement	
TD1.	I believe digital technologies play an important role in education.
TD2.	I understand that digital technologies are changing teaching and learning methods.
TD3.	I am aware of the application of emerging digital technologies, such as artificial intelligence, in education.
TD4.	I recognize the importance of integrating digital technologies into teaching.
TD5.	I can quickly locate, organize, and access the files or resources needed for teaching using computers, tablets, or teaching platforms.
TD6.	I can create or modify digital teaching resources.
TD7.	I can solve basic technical problems when using digital tools, such as device connection issues or software operation problems.
TD8.	I can use assignment platforms, online testing systems, or spreadsheet tools to collect and organize student learning data.
TD9.	I can conduct basic analysis of student learning data, such as comparing students' learning progress or identifying performance differences.
TD10.	I can use charts or digital tools to present teaching outcomes.
TD11.	I can analyze students' learning data to identify their learning difficulties.
TD12.	I plan how to use digital tools before teaching.
TD13.	I use digital tools to support remote or blended learning activities.
TD14.	I use digital tools to design interactive learning activities in teaching.
TD15.	I use digital information to adjust my teaching strategies.
TD16.	I guide students to use digital tools in problem-solving activities.
TD17.	I use digital tools to communicate with parents.
TD18.	I use digital tools to improve teaching effectiveness.
TD19.	I use digital tools to effectively organize and manage classroom activities.
TD20.	I guide students to use digital tools safely and responsibly.
TD21.	I think carefully before expressing my opinions online.
TD22.	I follow the principles of civility and respect in online communication.
TD23.	I only share information online that has been verified and is appropriate.

TD24.	I install security software to protect my digital devices.
TD25.	Even when digital tools are somewhat challenging, I continue to use them.
TD26	I use digital tools to improve my professional knowledge.
TD27	I participate in online training or learning activities.
TD28	I use digital tools to explore solutions to teaching problems.
TD29	I continuously improve my digital teaching methods.
TD30.	I use digital data to evaluate my teaching effectiveness.
The following statements reflect your personal background and cultural experiences related to your teaching profession. Indicate the extent to which you agree or disagree with each statement.	
CC1	I frequently participate in different types of cultural activities, such as exhibitions, performances, museum visits, and lectures.
CC2	I regularly participate in cultural or artistic activities (e.g., at least once a month).
CC3	I actively arrange time to participate in cultural or art-related activities.
CC4	I participate in cultural activities organized by schools or communities.
CC5	I regularly read books, literary works, or other cultural materials.
CC6	I am able to access and use a variety of cultural resources, such as books, media, and exhibitions.
CC7	I use cultural resources to enrich my knowledge and broaden my perspectives.
CC8	I am familiar with different types of cultural content, such as literature, art, and history.
CC9	I use cultural materials to support my teaching activities.
CC10	I possess skills related to cultural expression, such as writing, artistic creation, or performance.
CC11	I am able to express my views clearly in ways that are consistent with cultural norms and practices.
CC12	I am able to apply cultural knowledge to enrich my teaching practices.
CC13	I am confident in understanding cultural topics in educational contexts.
CC14	I am able to integrate cultural elements into classroom teaching activities.
The following statements describe competencies that may reflect your digital capital as a teacher. Indicate the extent to which you agree or disagree with each statement.	
DC1	I am able to access or use digital devices consistently, such as computers, tablets, or smartphones.
DC2	I am able to use a stable internet connection for teaching and professional activities.
DC3	My school provides sufficient digital infrastructure for teaching.
DC4	I am able to access digital tools needed for teaching activities.
DC5	I am able to use online platforms or systems for teaching and communication.
DC6	I have opportunities to receive training or support related to digital technologies.
DC7	I frequently use digital tools in my daily work.

DC8	I use different types of digital tools or platforms in professional activities.
DC9	I am exposed to and try new digital tools in the field of education, such as AI applications or learning platforms.
DC10	I use digital technologies in different stages of teaching, such as lesson preparation, classroom teaching, and assessment.
DC11	Beyond basic requirements, I actively use digital tools to complete additional tasks.
The following statements describe your participation in training or professional development activities related to digital literacy. Indicate the extent to which you agree or disagree with each statement.	
TP1	I actively participate in discussions and interactions during training activities.
TP2	I complete all learning tasks assigned during training.
TP3	I share my teaching experiences or perspectives with others during training.
TP4	I participate in both online and offline digital literacy training programs.
TP5	I participate in teacher training activities from different sources, including school-organized programs, education administration departments, external institutions, or self-enrolled training.
TP6	I receive training on different teaching-related topics, such as classroom management or the use of educational platforms.
TP7	I try to apply the methods or tools learned during training to my daily teaching practices.
TP8	After the training, I continue to use the materials, resources, or tools provided.
TP9	I am confident in transforming what I learned in training into specific teaching activities or instructional improvements based on actual classroom needs.