International Journal of Science and Research Archive
eISSN: 2582-8185
Cross Ref DOI: 10.30574/ijsra
Journal homepage: https://ijsra.net/

(RESEARCH ARTICLE)

ICT Literacy of Teachers and Resource Status of Public Elementary School Teachers in Kabugao Districts: Basis for Digital Infrastructure Framework

Nemalyn S. Bosing *

Apayao State College, Malama, Conner, Apayao, Philippines, 3807.

International Journal of Science and Research Archive, 2026, 19(02), 889-913

Publication history: Received on 04 April 2026; revised on 11 May 2026; accepted on 13 May 2026

Article DOI: https://doi.org/10.30574/ijsra.2026.19.2.1064

Abstract

This study examined the ICT literacy and ICT resource status of public elementary school teachers in Kabuga Districts 1 and 2, Division of Apayao, as a basis for proposing a digital infrastructure innovation framework for School Year 2025–2026. Employing a quantitative descriptive-correlational research design with a developmental component, the study involved public elementary school teachers from both districts selected through total enumeration. Data were gathered using structured survey questionnaires and supplemented by selected interviews for data triangulation. Statistical tools including descriptive statistics, t-test, ANOVA, and Pearson correlation coefficient were used to analyze the data. Findings revealed that teachers demonstrate a very high level of ICT literacy across five domains: basic ICT operations and concepts, ICT integration in teaching and learning, digital content creation and management, online communication and collaboration, and digital safety and security. ICT resources in the district were generally assessed as adequate and functional. However, persistent challenges were identified, including unreliable internet connectivity, limited access to devices and digital repositories, insufficient formal ICT training, heavy workload constraints, and inequitable access to technology among learners. No significant differences in ICT literacy were found across most profile variables, although position and length of teaching experience were found to significantly influence specific higher-order ICT competencies. A moderate positive and significant relationship was established between ICT literacy and ICT resource status, indicating that improved access to resources contributes to enhanced teacher ICT competence. Based on the findings, the study proposed the Kabuga ICT-READY Framework, a holistic and systems-based model comprising seven interconnected components designed to guide coordinated and sustainable digital infrastructure development in the district.

Keywords: ICT Literacy; ICT Resource Status; Digital Infrastructure; Technology Integration; ICT-READY Framework

1. Introduction

ICT literacy, defined as the ability of teachers to use digital technology, communication tools, and networks to access, manage, integrate, evaluate, and create information, has emerged as a foundational competency for effective teaching in the 21st century (Panel, 2002). The UNESCO ICT Competency Framework for Teachers underscores those educators must be equipped with digital competencies to guide learners in achieving educational goals aligned with the 2030 Agenda for Sustainable Development (Heine, 2013). ICT literacy encompasses not merely technical proficiency in operating devices or software, but also the pedagogical capacity to meaningfully embed digital tools into classroom instruction. Teachers who possess strong ICT literacy are better positioned to design engaging, student-centered lessons, manage digital learning environments, and respond to the evolving demands of technology-driven education (Dasal, 2025). Research consistently demonstrates that teacher ICT literacy is the single most critical factor in determining the quality and sustainability of technology integration in schools, making it the starting point of any serious inquiry into educational modernization (Bingbing and Guha Jr., 2025).

* Corresponding author: Nemalyn S. Bosing

Beyond literacy, ICT integration refers to the actual application of digital skills within the teaching and learning process, the point at which teacher competence translates into instructional practice. Research indicates that ICT integration requires coordinated efforts involving teachers, students, and school administrators, representing an evolving process rather than a static achievement (Ertmer and Otternbreit-Leftwich, 2010). Effective ICT integration goes beyond simply using a projector or accessing the internet; it involves designing technology-enhanced lessons, facilitating collaborative digital tasks, and using data-driven tools to monitor student progress. Studies from developed nations demonstrate that successful integration depends on multiple factors, including teacher confidence, access to infrastructure, and institutional support. Sang et al. (2011) found that teacher beliefs, self-efficacy, and school culture significantly influence the depth of technology adoption in classrooms, while Ward and Parr (2010) emphasized that teachers require sustained professional development to build the confidence necessary to move from basic ICT use to meaningful pedagogical integration. Within the Asia-Pacific region, despite substantial government investment in ICT infrastructure and training, a significant proportion of primary school teachers in countries such as Cambodia, Laos PDR, Malaysia, Myanmar, the Philippines, and Vietnam reported low confidence in using ICT for instruction as of 2019 — indicating a persistent gap between resource provision and actual classroom integration (Johns et al., 2022).

The impact of inadequate ICT resources on teaching quality and student learning outcomes is well-documented in the literature. When schools lack functional hardware, reliable internet, or updated software, teachers are forced to rely entirely on traditional instructional methods, limiting both the breadth and quality of learning experiences they can offer. Mustafa et al. (2024) found through a systematic literature review that inadequate infrastructure, poor internet connectivity, and insufficient funding are the primary barriers preventing teachers in rural schools from integrating ICT effectively. Trinidad (2020), analyzing PISA 2018 data from the Philippines, confirmed that disparities in access to educational technology significantly influence student performance outcomes. The relationship between ICT resource availability and effective teacher integration is not merely correlational, it is causally linked: teachers cannot practice or develop ICT competencies they have no tools to apply (Derder et al., 2024). Moreover, Avila et al. (2021) demonstrated that the quality of teacher ICT resource utilization directly determines the level of students' digital competence, reinforcing that resource gaps at the teacher level cascade into learning deficits at the student level. In Philippine public schools, Lumagbas et al. (2019) noted that even when devices such as tablets were provided, schools with weak management systems and limited teacher training failed to translate hardware provision into meaningful classroom use, underscoring those resources alone are insufficient without corresponding teacher literacy and institutional support.

In the Philippine context, the Department of Education has prioritized ICT integration through the DepEd Computerization Program, which has deployed computer packages to public schools nationwide, and through various initiatives aimed at improving digital infrastructure and teacher competency (Mula and Bucar, 2023). However, these efforts have not fully bridged the digital divide, particularly in geographically isolated and disadvantaged areas. Research reveals persistent gaps in both ICT literacy and ICT resources among public elementary school teachers. Que (2021) found that rural elementary teachers frequently lack access to ICT resources and formal training, limiting their ability to integrate digital tools in instruction despite showing willingness to learn. Brasileño and Bidad (2021) highlighted that the absence of a clearly defined ICT infrastructure plan remains a systemic flaw, with many schools relying on individual teacher initiative rather than institutionalized systems. Razak et al. (2019) similarly documented that over half of surveyed public-school teachers reported inadequate ICT tools, poor internet connectivity, and insufficient professional development, conditions that collectively undermine both ICT literacy development and meaningful integration. Infrastructure innovation, encompassing both hardware solutions (such as computer laboratories, tablets, projectors, and reliable network equipment) and software solutions (such as educational platforms, learning management systems, and digital content), is increasingly recognized as a necessary response to these gaps. Derder et al. (2024) confirmed that schools with stronger digital infrastructure are better positioned to support teachers in improving instructional delivery and student engagement, while Mackay et al. (2025) argued that sustainable digital transformation in Philippine schools requires enterprise-level infrastructure planning that addresses both technological adoption and institutional change management.

The Cordillera Administrative Region, encompassing Apayao province, presents a distinctive educational landscape shaped by geographical challenges, cultural diversity, and uneven development. Despite limited budgets relative to other regions, Apayao has achieved notable literacy outcomes, posting the highest basic literacy rate among Philippine provinces at 95.2 percent (Arellano, 2025), a testament to the dedication of its teachers and the strong cultural value placed on education. However, when it comes to ICT literacy and digital resource availability, Kabugao Districts 1 and 2 face significant deficits that are not yet systematically documented. Many public elementary schools in the districts operate without functional computer laboratories, and the few units available in select schools are often outdated or non-operational due to lack of maintenance and technical support. Internet connectivity is either absent or unreliable across most school sites, with mobile data connectivity serving as the primary, and inconsistent, means of internet

access for both teachers and learners. There are no dedicated ICT coordinators in most schools, and teachers who have received ICT training have largely done so through sporadic division-level seminars rather than sustained, structured programs. Educational software, learning management systems, and digital content repositories are not systematically deployed or used. While recent initiatives such as the DICT-CAR Robotics Workshop have introduced select students to digital technology (DICT-CAR, 2025), these remain isolated efforts that do not address the broader, systemic deficit in teacher ICT literacy and school-level infrastructure. This gap between the aspiration for digital education and the ground-level reality of technological deprivation in Kabugao Districts 1 and 2 forms the core problem motivating this research.

This study therefore sought to systematically assess the ICT literacy and ICT resource status of public elementary school teachers in Kabugao Districts 1 and 2, Apayao, as a basis for proposing a digital infrastructure innovation framework. By generating empirical evidence on teacher ICT competencies and school-level resource conditions, the research will provide school administrators, ICT coordinators, and policymakers with the data necessary to make informed decisions about professional development investments, hardware procurement, software deployment, and network infrastructure improvements. The findings will also contribute to the broader literature on ICT integration in geographically isolated and disadvantaged communities in the Philippines and comparable developing country contexts, where the intersection of resource constraints, cultural factors, and geographical challenges continues to define the boundaries of educational modernization.

2. Methodology

2.1. Research Design

The study employed a quantitative descriptive–correlational research design with a developmental component to examine ICT literacy and ICT resource status among public elementary school teachers in Kabugao Districts 1 and 2. The descriptive design assessed teachers' ICT skills across various domains, including basic operations, integration, content creation, communication, and digital safety, as well as school ICT resources in terms of hardware, software, connectivity, support, and policies, using mean and standard deviation. The comparative component applied t-tests and ANOVA to identify differences in ICT literacy by profile variables, while the correlational design used Pearson r to measure relationships between ICT literacy and school ICT resources. A developmental component synthesized findings to propose the Kabugao ICT-READY Framework, addressing gaps in ICT integration. Though primarily quantitative, the study also incorporated qualitative insights from interviews to triangulate data and strengthen validity.

2.2. Respondents of the Study

The respondents of the study were all public elementary school teachers currently employed in Kabugao Districts 1 and 2, Apayao. Using total enumeration as the sampling technique, all teachers in the target districts will be included in the study, ensuring complete population coverage. These teachers are chosen because they are the primary implementers of ICT in classroom instruction, and their level of ICT literacy, together with the resources available to them, directly determines the effectiveness of technology integration in education. The total number of respondents will be determined upon confirmation of the updated master list from the Division of Apayao, Department of Education.

2.3. Research Instruments

The study used an adapted survey questionnaire from Magtoltol and Oropa (2025) to collect both quantitative and qualitative data on teachers' ICT literacy and school resource status. The instrument included demographic items (age, position, years of experience, ICT training), self-rated ICT literacy skills (computer use, internet, educational software, digital tools), resource status items (hardware, software, connectivity, technical support), and open-ended questions on challenges and suggestions for digital infrastructure improvements. This approach ensured standardized responses for statistical analysis while also allowing teachers to provide deeper insights into their experiences and needs.

2.4. Statistical Analysis

The study applied both descriptive and inferential statistics to analyze data. Frequency and percentage were used to describe the demographic profile of respondents, while weighted mean measured ICT literacy and ICT resource status. Thematic analysis summarized challenges and guided the proposal of an innovation framework for ICT integration. Pearson's r correlation tested the relationship between teachers' ICT literacy and school ICT resources, while ANOVA and t-tests determined significant differences in ICT literacy across profile variables such as age, position, years of experience, and ICT training attended.

3. Results And Discussion

Table 1 Frequency and distribution of respondent's profile in terms of sex

Sex	F	%
Male	96	80.00
Female	24	20.00
Total	120	100

As shown in Table 1, the data indicate that the majority of respondents are male (80%), while only 20% are female, suggesting a male-dominated teaching workforce in the study context. Despite this imbalance, subsequent results show no significant differences in ICT literacy across sex, implying that gender does not influence ICT competence among teachers. This finding suggests that ICT skills are shaped more by access, exposure, and institutional support rather than gender. International studies have shown that gender gaps in ICT competence have diminished over time as access to No. 10533 (Enhanced Basic Education Act of 2013), which promotes inclusive and equitable access to quality education, including ICT integration, regardless of gender. Thus, the findings imply that existing policies and access mechanisms have contributed to minimizing gender-based disparities in ICT use.

Table 2 Frequency and distribution of respondent's profile in terms of age

Age	F	%
20–25 years old	8	6.70
26-30 years old	32	26.70
31-35 years old	27	22.50
36-40 years old	19	15.80
41-45 years old	13	10.80
46-50 years old	7	5.80
51 years old and above	14	11.70
Total	120	100

As can be seen in Table 2, the age distribution reveals that most respondents belong to the 26–30 age group, followed by those aged 31–35, indicating a relatively young and digitally adaptive teaching workforce. Younger teachers are often more exposed to technology during their academic preparation, making them more comfortable with ICT use. However, the absence of significant differences across age groups in later analyses suggests that ICT competence has become widespread across all age levels. This implies that even older teachers are able to adapt and acquire ICT skills through experience and professional development. This finding supports Tonder et al. (2017), who argued that while younger levels of competence. It also aligns with DepEd Order No. 42, s. 2017 (Philippine Professional Standards for Teachers), which mandates ICT integration as a competency across all career stages, reinforcing the idea that age is no longer a barrier to ICT proficiency.

Table 3 Frequency and distribution of respondent's profile in terms of position/designation

Position/Designation	F	%
Teacher I	53	44.20
Teacher II	3	2.50
Teacher III	41	34.20
Master Teacher I	9	7.50
Master Teacher II	1	0.80
Head Teacher / School Head	13	10.80
Total	120	100

Table 3 shows that most of the respondents are Teacher I and Teacher III, indicating that the findings largely reflect classroom-level practices rather than administrative perspectives. This is significant because classroom teachers are the primary implementers of ICT integration in instruction. However, later results reveal that position significantly affects higher-order ICT skills such as integration and content creation. This suggests that while basic ICT skills are common across all positions, advanced ICT use is influenced by professional roles and responsibilities. Teachers in higher positions may be more exposed to tasks requiring ICT, such as reporting, planning, and instructional leadership. This is consistent with the UNESCO ICT Competency Framework for Teachers (2018), which emphasizes that ICT competence evolves from basic knowledge acquisition to knowledge creation and innovation, often associated with leadership roles. Therefore, position influences the depth and complexity of ICT utilization rather than basic competence.

Table 4 Frequency and distribution of respondent's profile in terms of years of teaching experience

Years of Teaching Experience	F	Ranking
Less than 1 year	8	6.70
1 – 5 years	36	30.00
6 – 10 years	23	19.20
11 – 15 years	21	17.50
16 – 20 years	15	12.50
21 years and above	17	14.20
Total	120	100

As can be gleaned from Table 4, the results show that a large proportion of respondents have 1–5 years of teaching experience, indicating a relatively early-career workforce. Early-career teachers are typically more open to adopting innovative teaching strategies, including ICT integration. However, the absence of significant differences across most ICT domains suggests that teaching experience alone does not determine ICT competence. Instead, ICT literacy appears to be influenced by continuous exposure, training, and institutional support. Notably, a significant difference was observed in digital safety and security based on years of teaching, indicating that experience contributes to awareness of ethical and legal responsibilities in ICT use. This aligns with Republic Act No. 10173 (Data Privacy Act of 2012), which emphasizes the protection of personal data, particularly in educational settings where sensitive information is handled. Thus, experience enhances responsible ICT practices rather than technical skills alone.

Table 5 Frequency and distribution of respondent's profile in terms of length of service

Length of Service (Years of Teaching Experience)	F	%
No ICT training attended	73	60.80
1 – 2 trainings	18	15.00
3 – 5 trainings	20	16.70
6 – 10 trainings	7	5.80
More than 10 trainings	2	1.70
Total	120	100

Table 5 shows that the data reveal that most of the teachers (60.80%) have not attended any formal ICT training, which is a critical concern. Despite this, teachers still demonstrated high levels of ICT literacy in subsequent tables, suggesting that they rely on self-learning, peer collaboration, and practical experience. While this reflects adaptability, it raises concerns about the sustainability and standardization of ICT competence. Without formal training, teachers may lack exposure to emerging technologies and updated pedagogical approaches. UNESCO (2018) emphasizes that structured ICT training is essential for effective technology integration in education. Similarly, the DepEd Computerization Program highlights the need for capacity-building initiatives to complement ICT infrastructure. Therefore, the findings

imply that while ICT competence exists, it may not be systematically developed, underscoring the need for continuous and structured professional development programs.

Table 6 Mean distribution of the level of ICT literacy of public elementary school teachers in Kabugao Districts 1 and 2 in terms of basic ICT operations and concepts

Statements	Mean	DI
I can operate a desktop or laptop computer independently.	4.94	Strongly Agree
I am able to use basic productivity tools (MS Word, Excel, PowerPoint).	4.91	Strongly Agree
I can manage files and folders on a computer efficiently.	4.68	Strongly Agree
I understand fundamental computer hardware and software components.	4.73	Strongly Agree
I can troubleshoot basic computer problems on my own.	4.76	Strongly Agree
Category Mean	4.80	Strongly Agree

As shown in Table 6, the category mean of 4.80 indicates a very high level of competence in basic ICT operations. Teachers demonstrate strong skills in operating computers, using productivity tools, managing files, and troubleshooting basic problems. This suggests that foundational ICT literacy is already well-established among teachers. Such competence is essential as it serves as the foundation for more advanced ICT integration. According to Almerich et al. (2016), technological competence is a prerequisite for effective pedagogical use of ICT. The result also reflects the impact of long-term DepEd initiatives such as the Computerization Program, which has improved teachers' familiarity with digital tools. Thus, the findings indicate that teachers have transitioned from basic ICT users to digitally capable educators.

Table 7 Mean distribution of the level of ICT literacy of public elementary school teachers in Kabuga Districts 1 and 2 in terms of ICT integration in teaching and learning

Statements	Mean	DI
I regularly use ICT tools to prepare and deliver lessons.	4.77	Strongly Agree
I incorporate digital resources and multimedia in my teaching.	4.75	Strongly Agree
I use educational platforms or apps to enhance student learning.	4.63	Strongly Agree
I adapt my instructional strategies based on available ICT tools.	4.73	Strongly Agree
I design ICT-based activities aligned with the Most Essential Learning Competencies (MELCs).	4.74	Strongly Agree
Category Mean	4.72	Strongly Agree

As shown in Table 7, the category mean of 4.72 indicates a very high level of ICT integration in teaching practices. Teachers regularly use ICT tools for lesson preparation, delivery, and alignment with MELCs, suggesting that technology is already embedded in instructional processes. This reflects a shift from mere technology use to meaningful integration, where ICT enhances teaching effectiveness and student engagement. This finding aligns with Republic Act No. 10533, which promotes learner-centered and technology-enhanced education. It is also consistent with DepEd Order No. 012, s. 2020 (Basic Education Learning Continuity Plan), which emphasizes the use of ICT in ensuring continuous learning. However, while integration is widespread, the depth and innovativeness of ICT use may still vary, indicating the need for further enhancement of pedagogical practices.

Table 8 Mean distribution of the level of ICT literacy of public elementary school teachers in Kabuga Districts 1 and 2 in terms of digital content creation and management

Statements	Mean	DI
I can create digital presentations, videos, or multimedia materials for instruction.	4.66	Strongly Agree
I am able to edit and modify existing digital learning materials to suit my learners.	4.52	Strongly Agree
I use cloud storage platforms (Google Drive, OneDrive) to organize teaching files.	4.40	Strongly Agree
I can design simple digital assessments using online tools (Google Forms, Quizizz, etc.).	4.45	Strongly Agree
I regularly update and maintain a collection of digital instructional resources.	4.41	Strongly Agree
Category Mean	4.49	Strongly Agree

Table 8 shows that the category mean of 4.49 indicates that teachers have a very high level of competence in creating and managing digital content. Teachers are capable of producing multimedia materials, editing resources, and designing digital assessments. However, slightly lower ratings in file organization and resource management suggest challenges in maintaining systematic digital repositories. This implies that while teachers are effective content creators, they may need further support in managing and sustaining digital resources. The Dig Comp Edu framework emphasizes that digital competence includes not only content creation but also organization, sharing, and preservation. Therefore, the findings suggest a need to strengthen digital resource management systems within schools.

Table 9 Mean distribution of the level of ICT literacy of public elementary school teachers in Kabuga Districts 1 and 2 in terms of online communication and collaboration

Statements	Mean	DI
I use email and messaging platforms to communicate with colleagues and parents.	4.74	Strongly Agree
I participate in online professional learning communities or teacher groups.	4.60	Strongly Agree
I can conduct or facilitate online classes or virtual meetings effectively.	4.33	Strongly Agree
I use social media platforms appropriately for educational and professional purposes.	4.38	Strongly Agree
I collaborate with other teachers to develop and share digital learning resources.	4.56	Strongly Agree
Category Mean	4.52	Strongly Agree

As can be seen in Table 9, the category mean of 4.52 indicates a very high level of competence in online communication and collaboration. Teachers actively use digital platforms to communicate with colleagues, parents, and learners, and participate in professional learning communities. This reflects the normalization of digital communication in education, particularly in the context of remote and blended learning. The findings align with UNESCO's ICT framework, which highlights collaboration as a key component of digital competence. It also supports DepEd's initiatives promoting stakeholder engagement and communication through digital means. Thus, ICT has enhanced not only instruction but also professional collaboration and community interaction.

Table 10 Mean distribution of the level of ICT literacy of public elementary school teachers in Kabuga Districts 1 and 2 in terms of digital safety and security

Statements	Mean	DI
I practice safe browsing habits and protect my personal data online.	4.69	Strongly Agree
I am aware of common cyber threats such as phishing, malware, and identity theft.	4.56	Strongly Agree
I educate my students about responsible and ethical use of digital tools.	4.60	Strongly Agree
I use strong passwords and apply basic cybersecurity measures on my accounts.	4.67	Strongly Agree
I understand and comply with data privacy laws applicable to educators (e.g., RA 10173).	4.58	Strongly Agree
Category Mean	4.80	Strongly Agree

As shown in Table 10, the results show a high level of awareness of digital safety and security practices among teachers. They demonstrate knowledge of cybersecurity, safe browsing, and responsible use of digital tools. This is particularly important in educational settings where sensitive data are handled. The findings strongly align with Republic Act No. 10173 (Data Privacy Act of 2012), which mandates the protection of personal information. The results imply that teachers are not only competent ICT users but also responsible digital citizens who can promote safe and ethical technology use among learners.

Significant difference in the level of ICT literacy of teachers when grouped according to profile variable

3.1. Basic ICT operation and concepts

Table 11 Test of significant difference in the level of ICT literacy of teachers when grouped according to sex

Sex	Mean	DF	t-tabular	p-value	SD
Male	4.78	118	-1.554	0.123	Accept Ho
Female	4.89				

Table 11 shows that the results show that male teachers obtained a mean score of 4.78, while female teachers obtained a slightly higher mean score of 4.89 in terms of basic ICT operations and concepts. However, the computed p-value of 0.123 is greater than the 0.05 level of significance, leading to the acceptance of the null hypothesis. This indicates that there is no significant difference in the level of basic ICT competence between male and female teachers. Although female teachers appear to have a slightly higher mean, the difference is not statistically significant, suggesting that both groups possess comparable levels of foundational ICT skills. This implies that competencies such as operating computers, using productivity tools, and managing digital files are consistently evident among teachers regardless of sex. The result further suggests that access to ICT resources, exposure to digital tools, and institutional support have contributed to minimizing gender-related differences in ICT literacy. Therefore, it can be inferred that sex does not significantly influence teachers' basic ICT competence, and foundational ICT skills have become a universal capability among educators, reflecting the effectiveness of ICT integration efforts in the education sector.

Table 12 Test of significant difference in the level of ICT literacy of teachers when grouped according to age, position, years of Teaching, Years in Training

Profile	DF	F	P-value	Decision
Age				
Between Groups	6	1.511	0.181	Accept H_0
Within Group	113			
Position				
Between Groups	5	1.681	0.145	Accept H_0
Within Group	114			
Years of Teaching				
Between Groups	5	1.307	0.266	Accept H_0
Within Group	114			
Years in Training				
Between Groups	4	1.648	0.167	Accept H_0
Within Group	115			

Table 12 shows that the results reveal that when teachers are grouped according to age, the computed F-value of 1.511 with a p-value of 0.181 is greater than the 0.05 level of significance, leading to the acceptance of the null hypothesis. This indicates that there is no significant difference in the level of basic ICT operations and concepts across different age groups. This implies that teachers, regardless of age, demonstrate comparable levels of foundational ICT

competence. This finding suggests that ICT skills are no longer limited to younger teachers but are increasingly shared across generations due to widespread exposure to digital technologies. This is supported by Philippine-based research showing that teachers' ICT literacy has reached a generally acceptable level across different demographic groups, although still mostly at the basic level. Similarly, international frameworks such as the UNESCO ICT Competency Framework for Teachers emphasize that ICT competence is expected of all educators regardless of age, as part of professional standards in modern education. This also aligns with DepEd Order No. 42, s. 2017 (PPST), which mandates ICT integration competencies across all career stages, reinforcing that age is not a limiting factor in ICT proficiency.

In terms of position, the computed F-value of 1.681 and p-value of 0.145 also resulted in the acceptance of the null hypothesis, indicating that there is no significant difference in basic ICT competence among teachers with different designations. This suggests that whether teachers are in entry-level or higher positions, their ability to perform fundamental ICT tasks remains consistent. The result implies that basic ICT skills are essential competencies required of all teachers, regardless of rank. This is supported by studies indicating that ICT competence is a fundamental requirement for effective teaching and learning, and teachers are expected to possess these skills regardless of their professional role. Furthermore, this finding aligns with the objectives of the DepEd Computerization Program, which aims to provide equal access to ICT resources and develop ICT literacy among all teachers, ensuring uniform competence across positions.

For years of teaching experience, the computed F-value of 1.307 with a p-value of 0.266 likewise led to the acceptance of the null hypothesis, indicating that there is no significant difference in basic ICT competence based on teaching experience. This suggests that both novice and experienced teachers exhibit similar levels of ICT proficiency, highlighting that ICT skills are not solely acquired through years of service but are influenced by continuous exposure and practice. This finding is supported by recent Philippine studies showing that ICT competence is influenced more by access to technology and school support rather than years of experience alone. This further supports the idea that ICT literacy has become a standard professional requirement, rather than a skill developed only over time. In line with this, Republic Act No. 10533 (Enhanced Basic Education Act of 2013) promotes the integration of ICT in education, ensuring that all teachers, regardless of experience, are equipped with the necessary digital competencies.

Lastly, when grouped according to years in training, the computed F-value of 1.648 with a p-value of 0.167 also resulted in the acceptance of the null hypothesis, indicating that there is no significant difference in ICT competence based on the number of ICT trainings attended. This implies that even teachers with limited formal training are able to demonstrate adequate foundational ICT skills, possibly due to self-directed learning, peer collaboration, and practical experience. However, this does not diminish the importance of formal training. Studies emphasize that while teachers may develop basic ICT skills independently, structured training is still necessary to enhance higher-level competencies and ensure effective integration in teaching. This finding supports the continued implementation of capacity-building initiatives under DepEd policies, particularly those aimed at strengthening teachers' ICT competencies through professional development programs.

3.2. ICT Integration in Teaching and Learning

Table 13 Test of significant difference in the level of ICT literacy of teachers when grouped according to sex

Sex	Mean	DF	t-tabular	p-value	SD
Male	4.73	118	0.107	0.915	Accept H_o
Female	4.72				

As shown in Table 13, the results show that male teachers obtained a mean score of 4.73, while female teachers obtained a mean score of 4.72 in terms of ICT integration in teaching and learning. The computed p-value of 0.915 is greater than the 0.05 level of significance, leading to the acceptance of the null hypothesis. This indicates that there is no significant difference in the level of ICT integration between male and female teachers.

The nearly identical mean scores suggest that both male and female teachers demonstrate comparable levels of ICT integration, including the use of digital tools in lesson preparation, delivery, and assessment. This implies that ICT integration has become a common instructional practice among teachers regardless of sex. The result reflects that access to ICT resources, exposure to digital tools, and institutional support have minimized gender-related differences in instructional technology use.

This finding is supported by international studies indicating that gender is no longer a significant predictor of ICT integration among educators, as both male and female teachers demonstrate similar levels of digital competence when provided with equal opportunities and access (Almerich et al., 2016). In the Philippine context, this aligns with Republic Act No. 10533 (Enhanced Basic Education Act of 2013), which promotes equitable access to quality and technology-enhanced education for all teachers and learners. It is also consistent with DepEd Order No. 012, s. 2020 (Basic Education Learning Continuity Plan), which institutionalized the use of ICT in teaching, ensuring that all teachers, regardless of sex, adopt digital tools for instruction.

Therefore, it can be inferred that sex does not significantly influence ICT integration in teaching and learning, and that the use of technology in instruction has become a standardized and universally practiced competency among educators.

Table 14 Test of significant difference in the level of ICT literacy of teachers when grouped according to age, position, years of Teaching, Years in Training

Profile	DF	F	P-value	Decision
Age				
Between Groups	6	1.059	0.391	Accept H_0
Within Group	113			
Position				
Between Groups	5	4.327	0.001	Reject H_0
Within Group	114			
Years of Teaching				
Between Groups	5	1.374	0.239	Accept H_0
Within Group	114			
Years in Training				
Between Groups	4	0.399	0.809	Accept H_0
Within Group	115			

As can be gleaned from Table 14, the results show that when teachers are grouped according to age, the computed F-value of 1.059 with a p-value of 0.391 is greater than the 0.05 level of significance, leading to the acceptance of the null hypothesis. This indicates that there is no significant difference in the level of ICT integration in teaching and learning across different age groups. This implies that teachers, regardless of age, demonstrate comparable levels of ICT integration in their instructional practices. The finding suggests that ICT integration is no longer limited to younger teachers but has been widely adopted across all age groups due to increased exposure and institutional support. This is consistent with international studies which show that age is not a significant barrier to ICT integration when teachers are provided with adequate access and support (Tonder et al., 2017). In the Philippine context, this aligns with DepEd Order No. 42, s. 2017 (Philippine Professional Standards for Teachers), which requires all teachers, regardless of career stage, to integrate ICT in teaching

In terms of position, the computed F-value of 4.327 with a p-value of 0.001 is less than the 0.05 level of significance, leading to the rejection of the null hypothesis. This indicates that there is a significant difference in ICT integration when teachers are grouped according to their designation. This suggests that teachers in higher positions demonstrate greater or more advanced ICT integration compared to those in lower positions. This may be attributed to the increased responsibilities of higher-ranking teachers, such as instructional leadership, curriculum planning, and supervision, which require more extensive use of ICT. This finding is supported by studies showing that professional roles and leadership responsibilities influence the level of ICT integration in teaching (Cabero-Almenara et al., 2021). It also aligns with DepEd Order No. 16, s. 2023, which emphasizes the role of school leadership in implementing ICT programs and maximizing technology use in schools. Thus, position plays a significant role in determining the extent of ICT integration.

For years of teaching experience, the computed F-value of 1.374 with a p-value of 0.239 is greater than 0.05, resulting in the acceptance of the null hypothesis. This indicates that there is no significant difference in ICT integration based on teaching experience. Both novice and experienced teachers demonstrate similar levels of ICT integration, suggesting

that experience alone does not determine the use of technology in teaching. This implies that ICT integration is influenced more by access, training, and institutional support rather than years of service. This finding is supported by research indicating that ICT use in teaching is not dependent on experience but on exposure and professional development opportunities (Ertmer and Ottenbreit-Leftwich, 2019). This also aligns with Republic Act No. 10533, which promotes the integration of ICT in education across all levels and for all educators.

Lastly, when grouped according to years in training, the computed F-value of 0.399 with a p-value of 0.809 is greater than 0.05, leading to the acceptance of the null hypothesis. This indicates that there is no significant difference in ICT integration based on the number of ICT trainings attended. This suggests that even teachers with fewer formal trainings are able to integrate ICT in their teaching, possibly due to self-directed learning, peer collaboration, and practical exposure to technology. However, this does not diminish the importance of formal training. Studies emphasize that while teachers may develop ICT integration skills independently, structured training remains essential for enhancing the quality and effectiveness of ICT use (Trust and Whalen, 2020). This supports the need for continuous professional development programs under DepEd initiatives.

3.3. Digital Content Creation and Management

Table 15 Test of significant difference in the level of ICT literacy of teachers when grouped according to sex

Sex	Mean	DF	t-tabular	p-value	SD
Male	4.49	118	0.037	0.971	Accept H_o
Female	4.48				

Table 15 shows that the results show that male teachers obtained a mean score of 4.49, while female teachers obtained a mean score of 4.48 in terms of digital content creation and management. The computed p-value of 0.971 is greater than the 0.05 level of significance, leading to the acceptance of the null hypothesis. This indicates that there is no significant difference in the level of digital content creation and management between male and female teachers.

The nearly identical mean scores suggest that both male and female teachers demonstrate comparable abilities in creating, editing, and managing digital instructional materials, such as presentations, multimedia resources, and online assessments. This implies that digital content creation has become a shared competency among teachers, regardless of sex. The result reflects that access to ICT tools, exposure to digital platforms, and institutional support have contributed to minimizing gender-based differences in more advanced ICT skills.

This finding is consistent with international studies which indicate that gender is not a significant factor in teachers' digital competence, particularly when both groups are provided with equal access to technology and opportunities for practice (Cabero-Almenara et al., 2021). In the Philippine context, this aligns with Republic Act No. 10533 (Enhanced Basic Education Act of 2013), which promotes equitable access to quality and technology-enhanced education. It is also supported by DepEd Order No. 42, s. 2017 (Philippine Professional Standards for Teachers), which requires all teachers, regardless of sex, to develop competencies in the use of ICT, including the creation and management of digital learning resources.

Therefore, it can be inferred that sex does not significantly influence teachers' competence in digital content creation and management, and that this aspect of ICT literacy has become a standardized and universally practiced skill among educators.

As below in Table 16, The results show that when teachers are grouped according to age, the computed F-value of 0.886 with a p-value of 0.508 is greater than the 0.05 level of significance, leading to the acceptance of the null hypothesis. This indicates that there is no significant difference in digital content creation and management across different age groups. This implies that teachers, regardless of age, possess comparable abilities in creating, editing, and managing digital instructional materials. The finding suggests that digital content creation skills have become widespread and are no longer limited to younger teachers, likely due to increased exposure to ICT and institutional support. This is consistent with international studies which indicate that digital competence can be developed across all age groups when adequate support and access are provided (Tonder et al., 2017). In the Philippine context, this aligns with DepEd Order No. 42, s. 2017 (Philippine Professional Standards for Teachers), which requires all teachers to develop ICT competencies regardless of career stage.

Table 16 Test of significant difference in the level of ICT literacy of teachers when grouped according to age, position, years of Teaching, Years in Training

Profile	DF	F	P-value	Decision
Age				
Between Groups	6	0.886	0.508	Accept H_0
Within Group	113			
Position				
Between Groups	5	2.678	0.025	Reject H_0
Within Group	114			
Years of Teaching				
Between Groups	5	0.501	0.775	Accept H_0
Within Group	114			
Years in Training				
Between Groups	4	1.896	0.116	Accept H_0
Within Group	115			

In terms of position, the computed F-value of 2.678 with a p-value of 0.025 is less than the 0.05 level of significance, leading to the rejection of the null hypothesis. This indicates that there is a significant difference in digital content creation and management when teachers are grouped according to their designation. This suggests that teachers in higher positions demonstrate greater involvement and possibly higher proficiency in developing and managing digital instructional resources. This may be attributed to their increased responsibilities in preparing reports, instructional materials, and school-level digital outputs. This finding is supported by studies showing that professional roles and responsibilities influence advanced ICT competencies, such as content creation (Cabero-Almenara et al., 2021). It also aligns with DepEd Order No. 16, s. 2023, which highlights the role of school leadership in maximizing the use of ICT resources. Thus, position significantly influences the depth of engagement in digital content creation.

For years of teaching experience, the computed F-value of 0.501 with a p-value of 0.775 is greater than 0.05, resulting in the acceptance of the null hypothesis. This indicates that there is no significant difference in digital content creation and management based on teaching experience. Both novice and experienced teachers demonstrate similar levels of competence, suggesting that digital content creation is not solely dependent on years of service but is influenced by exposure to technology and access to digital tools. This supports findings that ICT competence is shaped more by access and support rather than experience alone (Ertmer and Ottenbreit-Leftwich, 2019). It also aligns with Republic Act No. 10533, which promotes the integration of ICT across all levels of education.

Lastly, when grouped according to years in training, the computed F-value of 1.896 with a p-value of 0.116 is greater than 0.05, leading to the acceptance of the null hypothesis. This indicates that there is no significant difference in digital content creation and management based on the number of ICT trainings attended. This suggests that teachers are able to develop digital content creation skills even with limited formal training, possibly through self-learning, peer collaboration, and practical experience. However, this does not diminish the importance of formal training, as structured professional development remains essential for enhancing advanced ICT competencies and ensuring effective use of digital tools (Trust and Whalen, 2020).

3.4. Online Communication and Collaboration

Below table 17 shows that male teachers obtained a mean score of 4.52, while female teachers obtained a slightly higher mean score of 4.53 in terms of online communication and collaboration. The computed p-value of 0.960 is greater than the 0.05 level of significance, leading to the acceptance of the null hypothesis. This indicates that there is no significant difference in the level of online communication and collaboration between male and female teachers.

Table 17 Test of significant difference in the level of ICT literacy of teachers when grouped according to age, position, years of Teaching, Years in Training

Sex	Mean	DF	t-tabular	p-value	SD
Male	4.52	118	0.050	0.960	Accept H_o
Female	4.53				

The almost identical mean scores imply that both male and female teachers demonstrate comparable competence in using digital communication tools, such as email, messaging platforms, and online collaboration systems. This suggests that online communication has become a routine and essential component of teaching practice, widely adopted regardless of sex. The finding reflects that access to communication technologies and institutional support mechanisms have contributed to equal participation of both male and female teachers in digital collaboration.

This result is consistent with international studies indicating that gender is not a significant factor influencing teachers' use of online communication tools, as these platforms have become universally accessible and necessary in educational settings (Trust and Whalen, 2020). In the Philippine context, this aligns with DepEd Order No. 012, s. 2020 (Basic Education Learning Continuity Plan), which institutionalized the use of digital communication platforms to ensure continuous learning and coordination among teachers, learners, and stakeholders. It is also supported by Republic Act No. 10533 (Enhanced Basic Education Act of 2013), which promotes the integration of ICT in education and ensures equal opportunities for all educators to utilize digital tools.

Therefore, it can be inferred that sex does not significantly influence teachers' competence in online communication and collaboration, and that the use of digital communication tools has become a standardized and universally practiced skill among educators.

Table 18 Test of significant difference in the level of ICT literacy of teachers when grouped according to age, position, years of Teaching, Years in Training

Profile	DF	F	P-value	Decision
Age				
Between Groups	6	1.666	0.136	Accept H_0
Within Group	113			
Position				
Between Groups	5	2.067	0.075	Accept H_0
Within Group	114			
Years of Teaching				
Between Groups	5	1.222	0.304	Accept H_0
Within Group	114			
Years in Training				
Between Groups	4	0.195	0.941	Accept H_0
Within Group	115			

Table 18 shows that when teachers are grouped according to age, the computed F-value of 1.666 with a p-value of 0.136 is greater than the 0.05 level of significance, leading to the acceptance of the null hypothesis. This indicates that there is no significant difference in the level of online communication and collaboration across different age groups. This implies that teachers, regardless of age, demonstrate comparable competence in using digital communication tools, such as email, messaging platforms, and virtual meeting applications. The finding suggests that online communication has become a widely adopted practice across all age groups, supported by increased exposure to digital platforms in both professional and personal contexts. This is consistent with international studies which show that digital communication tools are universally used among educators when access and institutional support are present (Trust and Whalen, 2020). In the Philippine context, this aligns with DepEd Order No. 012, s. 2020 (Basic Education Learning Continuity

Plan), which promoted the use of digital platforms for communication and collaboration among teachers, learners, and stakeholders.

In terms of position, the computed F-value of 2.067 with a p-value of 0.075 is greater than 0.05, resulting in the acceptance of the null hypothesis. This indicates that there is no significant difference in online communication and collaboration when teachers are grouped according to their designation. This suggests that teachers across all positions, from entry-level to leadership roles, demonstrate similar levels of engagement in digital communication practices. The finding implies that communication technologies are essential tools used by all educators, regardless of their professional roles. This supports the idea that online communication has become an institutional requirement rather than a role-specific competency.

For years of teaching experience, the computed F-value of 1.222 with a p-value of 0.304 is greater than 0.05, leading to the acceptance of the null hypothesis. This indicates that there is no significant difference in online communication and collaboration based on teaching experience. Both novice and experienced teachers demonstrate similar abilities in using digital communication tools, suggesting that these skills are not dependent on years of service but are influenced by continuous exposure and necessity. This implies that digital communication has become a standard professional practice, accessible to all teachers regardless of experience.

Lastly, when grouped according to years in training, the computed F-value of 0.195 with a p-value of 0.941 is greater than 0.05, resulting in the acceptance of the null hypothesis. This indicates that there is no significant difference in online communication and collaboration based on the number of ICT trainings attended. This suggests that teachers are able to effectively use communication technologies even with limited formal training, likely due to familiarity gained through regular use and interaction. However, while training may not significantly affect basic communication skills, it remains important for enhancing more advanced digital collaboration practices.

3.5. Digital Safety and Security

Table 19 Test of significant difference in the level of ICT literacy of teachers when grouped according to sex

Sex	Mean	DF	t-tabular	p-value	SD
Male	4.62	118	0.204	0.839	Accept H_o
Female	4.60				

Table 19 shows that male teachers obtained a mean score of 4.62, while female teachers obtained a mean score of 4.60 in terms of digital safety and security. The computed p-value of 0.839 is greater than the 0.05 level of significance, leading to the acceptance of the null hypothesis. This indicates that there is no significant difference in the level of digital safety and security between male and female teachers.

The very close mean scores suggest that both male and female teachers demonstrate comparable awareness and practices related to digital safety, including safe browsing, protection of personal data, use of strong passwords, and understanding of cybersecurity risks. This implies that digital safety and security have become shared competencies among teachers, regardless of sex. The finding reflects that exposure to ICT, institutional policies, and the increasing importance of data protection have contributed to equal awareness among educators.

This result is supported by international studies which indicate that digital safety awareness is not significantly influenced by gender but is shaped by access to technology and institutional guidance (Hatlevik et al., 2018). In the Philippine context, this aligns with Republic Act No. 10173 (Data Privacy Act of 2012), which mandates the protection of personal information and promotes responsible handling of digital data across all sectors, including education. It is also consistent with DepEd Order No. 42, s. 2017 (Philippine Professional Standards for Teachers), which requires teachers to demonstrate responsible and ethical use of ICT in their professional practice.

Therefore, it can be inferred that sex does not significantly influence teachers' competence in digital safety and security, and that awareness of cybersecurity and data protection has become a standardized and universally practiced responsibility among educators.

Table 20 Test of significant difference in the level of ICT literacy of teachers when grouped according to age, position, years of Teaching, Years in Training

Profile	DF	F	P-value	Decision
Age				
Between Groups	6	1.543	0.171	Accept H_0
Within Group	113			
Position				
Between Groups	5	0.672	0.646	Accept H_0
Within Group	114			
Years of Teaching				
Between Groups	5	2.554	0.031	Reject H_0
Within Group	114			
Years in Training				
Between Groups	4	0.347	0.845	Accept H_0
Within Group	115			

As can be seen in Table 20, it shows that when teachers are grouped according to age, the computed F-value of 1.543 with a p-value of 0.171 is greater than the 0.05 level of significance, leading to the acceptance of the null hypothesis. This indicates that there is no significant difference in digital safety and security across different age groups. This implies that teachers, regardless of age, demonstrate comparable levels of awareness and practice in cybersecurity, data protection, and responsible ICT use. The finding suggests that digital safety awareness has become widespread among teachers due to increased exposure to technology and institutional policies. This is consistent with international studies which show that digital safety competence is not age-dependent when teachers are provided with sufficient guidance and access (Hatlevik et al., 2018). In the Philippine context, this aligns with Republic Act No. 10173 (Data Privacy Act of 2012), which mandates data protection practices across all sectors, including education.

In terms of position, the computed F-value of 0.672 with a p-value of 0.646 is greater than 0.05, resulting in the acceptance of the null hypothesis. This indicates that there is no significant difference in digital safety and security when teachers are grouped according to their designation. This suggests that teachers, regardless of their professional role, demonstrate similar levels of awareness in protecting digital information and practicing safe ICT use. The finding implies that digital safety is a shared responsibility among all educators, not limited to specific positions. This is supported by policies such as DepEd Order No. 42, s. 2017 (PPST), which emphasizes ethical and responsible use of ICT as a competency required of all teachers.

For years of teaching experience, the computed F-value of 2.554 with a p-value of 0.031 is less than 0.05, leading to the rejection of the null hypothesis. This indicates that there is a significant difference in digital safety and security based on teaching experience. This suggests that teachers' awareness and practices related to digital safety are influenced by their length of service. More experienced teachers may have encountered more situations involving data privacy, cybersecurity risks, and digital ethics, leading to greater awareness and more refined practices. This finding implies that digital safety competence is not only a technical skill but also a professional responsibility that develops over time through experience. It also reinforces the importance of continuous exposure and real-world practice in strengthening cybersecurity awareness among teachers.

Lastly, when grouped according to years in training, the computed F-value of 0.347 with a p-value of 0.845 is greater than 0.05, leading to the acceptance of the null hypothesis. This indicates that there is no significant difference in digital safety and security based on the number of ICT trainings attended. This suggests that teachers are able to demonstrate adequate awareness of digital safety even with limited formal training, possibly due to institutional policies, personal experience, and the increasing emphasis on data protection in educational settings. However, this does not diminish the importance of formal training, as structured programs are still necessary to keep teachers updated on emerging cybersecurity threats and best practices.

3.6. Status of ICT Resources

Table 21 Mean distribution of status of ICT resources in public elementary schools in Kabuga Districts 1 and 2 in terms of Hardware Resources (Computers, Tablets, Projectors)

Statements	Mean	DI
The number of computers/tablets available in school is sufficient for teachers' use.	4.16	Often Available
The available computers and devices are in good working condition.	4.21	Always Available
Our school has a functional computer laboratory accessible to teachers and learners.	3.84	Often Available
Projectors or smart TVs are available and functional in classrooms.	4.08	Often Available
Printing and scanning equipment are accessible to teachers when needed.	4.41	Always Available
Category Mean	4.14	Often Available

Table 21 shows the category mean of 4.14 indicates that hardware resources are generally available and functional in schools. However, the relatively lower rating for computer laboratory access suggests that resource distribution may not be fully equitable. This implies that while individual devices may be present, shared facilities may still be insufficient. This finding aligns with international research emphasizing that access to ICT infrastructure is a critical factor in effective technology integration Ertmer and Ottenbreit-Leftwich, (2019). In the Philippine context, this supports the continued implementation of the DepEd Computerization Program, which aims to improve ICT infrastructure in public schools. Thus, the findings highlight the need for balanced distribution and accessibility of ICT hardware resources.

Table 22 Mean distribution of status of ICT resources in public elementary schools in Kabuga Districts 1 and 2 in terms of software and digital learning materials

Statements	Mean	DI
Licensed or DepEd-approved software is installed and available on school computers.	4.22	Always Available
Digital learning materials (e-books, modules, videos) are accessible to teachers.	4.23	Always Available
School computers have updated operating systems and necessary applications.	4.14	Often Available
Teachers have access to online educational platforms (e.g., DepEd Commons, LMS).	4.27	Always Available
There is a repository or library of digital resources available in our school.	2.88	Often Available
Category Mean	4.80	Always Available

As can be gleaned from Table 22, while the overall ratings for software availability are high, the significantly low mean for the availability of digital repositories indicates a lack of structured systems for organizing and sharing digital resources. This suggests that although teachers have access to digital materials, these are not systematically managed, which may affect efficiency and sustainability. This finding is consistent with the Dig Comp Edu framework, which emphasizes the importance of managing and sharing digital resources effectively Redecker, (2017). It also reflects a gap in institutional ICT systems, indicating the need for centralized digital repositories or learning management systems. Thus, the result highlights that availability does not necessarily equate to effective utilization without proper organization systems.

As below in Table 23, the high category mean (4.30) indicates that internet connectivity is reliable and supports teaching and learning activities. This suggests that schools have adequate infrastructure to facilitate ICT integration. However, the sustainability of connectivity remains critical, as inconsistent internet access can disrupt instruction. This finding is supported by research showing that infrastructure quality significantly affects ICT adoption and usage Petko et al., (2018). In the Philippine context, this aligns with DepEd's ICT initiatives aimed at improving connectivity in schools. Thus, the result implies that stable internet connectivity is a key enabler of effective ICT integration.

Table 23 Mean distribution of status of ICT resources in public elementary schools in Kabuga Districts 1 and 2 in terms of internet connectivity and network infrastructure

Statements	Mean	DI
Our school has a stable and reliable internet connection for instructional use.	4.20	Often Available
Internet speed is sufficient to support online teaching and learning activities.	4.41	Always Available
Wi-Fi access is available in classrooms and other areas used for instruction.	4.39	Always Available
Teachers are given individual internet access or data allowance for school purposes.	4.26	Always Available
Our school's network infrastructure is regularly maintained and upgraded.	4.22	Always Available
Category Mean	4.30	Always Available

Table 24 Mean distribution of status of ICT resources in public elementary schools in Kabuga Districts 1 and 2 in terms of technical support and maintenance services

Statements	Mean	DI
A designated ICT coordinator or technician provides technical support in our school.	4.59	Always Available
ICT-related concerns and equipment problems are addressed promptly.	4.44	Always Available
Teachers receive timely assistance when they encounter technology issues during instruction.	4.33	Always Available
Regular maintenance schedules are in place for ICT equipment in our school.	4.22	Always Available
The school has a system for reporting and tracking ICT equipment repairs and replacements.	4.23	Always Available
Category Mean	4.36	Always Available

As shown in Table 24, the high category mean (4.36) indicates that technical support services are readily available and responsive. This suggests that schools have systems in place to address ICT-related issues, which enhances teachers' confidence in using technology. Studies have shown that technical support is a critical factor in technology adoption, as it reduces anxiety and increases competence among teachers (Ertmer and Ottenbreit-Leftwich, 2019, https://doi.org/10.1080/00461520.2019.1707443). In the Philippine setting, the presence of ICT coordinators aligns with DepEd's support mechanisms for ICT implementation. Therefore, the result implies that technical support plays a vital role in sustaining ICT integration and teacher competence.

Table 25 Mean distribution of status of ICT resources in public elementary schools in Kabuga Districts 1 and 2 in terms of ICT-related policies and administrative support

Statements	Mean	DI
Our school has a clear ICT integration plan aligned with DepEd policies.	4.43	Always Available
School administrators actively support and encourage teachers to use ICT in instruction.	4.46	Always Available
There is an allocated budget for the acquisition and maintenance of ICT resources.	4.38	Always Available
ICT use guidelines and policies are communicated and implemented properly in school.	4.44	Always Available
Teachers are recognized and rewarded for innovative use of ICT in teaching.	4.31	Always Available
Category Mean	**4.40**	Always Available

Table 25 shows the high category mean (4.40) indicates strong administrative support for ICT integration. Schools have clear policies, allocated budgets, and leadership support for ICT use. This suggests that ICT integration is not only a teacher-level initiative but also a school-wide institutional priority. Research has shown that leadership support significantly influences teachers' adoption of ICT (Cabero-Almenara et al., 2021, https://doi.org/10.3390/educsci11070352). This aligns with DepEd Order No. 016, s. 2023, which provides guidelines for implementing the Computerization Program. Thus, the result implies that effective leadership and policy support are essential for sustaining ICT integration in schools.

Relationship between teachers' ICT literacy and teachers' ICT resource status of schools

Table 26 Test of significant relationship between teachers' ICT literacy and teachers' ICT resource status of schools

Parameter	Mean	SD	Pearson r	p-value	DI
Level of ICT literacy of public-school teachers	4.63	0.34	0.574	0.000	Reject Ho
Status of ICT resources in public elementary schools in Kabuga Districts 1 and 2	4.23	0.50			

Table 26 shows the Pearson correlation result ($r = 0.574$, $p = 0.000$) indicates a moderate positive significant relationship between ICT literacy and ICT resource status. This means that as ICT resources improve, teachers' ICT literacy also tends to increase. However, the moderate level suggests that other factors, such as training, experience, and support, also contribute to ICT competence. This finding is supported by Almerich et al. (2016), who emphasized that ICT competence is influenced by both personal and contextual factors. In the Philippine context, this aligns with DepEd's policy direction that improving ICT infrastructure enhances teaching and learning outcomes. Therefore, the result implies that ICT resources are a significant but not sole determinant of ICT literacy, highlighting the need for a holistic approach combining infrastructure, training, and support.

3.7. Challenges encounter by public school teachers in integrating ICT in instruction

The challenges in ICT integration were analyzed using a mixed-method approach, combining results from the survey questionnaire and interviews. This integration allowed for triangulation of data, providing both measurable trends and deeper insights into teachers lived experiences (Creswell and Plano Clark, 2018). The findings reveal that ICT integration is influenced by a complex interplay of technological, human, institutional, and socio-economic factors, which collectively affect the effective implementation of digital instruction.

One of the most significant challenges identified is related to infrastructure constraints, particularly unreliable internet connection, insufficient devices, and frequent power interruptions. Quantitative results show that teachers generally agree that these factors hinder ICT integration, while qualitative responses emphasize how unstable connectivity disrupts lesson delivery and limits access to online resources. These findings are consistent with studies indicating that infrastructure plays a critical role in determining the success of ICT integration in education (Petko et al., 2018). In the Philippine context, this reflects ongoing efforts under the DepEd Computerization Program, which aims to enhance ICT infrastructure in schools (Department of Education, 2023). However, the persistence of these issues suggests that improvements in infrastructure remain a priority.

In addition to infrastructure, capacity and skills limitations emerged as a major concern. Teachers reported a lack of adequate training, limited confidence, and insufficient skills in integrating ICT into their teaching practices. While many teachers are capable of performing basic ICT tasks, they expressed difficulty in applying these skills in pedagogically meaningful ways. This finding aligns with research emphasizing that teacher training is essential for effective ICT integration (Trust and Whalen, 2020). It also supports the requirements of DepEd Order No. 42, s. 2017 (Philippine Professional Standards for Teachers), which highlights ICT competence as a key domain for teacher development (Department of Education, 2017). These results suggest that ICT integration requires not only technical knowledge but also continuous professional development and confidence-building.

Another critical issue identified is the impact of workload and time constraints on ICT integration. Teachers indicated that heavy teaching loads and administrative responsibilities limit their ability to prepare ICT-based instructional materials. The qualitative findings further reveal that developing digital lessons is time-consuming, making it difficult to consistently integrate ICT into instruction. This supports the findings of Ertmer and Ottenbreit-Leftwich (2019), who emphasized that time constraints significantly influence teachers' adoption of technology. This implies that ICT

integration is not solely dependent on competence but also on institutional support in managing workload and providing time for ICT-related tasks.

The study also highlights the importance of technical support in sustaining ICT use. Teachers reported that limited access to ICT personnel and delayed troubleshooting discourage them from using technology during instruction. When technical issues arise and are not immediately resolved, teachers tend to revert to traditional teaching methods. This finding is consistent with studies showing that technical support is a key factor in promoting teachers' confidence and sustained use of ICT (Ertmer and Ottenbreit-Leftwich, 2019). Thus, the presence of efficient technical support systems is essential for successful ICT integration.

Furthermore, the findings reveal significant student-related constraints, particularly limited access to devices and internet connectivity at home. Teachers noted that not all students have the necessary resources to participate in digital learning, resulting in unequal opportunities and reduced effectiveness of ICT-based instruction. This reflects the issue of the digital divide, which continues to affect educational equity (UNESCO, 2018). In the Philippine setting, this concern is addressed in the Basic Education Learning Continuity Plan (DepEd Order No. 012, s. 2020), which recognizes disparities in access to ICT resources (Department of Education, 2020). The results suggest that ICT integration must consider both teacher readiness and student accessibility to ensure inclusive education.

Closely related to this is the issue of financial constraints, as teachers reported that the cost of internet data and technology resources is a burden. Many teachers rely on personal funds to support ICT integration, highlighting the financial challenges associated with technology use. This finding aligns with global research indicating that economic factors significantly influence ICT adoption, particularly in developing contexts (Petko et al., 2018). This underscores the need for institutional support mechanisms to alleviate financial burdens on teachers and learners.

The study also identified instructional resource limitations, particularly the lack of updated and curriculum-aligned digital materials. Teachers expressed difficulty in locating relevant resources, often requiring them to create their own instructional materials. This increases workload and may affect the quality of ICT integration. This finding is consistent with the Dig Comp Edu framework, which emphasizes the importance of accessible and well-organized digital resources for effective teaching (Redecker, 2017). Therefore, the development of centralized and updated digital repositories is essential to support teachers in delivering quality instruction.

In addition, institutional and policy barriers were identified as factors that limit ICT integration. Teachers reported that certain school policies and administrative processes restrict flexibility in using ICT. This suggests that ICT integration is influenced not only by individual competence but also by the organizational environment and leadership support. Research indicates that institutional support and leadership play a crucial role in technology adoption (Cabero-Almenara et al., 2021). This aligns with DepEd initiatives that emphasize the importance of leadership in implementing ICT programs (Department of Education, 2023). Thus, supportive policies are necessary to encourage innovation and flexibility in ICT use.

Finally, the study highlights language and usability barriers as challenges affecting ICT integration. Teachers and students reported difficulties in using digital tools that are not localized or are complex to navigate. This suggests that accessibility and usability are critical factors in effective ICT implementation. Studies confirm that user-friendly and culturally responsive technologies enhance digital competence and adoption (Hatlevik et al., 2018). Therefore, the development of localized and easy-to-use digital tools is essential for inclusive ICT integration.

Table 27 Proposed digital infrastructure innovation framework to enhance ICT integration in Kabuga Districts 1 and 2.

Component	**Key Issues Addressed (Based on Findings)**	**Proposed Innovations / Strategies**	**Policy Alignment**	**Expected Outcomes**
K – Knowledge and Capacity Building	Limited formal ICT training despite high ICT literacy	Continuous ICT trainings and workshops Training on digital pedagogy, LMS, and assessment tools Cybersecurity and digital ethics training	Republic Act No. 10533 – promotes ICT integration in education DepEd Order No. 42, s. 2017 (PPST) – ICT	Improved learner engagement Enhanced digital learning experiences

			competence standard	Increased learner participation and academic performance
A – Access to Digital Infrastructure	Limited access to devices insufficient computer laboratory utilization	Provision of computers, tablets, smart TVs Establishment/strengthening of computer laboratories Device-sharing systems	RA 10533 – technology-enhanced learning DepEd Computerization Program (DO 16, s. 2023)	Improved access to ICT tools Increased ICT-based instruction
B – Better Connectivity and Power Support	Unreliable internet connection power interruptions	Stable internet connectivity and school-wide Wi-Fi Data support for teachers Backup power solutions	DepEd Order No. 012, s. 2020 (BE-LCP) – supports digital learning continuity	Continuous ICT integration Reduced instructional disruptions
U – Utilization of Digital Learning Resources in the classroom	Lack of updated, curriculum-aligned materials	Development of MELC-aligned digital repository Cloud-based storage systems Localization of content	RA 10533 – curriculum alignment DepEd DO 12, s. 2020 – digital learning materials	Relevant instructional materials Reduced teacher workload
G – Guided Technical Support System	Limited or delayed technical assistance	Designation of ICT coordinators Helpdesk and troubleshooting system Regular maintenance and monitoring	DepEd DO 16, s. 2023 – ICT support systems	Faster issue resolution Sustained ICT usage
A – Administrative and Policy Support	Need for stronger leadership	Implementation of ICT policies and guidelines Monitoring and evaluation mechanisms	DepEd DO 42, s. 2017 – leadership and professional standards	Strong ICT governance Sustainable implementation
O – Open and Inclusive Digital Access	Digital divide limited student access to devices and internet	Offline and blended learning resources Device-sharing programs Community ICT access initiatives Localized tools	RA 10533 – inclusive education DepEd DO 12, s. 2020 – equity in access	Inclusive digital learning Increased student engagement

The proposed Kabugao ICT-READY Framework presents a comprehensive and systems-oriented model designed to enhance ICT integration among public elementary school teachers in Kabugao Districts 1 and 2. It is anchored on the empirical findings of the study, which revealed that while teachers demonstrate very high levels of ICT literacy and generally adequate ICT resource availability, there remain critical challenges related to infrastructure, accessibility, training, and institutional support. These findings underscore the need for a framework that does not merely focus on isolated interventions but instead promotes a holistic and integrated approach to digital transformation in education.

At its core, the framework recognizes that ICT integration is a multi-dimensional process, influenced by the dynamic interaction between teacher competence, availability of resources, institutional leadership, and socio-economic conditions. The inclusion of seven interrelated components—Knowledge and Capacity Building, Access to Digital Infrastructure, Better Connectivity and Power Support, Updated Digital Learning Resources, Guided Technical Support System, Administrative and Policy Support, and Open and Inclusive Digital Access—demonstrates that effective ICT integration requires simultaneous and coordinated efforts across multiple domains.

The Knowledge and Capacity Building component highlights the importance of sustaining and advancing teachers' ICT competencies. Although the study revealed very high levels of ICT literacy, the limited participation in formal ICT training suggests that teachers may rely heavily on self-directed learning. While this reflects adaptability, it also indicates a potential gap in structured and pedagogically grounded ICT integration. Therefore, continuous professional development is essential to ensure that teachers can move beyond basic digital skills toward innovative and transformative uses of technology in instruction. This component aligns with the national mandate for teachers to demonstrate ICT competence and reinforces the role of lifelong learning in professional development.

The Access to Digital Infrastructure and Better Connectivity and Power Support components collectively address the foundational requirements of ICT integration. The findings indicate that while ICT resources are generally available, issues such as limited access to functional devices, unreliable internet connection, and power interruptions continue to hinder effective utilization. These challenges highlight that the mere presence of technology does not guarantee its effective use. Instead, there must be equitable access, reliability, and functionality of ICT resources to ensure consistent integration in classroom practices. These components emphasize the need for sustained investment in infrastructure to support digital learning environments.

The Updated Digital Learning Resources component underscores the importance of content in ICT integration. The study revealed that teachers face challenges in accessing updated and curriculum-aligned digital materials, which often results in increased workload due to the need to create their own resources. This suggests that ICT integration is not only dependent on tools and devices but also on the availability of high-quality, relevant, and accessible digital content. By promoting the development of centralized and localized digital repositories, the framework ensures that teachers are supported in delivering meaningful and standards-aligned instruction.

The Guided Technical Support System component addresses the operational aspect of ICT integration. The presence of technical issues during instruction can significantly disrupt teaching and reduce teachers' confidence in using ICT. The framework recognizes that sustained ICT integration requires efficient and responsive technical support systems, including designated personnel and maintenance mechanisms. This ensures that technological challenges do not become barriers to instructional delivery.

The Administrative and Policy Support component highlights the critical role of leadership and institutional structures in facilitating ICT integration. The findings suggest that while administrative support exists, there is a need for clearer policies, flexible procedures, and stronger governance mechanisms. This component emphasizes that ICT integration must be institutionalized through policies, strategic planning, and monitoring systems to ensure sustainability. Leadership support is particularly important in fostering a culture of innovation and encouraging teachers to adopt technology-enhanced teaching practices.

Finally, the Open and Inclusive Digital Access component addresses the issue of equity, particularly the digital divide among learners. The study revealed that students' limited access to devices and internet connectivity at home affects their ability to fully participate in digital learning. This highlights the importance of ensuring that ICT integration is inclusive and accessible to all learners, regardless of their socio-economic background. By promoting offline and blended learning solutions, device-sharing programs, and localized tools, the framework ensures that no learner is left behind in the digital transformation process.

4. Conclusion

Based on the results, the study examined the ICT literacy and ICT resource status of public elementary school teachers in Kabuga Districts 1 and 2 and found that teachers demonstrate very high levels of ICT literacy across all domains, while ICT resources are generally adequate and functional, supporting technology integration in teaching. However, several challenges persist, including unreliable internet connection, limited access to devices and digital repositories, lack of formal ICT training, workload constraints, and issues related to equity and student access, indicating that systemic and contextual barriers still affect effective ICT integration. The results further showed no significant differences in ICT literacy across most profile variables, suggesting that ICT competence is widely shared, although position influences higher-order ICT skills and teaching experience affects digital safety and security. Additionally, a moderate positive significant relationship between ICT literacy and ICT resource status confirms that improved infrastructure enhances ICT competence, but other factors such as training and institutional support also play crucial roles. Based on these findings, the study proposed the Kabuga ICT-READY Framework, which emphasizes a holistic and integrated approach involving capacity building, infrastructure development, connectivity support, resource management, technical assistance, administrative support, and inclusive access; thus, the study concludes that while

ICT readiness is evident, sustained and coordinated efforts are necessary to fully optimize ICT integration and promote effective, inclusive, and technology-enhanced teaching and learning.

Compliance with ethical standards

Acknowledgments

I acknowledge that I have not used ChatGPT or Copilot for refining some of the sections in the document.

Disclosure of conflict of interest

Authors have declared that they have no known competing financial interests OR non-financial interests OR personal relationships that could have appeared to influence the work reported in this paper.

Statement of ethical approval

The study was conducted with approval and in accordance with the standards of the college. No ethical approval was required, as the research followed all applicable ethical guidelines, ensuring respect for the respondents' privacy and confidentiality

Statement of informed consent

I affirm that the respondents voluntarily agreed to participate after being fully informed about the purpose, nature, and potential implications of the study. Their responses have been collected with utmost respect for their privacy and confidentiality, in accordance with ethical research guidelines.

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