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Teachers' Digital Literacy, Skills, And Readiness to Integrate Technology in Instruction Among Public School Teachers in Sulu

Judiann Mudjahirin Sali
Department of Education Region IX – Division of Sulu
judiannsali@gmail.com

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ABSTRACT

Digitalization increasingly requires teachers to combine digital competence with pedagogically meaningful technology use. This study examined the relationships among teachers' digital literacy, digital skills, ICT classroom practices, and readiness for technology integration, including the moderating role of school challenges among public elementary school teachers in Sulu. A quantitative cross-sectional survey design was used with 329 teachers drawn from a population of 2,275 through multistage cluster and simple random sampling. Data were collected through a contextualized, expert-validated questionnaire; a pilot test with 10 teachers produced Cronbach's alpha coefficients ranging from .796 to .953. Descriptive statistics, analysis of variance, t-tests, multiple regression, and hierarchical moderated regression were applied. Teachers generally demonstrated high digital literacy and digital skills, while ICT practices were strongest in lesson planning and less consistent in facilitation and assessment. No significant differences were found across the demographic groupings tested. Communication and collaboration literacy, information handling, digital collaboration, and content creation significantly predicted ICT classroom practices. Readiness was significantly predicted by communication and collaboration literacy, ethical and socio-emotional literacy, information handling, content creation, and problem-solving skills. The digital literacy × school challenges and digital skills × school challenges interaction terms were significant, indicating that contextual barriers shaped how competencies translated into readiness. The findings underscore the need to pair competency-focused professional development with reliable infrastructure, institutional support, and enabling school conditions.

Keywords: *digital literacy, digital skills, ICT classroom practices, technology integration readiness, public school teachers, school challenges*

INTRODUCTION

Technology has reshaped instructional planning, communication, assessment, and access to learning resources, making digital competence an increasingly important component of teachers' professional practice. In the Philippine public-school context, this transition requires teachers to move beyond basic device operation toward the purposeful selection, evaluation, creation, and ethical use of digital resources. International frameworks similarly emphasize that meaningful educational technology use depends on both teacher competence and the ability to connect digital tools with pedagogy and content (European Commission, 2017; UNESCO, 2018; Timotheou et al., 2023).

Evidence from different educational settings shows that teachers may possess general confidence in technology while still experiencing difficulty in applying digital tools consistently to instruction. Professional development, pedagogical knowledge, and opportunities for sustained technology use remain important in

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converting digital competence into classroom practice (Greenhow et al., 2021; Tondeur et al., 2021; Dinçer, 2024). In the Philippines, teachers have likewise recognized the value of technology while reporting practical difficulties in effective implementation, particularly where access, infrastructure, and institutional support are uneven (Atilano-Tang & Cirilo, 2023).

These concerns are especially relevant in Sulu, where schools operate across geographically dispersed municipalities and may encounter limitations in connectivity, electricity, equipment, training opportunities, and time for technology-supported preparation. Such constraints can create a gap between what teachers know and what they are able to enact in classrooms. Research on digital divides and school technology adoption indicates that access alone is insufficient; teachers also require enabling organizational conditions and pedagogical support that allow technology to be used for meaningful learning rather than as an isolated technical addition (Alampay & Capule-Navarro, 2023; Bingimlas, 2009; Buabeng-Andoh, 2012).

Despite growing scholarship on teacher digital competence and ICT integration, empirical evidence specific to public elementary teachers in Sulu remains limited. The present study therefore examined whether digital literacy and digital skills varied across selected demographic characteristics, how these competencies influenced ICT classroom practices, the extent to which they predicted readiness for technology integration, and whether school challenges moderated the relationship between digital competencies and readiness. By linking individual competencies with contextual school conditions, the study provides evidence for professional development, resource allocation, and policy decisions intended to strengthen technology-enhanced instruction in the Division of Sulu.

Literature Review

Teachers' Digital Literacy and Digital Skills

Digital literacy encompasses the capacity to access, evaluate, create, communicate, and use information responsibly through digital technologies. UNESCO (2018) treats digital literacy as a multidimensional competency, while Falloon (2020) extends the concept toward teacher digital competence by integrating technical, cognitive, ethical, and pedagogical elements. Similar work emphasizes that teachers require information literacy, communication and collaboration competence, digital content creation, safety awareness, and problem-solving capacities to operate effectively in contemporary learning environments (Sajidan et al., 2023; European Commission, 2017). These competencies are particularly important because teachers function not only as users of technology but also as curators and designers of digital learning experiences.

Digital skills refer more directly to teachers' practical capacity to operate devices and software, manage information, collaborate through digital platforms, create instructional content, and solve technology-related problems. Research indicates that teachers often show uneven development across these domains, especially when professional learning emphasizes basic operation rather than pedagogical use (Tondeur et al., 2021; Koh et al., 2020). Greenhow et al. (2021) further noted that digital teaching requires the ability to evaluate online information and make instructional decisions in rapidly changing environments. Targeted professional development that combines technical and pedagogical practice can therefore strengthen teachers' confidence and competence, especially in settings where access to sustained training is limited (Dinçer, 2024).

ICT Classroom Practices and Readiness for Technology Integration

Teachers' ICT classroom practices include the use of digital tools in lesson planning and preparation, teaching and learning facilitation, and assessment and feedback. The Technological Pedagogical Content Knowledge framework explains that effective integration occurs when technological knowledge is coordinated with pedagogy and subject content rather than applied independently (Mishra & Koehler, 2006). Contemporary research continues to support this integrated view, showing that professional learning designed around TPACK can help teachers move from basic tool use toward instructional applications aligned with learning goals (Jiménez-Sierra et al., 2023). Digital collaboration, information management, and content creation are therefore likely to matter when technology is used for authentic classroom functions.

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Readiness for technology integration also includes teachers' confidence, willingness, pedagogical preparation, technical preparedness, and capacity to connect digital resources with content. The Technology Acceptance Model proposes that perceived usefulness and perceived ease of use influence technology acceptance and behavioral intention (Davis, 1989). This perspective is complemented by the will-skill-tool-pedagogy model, which emphasizes that sustained technology integration depends on more than access to hardware (Knezek & Christensen, 2016). Studies of classroom technology use similarly indicate that collaboration, pedagogical beliefs, and the ability to create or adapt digital learning resources support more meaningful implementation (Alharbi, 2020; Xie et al., 2021).

Demographic Contexts and Professional Development

Teacher characteristics such as age, rank, years of service, and educational attainment are frequently examined as possible sources of variation in digital competence. Some studies suggest that younger educators may be more familiar with emerging tools, whereas experienced teachers contribute stronger pedagogical knowledge that can support effective integration when appropriate assistance is available (Rachmadtullah, 2022; Sailer et al., 2021). These patterns, however, are not uniform across settings, and demographic characteristics do not necessarily determine actual competence or classroom technology use.

Professional development may be more influential when it is continuous, contextualized, collaborative, and connected to teachers' instructional responsibilities. Tondeur et al. (2021) emphasized that digital competence is shaped by professional experience and opportunities for meaningful practice, while Dinçer (2024) highlighted the continuing need to address both technical and pedagogical competencies. The DigCompEdu framework likewise positions professional digital competence as a developmental continuum rather than a fixed attribute (European Commission, 2017). This suggests that support programs should respond to observed competency needs instead of assuming that particular demographic groups are inherently more or less digitally capable.

School Challenges and Enabling Conditions for Technology Integration

School-level barriers can limit technology integration even when teachers possess adequate digital competence. Long-standing reviews identify inadequate equipment, unreliable internet connectivity, insufficient technical support, limited training, and time constraints as recurring barriers to ICT adoption in education (Bingimlas, 2009; Buabeng-Andoh, 2012). In the Philippine setting, electricity and internet access remain important conditions for digital inclusion, particularly in schools where infrastructure varies considerably (Alampay & Capule-Navarro, 2023). These conditions shape whether teachers can consistently transform digital skills into classroom practices.

Enabling conditions are also social and pedagogical. UNESCO (2022) emphasizes that ICT policy and planning should link infrastructure, teacher capacity, curriculum, and institutional support. Timotheou et al. (2023) similarly found that school digital transformation depends on interacting organizational, technological, and human factors. Ethical and socio-emotional competence is also important because technology integration introduces responsibilities related to privacy, digital citizenship, respectful communication, and learner well-being (Capuno et al., 2022; Zheng et al., 2023). Collaboration through digital tools can strengthen professional practice, but teachers need appropriate support to manage online interaction and shared learning effectively (Zuo et al., 2025).

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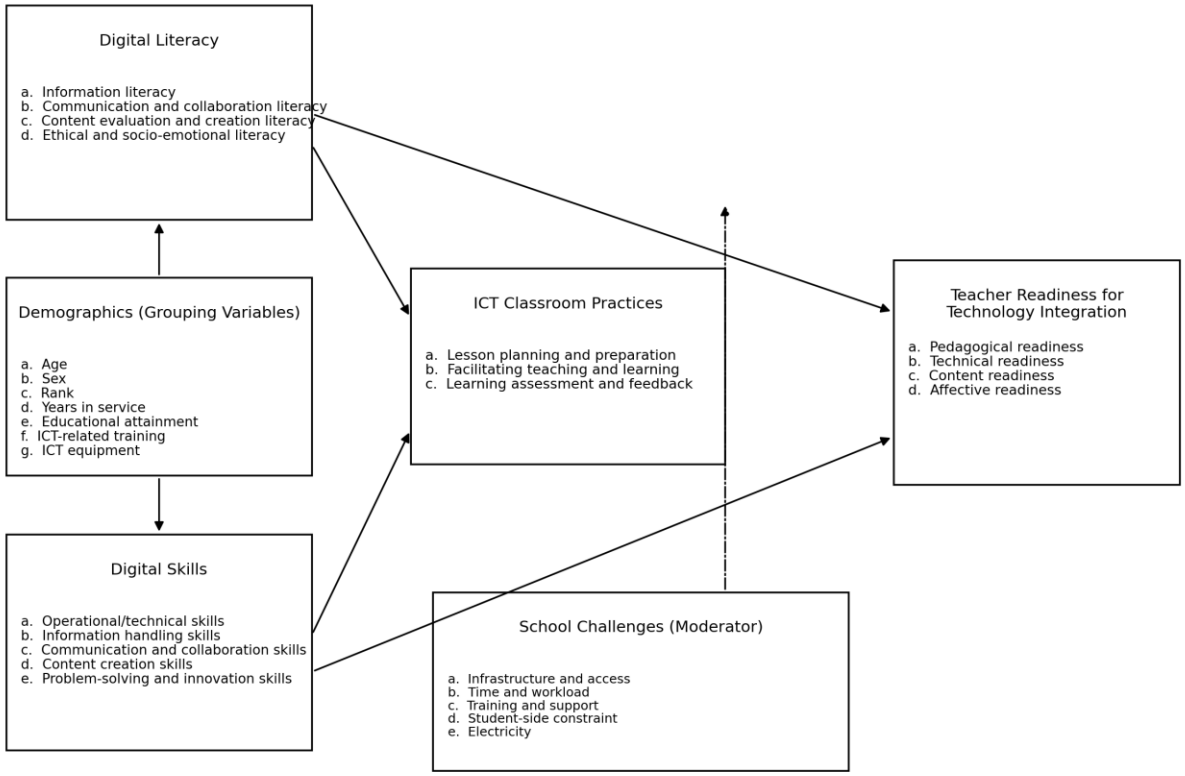

Figure 1. *Conceptual framework illustrating the relationship among digital literacy, digital skills, ICT classroom practices, and teacher readiness for technology integration, with school challenges as a moderating factor.*

METHODS

Research Design

The study employed a quantitative, cross-sectional survey design to examine relationships among teachers' digital literacy, digital skills, ICT classroom practices, and readiness for technology integration. Difference analyses were used to examine selected demographic groupings, while predictive analyses tested the influence of digital literacy and digital skills on ICT practices and readiness. A moderated regression model was also used to determine whether school challenges altered the relationships between teachers' digital competencies and readiness. This design was consistent with quantitative approaches used to examine relationships and predictive patterns among measured variables (Creswell, 2014).

Research Locale

The study was conducted among public elementary schools in Sulu, Philippines, during School Year 2025–2026. The sampling frame covered 13 municipalities: Jolo, Indanan, Maimbung, Patikul, Parang, Luuk, Panglima Estino, Omar, Talipao, Panamao, Kalinggalang Caluang, Pangutaran, and Siasi. These municipalities represented the geographically distributed public-school contexts in which teachers experienced varying levels of infrastructure, connectivity, equipment access, and institutional support for technology integration.

Participants and Sampling Technique

The population consisted of 2,275 active public elementary school teachers in Sulu. The required sample was estimated using Cochran's formula at a 95% confidence level, 5% margin of error, and maximum variability, with finite-population adjustment, resulting in a sample of 329 teachers. A multistage probability procedure was

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used. Municipalities served as natural clusters in the first stage, and simple random sampling using a fishbowl technique was applied within the selected clusters. This process was intended to represent teachers from geographically dispersed school settings while providing eligible teachers an equal chance of selection.

Research Instrument

Data were gathered using a contextualized survey questionnaire developed from established digital competence and technology-integration frameworks. Digital literacy items were adapted from the UNESCO Digital Literacy Global Framework (UNESCO, 2018). Digital skills and readiness items were informed by DigCompEdu and related teacher-readiness work (Bayrak Karsli et al., 2023; Tondeur et al., 2017; Knezek & Christensen, 2016), while school-challenge items were adapted from literature on barriers to ICT integration (Bingimlas, 2009; Buabeng-Andoh, 2012). Digital literacy, digital skills, and readiness were measured on five-point agreement scales, whereas ICT classroom practices and school challenges used five-point frequency scales.

Three experts in educational research and ICT integration reviewed the questionnaire for content relevance, clarity, and representativeness. Content-validity ratings ranged from 3.00 to 4.00, indicating that the items were relevant to highly relevant. A pilot test with 10 teachers was then conducted. Cronbach's alpha coefficients across the instrument dimensions ranged from .796 to .953, exceeding the .70 criterion used in the study and supporting the reliability of the instrument for the main data collection.

Data Gathering Procedure

The researcher first developed and validated the survey instrument and revised it following expert review and pilot testing. Formal permission was then secured from the Graduate School Dean, the Schools Division Office of Sulu, and the respective school heads. Selected teachers received an informed-consent form explaining the study purpose, procedures, voluntary nature of participation, and confidentiality safeguards. After consent was obtained, the validated questionnaire was administered to the sampled teachers. Completed responses were collected, encoded, checked, and prepared for statistical analysis.

Data Analysis

Descriptive statistics summarized digital literacy, digital skills, and ICT classroom practices. Analysis of variance and independent-samples t-tests were used to examine differences in digital literacy and skills across the demographic groupings reported in the inferential analysis. Multiple regression assessed the influence of digital literacy and digital-skill dimensions on ICT classroom practices and on readiness for technology integration. Hierarchical moderated regression tested the main effects of centered digital literacy, digital skills, and school challenges and the interaction terms digital literacy × challenges and digital skills × challenges. Statistical significance was evaluated at the .05 level.

Ethical Consideration

Participation was voluntary and based on informed consent. The researcher secured institutional and school-level permissions before data collection, protected participants' anonymity and confidentiality, informed participants of their right to withdraw, and restricted data use to the purposes of the study. Data were stored securely and were accessible only to authorized individuals. These procedures were consistent with the ethical safeguards described in the thesis and with the requirements of responsible research involving human participants.

RESULTS AND DISCUSSION

Levels of Digital Literacy, Digital Skills, and ICT Classroom Practices

Teachers reported generally high levels of digital literacy and digital skills. Content evaluation and creation literacy and ethical and socio-emotional literacy obtained the highest literacy means (both M = 4.05), while problem-solving and innovation skills had the highest digital-skill mean (M = 3.95). Information handling skills (M = 3.90) and operational/technical skills (M = 3.79) were also rated high. ICT classroom practices were less uniform: lesson planning and preparation was high (M = 3.93), whereas facilitating teaching and learning (M

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= 3.35) and learning assessment and feedback (M = 3.51) were interpreted as moderate. The pattern suggests that teachers were more consistent in using technology for preparation than for interactive instruction and assessment.

Table 1. *Descriptive Statistics of Teachers' Digital Literacy, Digital Skills, and ICT Classroom Practices*

Construct	Dimension	M	SD	VI
Digital Literacy	Information and Data Literacy	3.93	0.60	HL
	Communication and Collaboration Literacy	3.76	0.73	HL
	Content Evaluation and Creation Literacy	4.05	0.69	HL
	Ethical and Socio-emotional Literacy	4.05	0.77	HL
Digital Skills	Operational/Technical Skills	3.79	0.76	HL
	Information Handling Skills	3.90	0.67	HL
	Communication and Collaboration Skills	3.63	0.70	HL
	Content Creation Skills	3.77	0.75	HL
	Problem-Solving and Innovation Skills	3.95	0.69	HL
ICT Practices	Lesson Planning and Preparation	3.93	0.67	HL
	Facilitating Teaching and Learning	3.35	0.91	ML
	Learning Assessment and Feedback	3.51	0.86	ML

Note. VI = verbal interpretation; HL = High Level; ML = Moderate Level. The thesis used 1.00–1.80 = Very Low, 1.81–2.60 = Low, 2.61–3.40 = Moderate, 3.41–4.20 = High, and 4.21–5.00 = Very High.

The findings are consistent with research showing that digital competence can be relatively strong even when classroom integration remains uneven across instructional functions (Tondeur et al., 2021; Timotheou et al., 2023). This distinction is important because competence in using digital resources does not automatically ensure pedagogically meaningful application. As Xie et al. (2021) observed, internal and external barriers can influence whether available digital competence is translated into routine classroom practice.

Differences in Digital Literacy and Digital Skills across Demographic Groups

The inferential analyses did not identify statistically significant differences in digital literacy or digital skills across the demographic groupings reported in the thesis. Age, years in service, ICT training, access to ICT equipment, rank, and educational attainment all produced p-values above .05, with effect sizes ranging from trivial to small. Thus, the findings indicate that teachers' digital competence was relatively evenly distributed across these characteristics rather than concentrated in particular demographic groups.

Table 2. *Tests of Differences in Digital Literacy and Digital Skills across Demographic Groupings*

Grouping Variable	Digital Literacy	Digital Skills
Age	$F(2,326)=2.081$, $p=.126$, $\eta^2=.013$	$F(2,326)=2.915$, $p=.056$, $\eta^2=.018$
Years in Service	$F(2,326)=0.356$, $p=.701$, $\eta^2=.002$	$F(2,326)=0.698$, $p=.498$, $\eta^2=.004$
ICT Training	$F(2,326)=0.019$, $p=.981$, $\eta^2=.000$	$F(2,326)=0.311$, $p=.733$, $\eta^2=.002$
Access to ICT Equipment	$F(2,326)=0.597$, $p=.551$, $\eta^2=.004$	$F(2,326)=2.470$, $p=.086$, $\eta^2=.015$
Rank	$t(327)=0.603$, $p=.547$, $d=.16$	$t(327)=-0.196$, $p=.845$, $d=-.05$
Educational Attainment	$t(327)=-1.532$, $p=.126$, $d=-.23$	$t(327)=-1.021$, $p=.308$

This result supports the view that demographic characteristics do not uniformly explain teacher digital competence. Although age and professional experience can shape familiarity with technology in some contexts (Rachmadtullah, 2022; Sailer et al., 2021), the present sample showed no statistically meaningful differences across the tested groups. The finding reinforces the value of needs-based professional development that responds to demonstrated competencies and school conditions rather than relying primarily on demographic assumptions.

Predictors of ICT Classroom Practices

The multiple regression model predicting overall ICT classroom practices was statistically significant, $R = .720$, $R^2 = .519$, adjusted $R^2 = .505$, $F(9, 319) = 38.234$, $p < .001$. Communication and collaboration literacy was a positive literacy predictor ($\beta = .249$, $p < .001$), whereas ethical and socio-emotional literacy showed a small negative association ($\beta = -.134$, $p = .035$). Among the digital-skill dimensions, information handling ($\beta = .165$, p

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= .017), communication and collaboration (β = .228, p = .001), and content creation (β = .188, p = .006) significantly and positively predicted ICT classroom practices. Operational/technical skills and problem-solving and innovation skills were not significant in this model.

Table 3. *Multiple Regression Predicting ICT Classroom Practices from Digital Literacy and Digital Skills*

Predictor	β	p
Information and Data Literacy	−.046	.429
Communication and Collaboration Literacy	.249	< .001
Content Evaluation and Creation Literacy	−.005	.940
Ethical and Socio-emotional Literacy	−.134	.035
Operational/Technical Skills	.088	.188
Information Handling Skills	.165	.017
Communication and Collaboration Skills	.228	.001
Content Creation Skills	.188	.006
Problem-Solving and Innovation Skills	.102	.094

Note. $R = .720$, $R^2 = .519$, adjusted $R^2 = .505$, $F(9,319) = 38.234$, $p < .001$; Durbin–Watson = 1.498.

The significant effects were concentrated in competencies that support interaction, information management, and production of instructional materials. This is consistent with work suggesting that technology integration becomes more substantive when teachers can collaborate digitally, manage information, and create content for authentic learning purposes (Alharbi, 2020; Bayrak Karsli et al., 2023). The result also supports the TPACK perspective that effective classroom use depends on how technological capability is connected with instructional activity rather than on technical operation alone (Mishra & Koehler, 2006).

Predictors of Readiness for Technology Integration

The regression model predicting overall readiness for technology integration was also statistically significant, $R = .771$, $R^2 = .594$, adjusted $R^2 = .583$, $F(9, 319) = 51.851$, $p < .001$. Communication and collaboration literacy (β = .124, p = .018) and ethical and socio-emotional literacy (β = .278, p < .001) significantly predicted readiness. Significant digital-skill predictors were information handling (β = .289, p < .001), content creation (β = .163, p = .009), and problem-solving and innovation (β = .127, p = .023). Operational/technical and communication/collaboration skills were not significant after the other predictors were controlled.

Table 4. *Multiple Regression Predicting Teachers' Readiness for Technology Integration*

Predictor	β	p
Information and Data Literacy	−.023	.670
Communication and Collaboration Literacy	.124	.018
Content Evaluation and Creation Literacy	−.086	.190
Ethical and Socio-emotional Literacy	.278	< .001
Operational/Technical Skills	.000	1.000
Information Handling Skills	.289	< .001
Communication and Collaboration Skills	.049	.420
Content Creation Skills	.163	.009
Problem-Solving and Innovation Skills	.127	.023

Note. $R = .771$, $R^2 = .594$, adjusted $R^2 = .583$, $F(9,319) = 51.851$, $p < .001$; Durbin–Watson = 1.693.

These findings indicate that readiness was associated more strongly with higher-order capacities than with basic technical operation. Teachers who could manage digital information, create resources, solve problems, and navigate ethical and socio-emotional demands were more likely to report readiness for technology integration. This pattern is compatible with the idea that acceptance and readiness depend on perceived capacity to use technology meaningfully and responsibly, not merely on access to devices or basic operational knowledge (Davis, 1989; Knezek & Christensen, 2016; Falloon, 2020).

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Moderating Role of School Challenges

Hierarchical regression showed that digital literacy, digital skills, and school challenges were significant predictors of readiness in Model 1, which explained 58.0% of the variance, $R^2 = .580$, $F(3, 325) = 149.658$, $p < .001$. In Model 2, the digital literacy × challenges interaction was positive and significant ($\beta = .183$, $p = .041$), while the digital skills × challenges interaction was negative and significant ($\beta = -.190$, $p = .033$). The thesis interpreted these significant interaction coefficients as evidence that school challenges moderated the relationships between teachers' competencies and readiness. The increase in explained variance was small ($\Delta R^2 = .006$), and the reported block-level F-change was 2.328, $p = .099$.

Table 5. *Hierarchical Moderated Regression Predicting Readiness for Technology Integration*

Predictor	B	β	p
Model 1: Digital Literacy (cDL)	.213	.208	< .001
Model 1: Digital Skills (cDS)	.482	.486	< .001
Model 1: School Challenges (cCH)	.189	.175	< .001
Model 2: Digital Literacy (cDL)	.266	.260	< .001
Model 2: Digital Skills (cDS)	.429	.433	< .001
Model 2: School Challenges (cCH)	.193	.178	< .001
DL × Challenges	.199	.183	.041
DS × Challenges	−.187	−.190	.033

Note. Model 1: $R = .762$, $R^2 = .580$, adjusted $R^2 = .576$. Model 2: $R = .766$, $R^2 = .586$, adjusted $R^2 = .580$, $\Delta R^2 = .006$, F-change = 2.328, $p = .099$. cDL, cDS, and cCH are mean-centered variables.

The moderation pattern reinforces the study's central argument that individual competence and school context operate together. Higher school challenges strengthened the estimated association between digital literacy and readiness but weakened the positive association between digital skills and readiness. In practical terms, capable teachers may still find it difficult to translate competence into preparedness when infrastructure, connectivity, workload, training support, learner access, or electricity are inadequate. This interpretation is consistent with established evidence that institutional and infrastructural conditions can constrain educational technology adoption even when teachers are willing and competent (Bingimlas, 2009; Buabeng-Andoh, 2012; Alampay & Capule-Navarro, 2023; UNESCO, 2022).

CONCLUSION

The study concludes that public elementary school teachers in Sulu generally possessed high digital literacy and digital skills, but the translation of these competencies into classroom practice was uneven. Technology use was strongest in lesson planning and preparation and less consistent in instructional facilitation and assessment. Digital competence did not differ significantly across the demographic groupings reported in the inferential analysis, indicating that readiness and classroom use were better explained by functional competencies and school conditions than by background characteristics. Communication, collaboration, information handling, content creation, socio-emotional awareness, and problem-solving emerged as the competencies most consistently associated with ICT classroom practice and readiness. The significant interaction coefficients involving school challenges further indicate that contextual barriers shaped how teachers' competence translated into preparedness for integration. The study therefore contributes evidence that effective technology integration in Sulu requires the combined strengthening of teacher capacity and the school conditions that enable that capacity to be enacted.

Recommendation

The Schools Division Office and school administrators should prioritize sustained, practice-oriented professional development that moves beyond basic technical operation and strengthens information handling, digital collaboration, content creation, problem-solving, ethical digital citizenship, and technology-supported assessment. Training should be connected to teachers' actual lesson-planning, facilitation, and assessment

responsibilities and supported through mentoring, professional learning communities, and opportunities to develop context-appropriate digital materials.

At the same time, capacity-building should be accompanied by improvements in enabling conditions, particularly reliable electricity and internet access, adequate and maintainable ICT equipment, accessible technical support, and realistic time allocations for technology-supported preparation. School leaders and policymakers should use local needs data to prioritize resource allocation across municipalities. Future research may complement self-reported measures with classroom observations, performance-based digital competence assessments, qualitative inquiry into teachers' lived experiences, comparisons across school contexts, and longitudinal designs that examine how digital competence and readiness change over time.

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