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Mathematics Teachers' Competence and the Barriers they Face in Integrating ICT

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Abstract. Integrating Information and Communication Technology (ICT) into elementary mathematics instruction remains challenging due to varying teacher competence levels and persistent barriers. This study assessed the ICT competence of elementary mathematics teachers in the Schools Division of Bais City and how barriers hinder ICT integration in mathematics instruction. A descriptive-correlational research design was employed, involving 165 teachers selected through stratified random sampling. Data were gathered using a standardized questionnaire aligned with national ICT competency standards, covering four domains: technology operations, social and ethical practices, pedagogy, and the professional domain. Data were analyzed using descriptive and non-parametric statistical methods. Results revealed high ICT competence in technology operations and concepts ($\bar{x}$ = 3.43), as well as social and ethical practices ($\bar{x}$ = 3.45), but moderate in pedagogy ($\bar{x}$ = 3.26) and professional domain ($\bar{x}$ = 3.06). Significant barriers included poor internet connectivity ($\bar{x}$ = 3.58) and limited access to resources ($\bar{x}$ = 3.45), both classified as "barriers." In contrast, limited time ($\bar{x}$ = 3.39), insufficient ICT training ($\bar{x}$ = 3.38), lack of technical support ($\bar{x}$ = 3.37), limited ability to manipulate ICT tools ($\bar{x}$ = 3.35), and resistance to change ($\bar{x}$ = 2.89) were considered "somewhat of a barrier." The findings indicated no significant relationship between teachers' ICT competence and the extent of the effect of these barriers. Furthermore, teachers aged 25-34 and those who attended four or more ICT training sessions showed significantly higher ICT competence. No significant differences in ICT competence were found based on teachers' sex or years of teaching experience.

Keywords: Elementary mathematics teachers; ICT competence; ICT integration barriers; National ICT competency standards; Technology in education.

1.0 Introduction

Information and Communication Technologies (ICT) have become essential educational tools, enabling improved access to information, enhancing teaching quality, and fostering better learning outcomes (Roy, Daniel, & Agrawal, 2023; IIEP-UNESCO, 2021). Countries that effectively integrate ICT in education, such as Singapore, consistently perform well in global assessments like PISA 2022, which links technology use to student achievement (Barrett et al., 2019). The World Economic Forum (2023) highlights that digital skills are critical for future employability, underscoring the urgent need for Education 4.0 and effective ICT integration. Despite ongoing efforts by the Philippine Department of Education (DepEd), including initiatives like ICT for Education (ICT4E), the DepEd Computerization Program (DCP), and the Digital Rise Program, Filipino students continue to face challenges in core subjects such as mathematics, reading, and science (Philstar.com, 2023). The COVID-19 pandemic exposed significant gaps in ICT resources and revealed many teachers' limited digital competence (Espinosa et al., 2023). These challenges directly impact the quality of teaching and learning, particularly in public

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elementary schools, where ICT integration is critical but often hampered by infrastructure and skill deficits.

This study focuses on assessing the ICT competence of mathematics teachers in public elementary schools within the Schools Division of Bais City. This area has not been extensively studied despite its unique challenges. Using the National ICT Competency Standards for Teachers (NICS-Teachers), this research examines teachers' skills across technology operations, social and ethical practices, and pedagogical and professional domains. While previous studies have addressed ICT competence broadly, few have specifically evaluated the intersection of ICT integration and mathematics instruction in this locality, which is vital given the persistent low performance in math.

Understanding teachers' ICT competence and the barriers they face is essential for designing targeted interventions to support effective technology integration. This aligns with Sustainable Development Goals (SDGs) 4.1 and 5, emphasizing quality education and gender equality in access to resources and training. As a practicing elementary math teacher in Bais City, the researcher offers valuable insider perspectives on the local educational context, enriching the study's relevance. The findings of this research will inform the development of context-sensitive professional development programs and resource allocations, ultimately aiming to improve ICT-enabled math teaching and learning outcomes in the division. This study contributes to closing the gap between national ICT policies and classroom realities by highlighting specific local challenges and opportunities.

2.0 Methodology

2.1 Research Design

The study was conducted using a descriptive-correlational research design. This approach allowed for a detailed description of the ICT competency levels and the barriers faced by elementary mathematics teachers in the Schools Division Office of Bais City. Additionally, the study determined the relationships between demographic factors and ICT competency levels, as well as between ICT competency levels and the barriers to ICT integration. The descriptive aspect provided a comprehensive overview of ICT competency, while the correlational aspect helped understand the variables' associations.

2.2 Research Locale

The study was conducted within the Schools Division of Bais City, Bais City, Negros Oriental, Philippines. The environment includes 31 elementary and 10 integrated public schools with diverse teaching and learning conditions. These schools use the traditional classroom instruction model and incorporate ICT tools when available. Teachers primarily rely on traditional methods, such as direct instruction and textbooks, while gradually using ICT tools to enhance learning experiences. The integration of ICT varies significantly among schools, influenced by the availability of resources and teacher competency. The student-teacher ratio generally adheres to national standards but can vary significantly between schools, affecting the individual attention each student receives and the feasibility of implementing ICT-based activities. Internet connectivity is inconsistent across the schools. Some schools have stable and reliable Wi-Fi connections, enabling regular use of online resources, while others face significant connectivity issues, limiting their ability to integrate ICT effectively. The presence of computer laboratories and the availability of ICT devices such as laptops, tablets, and projectors also vary among the schools. Some schools have modern ICT facilities, while others lack sufficient resources. Additionally, elementary public schools in the Schools Division of Bais City do not have e-libraries; some have traditional libraries with physical books, while others, with limited space, have mini-libraries offering a smaller collection of books and resources.

2.3 Research Participants

The research respondents for this study include the 165 elementary mathematics public school teachers in the Schools Division of Bais City. They include those who teach mathematics alongside other subjects. The sample size was determined using stratified random sampling to ensure representation from various schools within the division. The exact number was calculated based on the total population of 288 teachers and the desired confidence level and margin of error. Stratified random sampling was employed to ensure that different subgroups within the population were adequately represented. This technique helped the researchers obtain a representative sample that reflected the diversity of the schools within the Schools Division of Bais City.

2.4 Research Instrument

The research instrument used in this study is a standardized questionnaire adopted from the National ICT Competency Standards for Teachers (NICS). The questionnaire is titled "ICT Competence and Barriers to ICT Integration of Elementary Mathematics Teachers." It comprises 76 statements across four domains: Technology Operations and Concepts, Social and Ethical, Pedagogical, and Professional Domains. Each statement is designed to be rated on a scale with five levels of competence. The questionnaire consists of four parts. The first part presents a disclosure statement explaining the purpose of the study, ensuring that the participants understood the voluntary nature of their participation and the confidentiality of their responses. The second part collects demographic information, including age, sex, years of teaching experience, and the total number of ICT training sessions attended in the past five years. The third part assesses ICT competency levels across four domains.

The Technology Operations and Concepts domain includes basic computer operations, productivity tools, internet and network applications, and information/data management. The Social and Ethical domain covers legal practices, ethical use of technology, promoting safe learning environments, and facilitating equitable access to technology. The Pedagogical domain involves applying technology to develop students' higher-order thinking skills, conducting flexible learning environments, and using technology for assessment and evaluation. The Professional domain focuses on engaging in continuous learning, reflecting on the use of technology for professional development, and collaborating with peers to advance technology use in education. The final part identifies and measures barriers to ICT integration, such as lack of access to resources, insufficient training, limited ability to manipulate ICT tools, poor internet connectivity, lack of technical support, limited time for integration, and resistance to change from traditional methods.

Given that the questionnaire was adopted from a standardized framework, it was inherently designed to be valid and reliable. However, several steps were undertaken to ensure its suitability for the specific context of this study. First, the questionnaire was reviewed by experts in educational technology and experienced mathematics teachers to ensure its relevance, clarity, and comprehensiveness, providing feedback on the content, structure, and language to ensure it accurately measured the intended competencies and barriers. Second, a pilot test was conducted with a small sample of elementary mathematics teachers not part of the main study to identify issues, such as ambiguous questions or technical problems, allowing for necessary adjustments before full-scale administration.

Finally, reliability was assessed using Cronbach's Alpha across all domains and the identified barriers. The results indicated strong internal consistency, with coefficients ranging from 0.825 to 0.982, all exceeding the 0.70 threshold for reliability. Specifically, the technological operations and concepts domain had coefficients between 0.936 and 0.975 across four standards, while the social and ethical domain ranged from 0.923 to 0.948 across its four standards. The pedagogical domain showed the highest variation, with coefficients ranging from 0.825 to 0.982 across six standards, and the professional domain ranged from 0.889 to 0.909 across three standards. The identified barriers demonstrated a reliability of 0.918. These findings confirm that the instrument is reliable across all standards and domains, making it suitable for measuring ICT competence and identifying barriers to its practical use.

2.5 Data Gathering Procedure

Following the design hearing, the researchers incorporated all corrections and suggestions provided by the panel members. Subsequently, a letter of request to conduct the study was sent to the Schools Division Superintendent of the Schools Division of Bais City, endorsed by the dean of the graduate school. After the request was signed and approved, it was presented to the school principals and relevant authorities within the Schools Division of Bais City. During the preparation phase, the researchers utilized a standard questionnaire and modified it by adding a section on identified barriers to ICT integration. Validation and reliability testing, including a dry run and reliability tests, were conducted to ensure the questionnaire's validity and reliability.

Following validation, data collection commenced by administering the questionnaire to the chosen sample of elementary mathematics teachers within the Schools Division of Bais City. The questionnaire was distributed through Google Forms or in printed format, depending on the respondents' preferences and comfort levels. During distribution, the researchers explained the purpose and importance of the research to the respondents. For Google Forms, the responses were retrieved immediately upon completion, while printed questionnaires were collected right after the respondents answered them. After data collection, the results were tallied using MS Excel and analyzed using appropriate statistical software, such as Jamovi, to describe the current state and examine the relationships among variables. The findings were then compiled into a comprehensive report, including practical recommendations for improving ICT integration in elementary mathematics lessons within the Schools Division of Bais City.

2.6 Data Analysis Procedure

The statistical treatment of data involved applying various statistical methods. In this study, the following tools were used:

Weighted mean. This was used to determine the average ICT competency level of mathematics teachers across various domains, including Technology Operations and Concepts, Social and Ethical Practices, Pedagogy, and the Professional Domain, and to assess the extent to which barriers in ICT integration affect mathematics instruction.

Standard deviation. This was used to measure the variability or dispersion of ICT competency levels and barriers faced by the teachers.

Spearman's rank-order correlation was used to analyze the relationship between mathematics teachers' ICT competency levels and the extent to which the barriers affect ICT integration. This tool is appropriate for a non-parametric test suited for ordinal data, making it ideal for identifying monotonic relationships that may not necessarily be linear.

The study also used a Likert scale to assess ICT competency and the extent of barriers to ICT integration. The scaling system allowed for categorizing responses into meaningful levels, making it easier to interpret the results.

For ICT competency, the scale ranged from 1.00 to 5.00, with the following verbal descriptions:

Score	Scale	Verbal Description
5	4.21 – 5.00	Very High
4	3.41 – 4.20	High
3	2.61 – 3.40	Moderate
2	1.81 – 2.60	Low
1	1.00 – 1.80	Very Low

For barriers to ICT integration, a similar 1.00 to 5.00 scale was used with different verbal descriptions:

Score	Scale	Verbal Description
5	4.21 – 5.00	A very significant barrier
4	3.41 – 4.20	A barrier
3	2.61 – 3.40	Somewhat a barrier
2	1.81 – 2.60	Slightly a barrier
1	1.00 – 1.80	Not a barrier at all

Mann-Whitney U test. This was used to compare the ICT competency levels between different groups (e.g., male vs. female teachers). It was chosen because the data did not meet the assumptions of normality and was more appropriate for comparing two independent groups with ordinal-level data.

Kruskal-Wallis test. This was used to compare the ICT competency levels among groups based on age, years of teaching experience, and number of ICT training sessions attended. This non-parametric test was selected because it allows for comparing more than two independent groups when the data are not normally distributed.

2.7 Ethical Considerations

The study adhered to ethical standards by ensuring informed consent from all respondents. Confidentiality and anonymity were strictly maintained, and the respondents were informed about their right to withdraw from the study at any time. Any potential risks were communicated clearly, and measures were taken to minimize them. Ethical approval was obtained from the Ethical Committee of the Foundation University Research Office and the Schools Division Office of Bais City before the study was conducted.

Results and Discussion

3.1 Level of ICT Competency of Elementary Mathematics Teachers

Table 1 presents the level of ICT competency of elementary mathematics teachers in terms of technology operations and concepts under Standard 1. The composite mean score of ($\bar{x}$ = 3.52, SD = 0.95) falls within the "high" verbal description, indicating that teachers generally possess high competence in basic computer operations and related tasks.

Table 1. *Level of ICT Competency of Elementary Math Teachers in Terms of Technology Operations and Concepts – Standard 1 (n=165)*

No.	Indicators	Mean	Verbal Description	Standard Deviation
	Standard 1: Demonstrate knowledge and skills in basic computer operation and other information devices, including basic troubleshooting and maintenance			
1	Identify and define the functions of the main components (i.e., monitor, CPU, keyboard, mouse) of the computer.	3.99	H	0.84
2	Identify and define the functions of computer peripherals (i.e., printer, scanner, modem, digital camera, speaker, etc.).	3.88	H	0.85
3	Organize and manage computer files, folders, and directories	3.78	H	0.93
4	Use storage devices (i.e., hard disk, diskette, CD, flash memory, etc.) for storing and sharing computer files. Create backups of essential files.	3.77	H	0.99
5	Properly connect main components, configure peripherals, and install drivers when required.	3.48	H	0.97
6	Understand the basic functions of the operating system.	3.39	M	0.94
7	Configure the computer settings of various software and hardware.	3.16	M	0.99
8	Protect the computer from viruses, spyware, adware, malware, hackers, etc.	3.13	M	1.02
9	Use online and offline help facilities to troubleshoot, maintain, and update applications.	3.10	M	1.02
	Composite	**3.52**	**H**	**0.95**

Note: 4.21 – 5.00 (Very High, VH), 3.41 – 4.20 (High, H), 2.61 – 3.40 (Moderate, M), 1.81 – 2.60 (Low, L), 1.00 – 1.80 (Very Low, VL)

Teachers demonstrated the highest competency in identifying and defining the functions of main computer components ($\bar{x}$ = 3.99, SD = 0.84) and computer peripherals ($\bar{x}$ = 3.88, SD = 0.85). These findings suggest that teachers are well-versed in recognizing essential hardware components, which is fundamental for effective technology integration in the classroom. Additionally, they showed strong abilities in organizing and managing computer files, folders, and directories ($\bar{x}$ = 3.78, SD = 0.93) and using storage devices for file management and backup ($\bar{x}$= 3.77, SD = 0.99). These skills are essential for maintaining digital resources and ensuring the security of instructional materials.

Another area of high competency is properly connecting main components, configuring peripherals, and installing drivers when required ($\bar{x}$ = 3.48, SD = 0.97). While this score remains within the High category, its lower mean than other indicators suggests that some teachers may require further training in troubleshooting and hardware setup. Moderate verbal descriptions can also be observed in several areas, indicating room for improvement. Teachers had only moderate competency in understanding the basic functions of the operating system ($\bar{x}$ = 3.39, SD = 0.94) and configuring computer settings for software and hardware ($\bar{x}$ = 3.16, SD = 0.99). This implies that while teachers are comfortable with basic operations, they may struggle with deeper system settings that could optimize ICT integration in teaching.

Moderate competencies are also noted in computer protection against malware, spyware, and hackers ($\bar{x}$ = 3.13, SD = 1.02) and troubleshooting, maintenance, and updating applications using online and offline help facilities ($\bar{x}$ = 3.10, SD = 1.02). A standard deviation around 1.0 typically reflects variation in individual responses (Sauro and Lewis, 2023), suggesting that while some teachers are proficient in these areas, others may require additional support or training in cybersecurity and system maintenance. This result affirms the findings of Burrows, Borowczak, and Mugayitoglu (2021), who noted significant variability in teachers' competencies in cybersecurity, indicating the necessity for tailored support and training to meet the diverse needs of teachers.

Teachers should improve their technical troubleshooting, security, and system configuration skills to integrate technology into math instruction better. This aligns with the study of De Juana-Espinosa (2022), which emphasized that structured programs providing continuous professional development should be implemented to ensure teachers can adapt to evolving digital tools and maximize their impact in the classroom. Digital technologies have become increasingly embedded in everyday life, and in 2020, they played a central role across all sectors, including education. This shift reinforced the urgent need for teachers to continuously enhance their digital skills to keep pace with technological advancements (Gumiero & Pazuch, 2024).

Table 2 reveals the ICT competency level of elementary mathematics teachers in technology operations and concepts under Standard 2. With a composite mean of 3.45, teachers demonstrate a "high" level of competence in using office and teaching productivity tools. This means that the teachers are already well-acquainted with digital productivity tools in educational technology. These tools transform teaching and learning, enhance the work environment, streamline task management, and improve overall work quality (Oloyede & Ogunwale, 2022).

Table 2. *Level of ICT Competency of Elementary Math Teachers in Terms of Technology Operations and Concepts – Standard 2 (n=165)*

No.	Indicators	Mean	Verbal Description	Standard Deviation
	Standard 2: Use appropriate office and teaching productivity tools.			
1	Format text, control margins, layout, and tables.	3.84	H	0.91
2	Print, store, and retrieve text documents from a word processor.	3.82	H	0.86
3	Use a word processor to enter and edit text and images.	3.80	H	0.93
4	Print presentation handouts and store slide presentations.	3.61	H	1.02
5	Make effective class presentations using the slides and LCD projector.	3.61	H	0.94
6	To acquire digital images and other media from websites, CDs, flash drives, etc.	3.52	H	1.00
7	Crop, scale, color correct, and enhance digital images.	3.44	H	1.04
8	Play various media files using appropriate media players.	3.41	H	1.01
9	Store digital images using optical media (CD, DVD, flash disk) and online repositories.	3.41	H	1.00
10	Use a presentation package to add text and sequence a presentation	3.39	M	0.90
11	Enhance slide presentations by adding sound, customizing animation, and inserting images.	3.39	M	1.03
12	Use a calculation spreadsheet to enter data, sort data, and format cells into tables.	3.31	M	1.01
13	Attached and configured scanners, cameras, and cell phones to acquire digital images.	3.27	M	1.06
14	Print and store data tables using a spreadsheet application.	3.25	M	1.08
15	Make computations, use formulas, and create graphs using spreadsheets.	3.08	M	1.08
16	Stitch together video footage and soundtracks and add simple enhancements - transitions, titles, etc.	3.08	M	1.07
	Composite	**3.45**	**H**	**1.00**

Note: 4.21 – 5.00 (Very High, VH), 3.41 – 4.20 (High, H), 2.61 – 3.40 (Moderate, M), 1.81 – 2.60 (Low, L), 1.00 – 1.80 (Very Low, VL)

Among the individual indicators, teachers demonstrated the highest competence in formatting text, adjusting margins, and managing layout and tables ($\bar{x}$ = 3.84, SD = 0.91), followed closely by their ability to print, store, and retrieve text documents from a word processor ($\bar{x}$ = 3.82, SD =0.86), both of which are rated "high." These results suggest that teachers are comfortable performing essential text-editing and document-handling tasks, which are fundamental for preparing lesson materials and administrative documents. Using a word processor to enter and edit text and images also scored "high" ($\bar{x}$ = 3.80, SD =0.93), further reinforcing their ability to create visually engaging and well-organized materials.

In terms of presentation-related skills, the teachers scored "high" on printing handouts ($\bar{x}$ = 3.61, SD =1.02) and storing slide presentations, as well as making class presentations using slides and an LCD projector ($\bar{x}$ = 3.61, SD = 0.94). These competencies reflect their ability to prepare and deliver digital presentations, making classroom instruction more dynamic and visually appealing. Furthermore, acquiring digital images and media from various sources ($\bar{x}$ = 3.52, SD =1) and performing basic image editing tasks like cropping and scaling ($\bar{x}$ = 3.44, SD = 1.04) are rated "high," indicating that teachers can incorporate multimedia elements into their teaching materials. Playing various media files using appropriate media players ($\bar{x}$ = 3.41, SD =1.01) and storing digital images using optical media and online repositories were also rated "high" ($\bar{x}$ = 3.41, SD =1.00), showing that teachers can access and manage digital content to support classroom instruction.

Despite these strengths, specific indicators received "moderate" ratings. For example, using presentation software to add text, sequence slides ($\bar{x}$ = 3.39, SD =0.90), and enhancing them with sound and animations ($\bar{x}$ = 3.39, SD =1.03) highlights a gap in creating more engaging and interactive presentations. Spreadsheet-related tasks—such as entering and sorting data ($\bar{x}$ = 3.31, SD =1.01), making computations, using formulas, and creating graphs ($\bar{x}$ = 3.08, SD =1.08), and printing and storing data tables using spreadsheet application ($\bar{x}$ = 3.25, SD =1.08) were rated "moderate," showing that more advanced data manipulation skills remain an area for improvement. Lastly, attaching and configuring scanners, cameras, and phones to acquire digital images ($\bar{x}$ = 3.27, SD =1.06) and working with multimedia tools, such as stitching video footage and adding enhancements ($\bar{x}$ = 3.08, SD =1.07) are also under the "moderate" category, suggesting that users can engage with digital tools but might need support for advanced features. Interactive and adaptive digital tools enhance student engagement by encouraging active participation and catering to diverse learning styles. Additionally, when seamlessly incorporated into curricula, these tools improve academic performance (Kalmuratova, 2024). Studies highlighting the integration of digital tools, such as Microsoft Office 365, support the need for further professional development in classroom learning. While these tools offer significant benefits, challenges such as low mastery of certain features and the need for additional training remain prevalent (Wahyuni & Kusumawati, 2021).

Table 3 depicts the level of ICT competency of elementary mathematics teachers in terms of technology operations and concepts under Standard 3. This standard evaluates the understanding and effective use of the Internet and network applications and resources.

Table 3. *Level of ICT Competency of Elementary Math Teachers in Terms of Technology Operations and Concepts – Standard 3 (n=165)*

No.	Indicators	Mean	Verbal Description	Standard Deviation
	Standard 3: Understand and effectively use the Internet and network applications and resources.			
1	Send and receive emails with attachments, manage emails, and use LAN and Web-based mail servers.	3.53	H	0.91
2	Connect to the internet via dial-up or LAN.	3.44	H	1.00
3	Effectively use search engines, web directories, and bookmarks.	3.43	H	0.96
4	Connect and use shared printers, shared folders, and other devices within a network.	3.42	H	0.94
5	Use synchronous and asynchronous web-based communication tools like instant messengers, voice, and teleconferencing.	3.41	H	0.96
6	Download and install relevant applications, including freeware and shareware.	3.38	M	0.99
7	Configure and use Web Browsers and Help applications.	3.33	M	0.94
8	Updates, patches, viewers, and support applications.	3.18	M	0.99
	Composite	**3.39**	**M**	**0.96**

Note: 4.21 – 5.00 (Very High, VH), 3.41 – 4.20 (High, H), 2.61 – 3.40 (Moderate, M), 1.81 – 2.60 (Low, L), 1.00 – 1.80 (Very Low, VL)

A "high" level of competence is observed in tasks such as sending and receiving emails with attachments, managing emails, and using LAN and web-based mail servers ($\bar{x}$ = 3.53, SD =0.91), connecting to the Internet via dial-up or LAN ($\bar{x}$ = 3.44, SD =1.00), effectively using search engines, web directories, and bookmarks ($\bar{x}$ = 3.43, SD =0.96), connecting to and using shared printers, shared folders, and other devices within a network ($\bar{x}$ = 3.42, SD =0.94), and effectively using synchronous and asynchronous web-based communication tools like instant messengers, voice, and teleconferencing ($\bar{x}$ = 3.41, SD =0.96). These results signify that teachers are comfortable with and adept at managing everyday online communications and network connectivity, which are integral to modern classroom operations and efficient administrative work.

Conversely, a "moderate" level of competence is observed in downloading and installing relevant applications, including freeware and shareware ($\bar{x}$ = 3.38, SD =0.99), configuring and using web browsers and help applications ($\bar{x}$ = 3.33, SD =0.94), and managing updates, patches, viewers, and support applications ($\bar{x}$ = 3.18, SD =0.99). This indicates that while teachers are proficient in basic operational tasks, they may encounter challenges when dealing with more complex technical processes. Similarly, Noveloa (2022) found that although teachers are generally adept at using productivity tools and managing emails, their competency in web browsing, video conferencing, and other online applications is lower, primarily due to insufficient training and technical difficulties.

Moreover, teachers' competency in understanding and effectively using the Internet and network applications is "moderate," with a composite mean of ($\bar{x}$ = 3.39, SD =0.99). This implies that while teachers are proficient in routine digital tasks, such as sending emails and navigating the web, they exhibit less familiarity with more technical operations, including configuring web browsers, downloading and installing relevant applications, and managing updates. These findings stress the need for focused professional development initiatives to enhance teachers' digital literacy. This recommendation is further supported by Szymkowiak et al. (2021), whose study highlights the importance of adapting teaching methods to integrate modern technologies that align with the needs and preferences of digitally native learners in today's education system.

Table 4 shows the level of ICT competency of elementary mathematics teachers in terms of technology operations and concepts under Standard 4. The table reveals that elementary mathematics teachers demonstrate a "moderate" level of ICT competency in information and data management, with a composite mean of ($\bar{x}$ = 3.36, SD = 0.90). This indicates that while teachers have foundational skills in handling digital information, there is significant room for improvement in effectively managing, organizing, and ethically using information resources.

Table 4. *Level of ICT Competency of Elementary Math Teachers in Terms of Technology Operations and Concepts – Standard 4 (n=165)*

No.	Indicators	Mean	Verbal Description	Standard Deviation
	Standard 4: Demonstrate knowledge and skills in information and data management.			
1	Search and collect textual and non-textual information from online and offline sources.	3.48	H	0.88
2	Properly acknowledge information sources – online and offline.	3.35	M	0.85
3	Use search engines, directories, crawlers, and agents to locate information sources.	3.33	M	0.93
4	Distribute, share, publish, and print information via print or web.	3.33	M	0.94
5	Efficiently store and organize collected information using directories, drives, or databases.	3.31	M	0.91
	Composite	**3.36**	**M**	**0.90**

Note: 4.21 – 5.00 (Very High, VH), 3.41 – 4.20 (High, H), 2.61 – 3.40 (Moderate, M), 1.81 – 2.60 (Low, L), 1.00 – 1.80 (Very Low, VL)

The table also shows that teachers exhibit a "high" level of competence in searching and collecting textual and non-textual information from online and offline sources, with a mean of ($\bar{x}$ =3.48, SD = 0.88). This means that teachers can utilize various resources to gather relevant information effectively. This finding is supported by Nobis (2021), who posited that mathematics teachers are highly aware of how to find online information and data, which is crucial for classroom discussions and effective teaching. Additionally, the table shows a "moderate" level of competency in several key areas. Specifically, teachers scored moderately in properly acknowledging information sources ($\bar{x}$ = 3.35, SD = 0.85). While they have a general understanding of citation practices, it is essential to strengthen their awareness further, as proper acknowledgment of sources is emphasized in Philippine law. The Copyright Law of the Philippines highlights that the use of published works requires proper acknowledgment under the principle of fair use. These legal provisions underscore the importance of ethical information usage in education and reinforce the necessity of adequate citation practices among teachers (Official Gazette, 1996).

The table also reveals "moderate" competency levels in effectively using search engines, directories, crawlers, and agents ($\bar{x}$ = 3.33, SD = 0.93), distributing, sharing, publishing, and printing information ($\bar{x}$ = 3.33, SD = 0.94), and efficiently storing and organizing collected information using directories, drives, or databases ($\bar{x}$ = 3.31, SD = 0.91). These results signify that while teachers possess foundational skills in managing digital information, further professional development is necessary to enhance these competencies. Having sufficient knowledge in these areas can help teachers provide accurate and well-sourced information to their students, ultimately improving the learning experience (Nobis, 2021).

Table 5 displays the level of ICT competency of elementary mathematics teachers in terms of social and ethical aspects, specifically in Standard 1. This standard assesses understanding and following legal guidelines for using technology. The composite mean of ($\bar{x}$ =3.25, SD = 0.91) indicates a "moderate" level of competence. Teachers demonstrated a moderate level of competency across all indicators, including understanding the legal implications of software licenses and fair use ($\bar{x}$ = 3.29, SD = 0.90), explaining basic concepts of intellectual property rights ($\bar{x}$ = 3.25, SD= 0.91), and differentiating and identifying copyright, trademark, and patent aspects of various products ($\bar{x}$ = 3.20, SD= 0.93).

Table 5. *Level of ICT Competency of Elementary Math Teachers in Terms of Social and Ethical – Standard 1 (n=165)*

No.	Indicators	Mean	Verbal Description	Standard Deviation
	Standard 1: Understand and observe legal practices in the use of technology.			
1	Understand the legal implications of Software Licenses and Fair Use.	3.29	M	0.90
2	Understand and explain the basic concepts of Intellectual Property Rights.	3.25	M	0.91
3	Differentiate and identify the Copyright, Trademark, and Patent of various products.	3.20	M	0.93
	Composite	**3.25**	**M**	**0.91**

Note: 4.21 – 5.00 (Very High, VH), 3.41 – 4.20 (High, H), 2.61 – 3.40 (Moderate, M), 1.81 – 2.60 (Low, L), 1.00 – 1.80 (Very Low, VL)

These findings reflect a foundational awareness of legal practices in technology among teachers. However, further professional development is necessary to enhance their understanding of intellectual property laws and ethical technology use. The Philippine laws, such as the Intellectual Property Code (RA 8293), mandate proper attribution of digital content and regulate its moral use. Additionally, research highlights the importance of integrating legal and ethical technology literacy into teacher training programs, as emphasized in the Technological Pedagogical Content Knowledge (TPACK) framework, to ensure that educators develop the necessary knowledge and skills to use technology responsibly and in compliance with legal standards in educational settings (Mishra & Koehler, 2006; UNESCO, 2018).

Table 6 reveals the level of ICT competency of elementary mathematics teachers in terms of social and ethical aspects, specifically in Standard 2. This standard analyzes their ability to recognize and practice ethical use of technology at both personal and professional levels. Overall, the composite mean of ($\bar{x}$ = 3.50, SD=0.87) indicates that elementary mathematics teachers generally exhibit a "high" level of competency in ethical and responsible ICT use, although certain areas, particularly plagiarism detection and anti-piracy advocacy, show room for improvement.

Table 6. *Level of ICT Competency of Elementary Math Teachers in Terms of Social and Ethical – Standard 2 (n=165)*

No.	Indicators	Mean	Verbal Description	Standard Deviation
	Standard 2: Recognize and practice ethical use of technology at both personal and professional levels.			
1	Show respect for privacy and cyber etiquette, phone etiquette, and similar use of technology.	3.78	H	0.83
2	Advocate the responsible use of various technologies like computers, cell phones, etc.	3.70	H	0.84
3	Properly acknowledge sources used in your work.	3.43	H	0.86
4	Be an Anti-Piracy advocate for all products with IPR, like music, data, video, and software.	3.40	M	0.92
5	Detect plagiarism in student work.	3.21	M	0.91
	Composite	**3.50**	**H**	**0.87**

Note: 4.21 – 5.00 (Very High, VH), 3.41 – 4.20 (High, H), 2.61 – 3.40 (Moderate, M), 1.81 – 2.60 (Low, L), 1.00 – 1.80 (Very Low, VL)

Teachers demonstrate a "high" level of competency in three key areas related to ethical technology use. They exhibit strong awareness of privacy and cyber etiquette, phone etiquette, and similar technology practices ($\bar{x}$ = 3.78, SD = 0.83), enabling them to guide students in responsible online behavior. They also actively advocate for the responsible use of various technologies, including computers and cell phones ($\bar{x}$ = 3.70, SD = 0.84), reinforcing ethical digital practices in both personal and professional settings. Additionally, they show competence in properly acknowledging sources used in their work ($\bar{x}$ = 3.43, SD = 0.86), reflecting their understanding of intellectual property rights and the need to credit original authors.

On the other hand, teachers demonstrate a "moderate" level of competency in being an anti-piracy advocate for all products with Intellectual Property Rights (IPR), such as music, data, video, and software ($\bar{x}$ = 3.40, SD = 0.92) and detecting plagiarism in student work ($\bar{x}$ = 3.21, SD = 0.91). This suggests that teachers may have limited confidence in or exposure to these areas while they recognize the importance of intellectual property protection and academic honesty. The moderate ratings indicate a need for better tools and increased awareness to enhance plagiarism detection and anti-piracy advocacy.

The Intellectual Property Code of the Philippines, the Cybercrime Prevention Act (RA 10175), and the E-Commerce Act (RA 8792) emphasize the necessity of strict compliance with intellectual property rights. These laws ensure the ethical use of digital content and promote accountability in online transactions. Research by Hossain et al. (2024) supports the need for structured policies, training programs, and digital tools to equip educators with the necessary skills to effectively address plagiarism, digital ethics, and intellectual property rights, ultimately strengthening academic integrity in education.

Table 7 displays the level of ICT competence of elementary mathematics teachers in terms of social and ethical aspects, specifically in Standard 3. This standard evaluates the ability to plan, model, and create a safe, technology-supported learning environment. Findings reveal that all indicators in this standard are rated "high," with an overall composite mean of ($\bar{x}$ = 3.65, SD = 0.90). Teachers exhibit high competence in maintaining a clean and orderly learning environment ($\bar{x}$ = 3.84, SD = 0.88), enforcing rules on proper computer use ($\bar{x}$ = 3.75, SD = 0.92), and demonstrating appropriate handling of computer devices and applications ($\bar{x}$ = 3.73, SD = 0.82). Additionally, they display competence in accurately reporting software and hardware issues ($\bar{x}$ = 3.50, SD = 0.92) and monitoring students' use of computers, including software, hardware, computer games, and internet activities ($\bar{x}$ = 3.42, SD = 0.94).

Table 7. *Level of ICT Competency of Elementary Math Teachers in Terms of Social and Ethical – Standard 3 (n=165)*

No.	Indicators	Mean	Verbal Description	Standard Deviation
	Standard 3: Plan, model, and promote a safe and sound technology-supported learning environment.			
1	Maintain a clean and orderly learning environment for students.	3.84	H	0.88
2	Promote and implement rules and regulations on the proper use of computers.	3.75	H	0.92
3	Demonstrate proper handling of computer devices and use of applications.	3.73	H	0.82
4	Accurately report malfunctions and problems with computer software and hardware.	3.50	H	0.92
5	Monitor how students use the computer, specifically on software, hardware, computer games, and internet activities.	3.42	H	0.94
	Composite	**3.65**	**H**	**0.90**

Note: 4.21 – 5.00 (Very High, VH), 3.41 – 4.20 (High, H), 2.61 – 3.40 (Moderate, M), 1.81 – 2.60 (Low, L), 1.00 – 1.80 (Very Low, VL)

These results show that elementary mathematics teachers effectively integrate responsible technology into classroom management and instruction. Their proficiency in fostering a structured and secure digital learning environment ensures that students engage with technology safely and responsibly. Moreover, the study by Al-Sherideh et al. (2023) emphasizes the importance of implementing strong cybersecurity measures to enhance the security and effectiveness of e-learning platforms, which, in turn, positively impacts both students and teachers by increasing their confidence, engagement, and academic achievement.

Table 8 presents the level of ICT competency of elementary mathematics teachers in terms of social and ethical aspects, specifically in Standard 4. Teachers reveal "high" competence in facilitating equitable access to technology that addresses learning, social, and cultural diversity with a composite mean of ($\bar{x}$ = 3.41, SD = 0.86).

Table 8. *Level of ICT Competency of Elementary Math Teachers in Terms of Social and Ethical – Standard 4 (n=165)*

No.	Indicators	Mean	Verbal Description	Standard Deviation
	Standard 4: Facilitate equitable access to technology that addresses learning, social, and cultural diversity.			
1	Prepare lessons and activities appropriate to students' learning levels and cultural backgrounds.	3.62	H	0.78
2	Design class activities to minimize the effect on students being disadvantaged or left out.	3.40	M	0.89
3	Help minimize the effects of the digital divide by providing access to digital materials for all students.	3.31	M	0.88
4	Adapt activities using specialized hardware and software for physically disadvantaged students.	3.30	M	0.89
	Composite	**3.41**	**H**	**0.86**

Note: 4.21 – 5.00 (Very High, VH), 3.41 – 4.20 (High, H), 2.61 – 3.40 (Moderate, M), 1.81 – 2.60 (Low, L), 1.00 – 1.80 (Very Low, VL)

The finding shows that teachers demonstrate "high" competence in preparing lessons and activities suited to students' learning levels and cultural backgrounds ($\bar{x}$ = 3.62, SD = 0.78). This aligns with Abedi (2024), who postulated that teachers frequently use technology for lesson preparation and presentation to enhance relevance and student engagement. Teachers can design more inclusive and culturally responsive lessons by leveraging technology to access up-to-date information and diverse educational resources. This ensures that content is accessible and meaningful to all learners.

The findings also indicate that specific indicators fall within the "moderate" range, including designing class activities that prevent students from feeling disadvantaged ($\bar{x}$ = 3.40, SD = 0.89), bridging the digital divide by ensuring access to digital materials for all students ($\bar{x}$ = 3.31, SD = 0.88), and adapting activities using specialized hardware and software for physically disadvantaged students ($\bar{x}$ = 3.30, SD = 0.89). These moderate ratings depict variations in digital accessibility. Also, the lack of ICT adaptability for students with disabilities stipulates that teachers may require training on assistive technologies and differentiated instruction using ICT. UNESCO (2022) stated that the total cost of ICT ownership, which includes infrastructure, training, and technical support, is a key factor affecting ICT adoption in education. Addressing these challenges is crucial to ensuring sustainable and inclusive ICT integration, allowing all students to benefit from digital learning opportunities.

Table 9 exhibits the ICT competence of elementary mathematics teachers in terms of pedagogical aspects, specifically Standard 1, which focuses on applying technology to develop students' higher-order thinking skills and creativity.

Table 9. *Level of ICT Competency of Elementary Math Teachers in Terms of Pedagogical – Standard 1 (n=165)*

No.	Indicators	Mean	Verbal Description	Standard Deviation
	Standard 1: Apply technology to develop students' higher-order thinking skills and creativity.			
1	Encourage students to do data analysis, problem-solving, decision-making, and exchange of ideas.	3.16	M	0.97
2	Make students use databases, spreadsheets, concept mapping, communication tools, etc.	2.96	M	0.98
	Composite	**3.06**	**M**	**0.98**

Note: 4.21 – 5.00 (Very High, VH), 3.41 – 4.20 (High, H), 2.61 – 3.40 (Moderate, M), 1.81 – 2.60 (Low, L), 1.00 – 1.80 (Very Low, VL)

The data reveal that teachers demonstrate a "moderate" level of competence in applying technology to enhance students' higher-order thinking skills and creativity, as reflected in the composite mean of 3.06. The "moderate" competence is observed across both indicators: encouraging students to engage in data analysis, problem-solving, decision-making, and exchanging ideas ($\bar{x}$ = 3.16, SD = 0.97) and integrating databases, spreadsheets, concept mapping tools, and communication tools into instruction ($\bar{x}$ = 2.96, SD = 0.98). These findings imply that while teachers utilize technology in their instructional practices, their competence remains moderate. This indicates that technology integration in developing students' higher-order thinking skills and creativity is present but not yet fully maximized. Schools should train teachers on interactive simulations and problem-solving software to enhance student engagement. Likewise, Alcantara et al. (2020) claimed that digital tools, such as spreadsheets and concept mapping applications, improve students' understanding of mathematical concepts. However, many educators still lack the confidence to implement these tools effectively.

Table 10 displays the ICT competency levels of elementary mathematics teachers in terms of pedagogical aspects, specifically Standard 2, which highlights providing performance tasks that require students to locate and analyze information and use various media to communicate results effectively.

Table 10. *Level of ICT Competency of Elementary Math Teachers in Terms of Pedagogical – Standard 2 (n=165)*

No.	Indicators	Mean	Verbal Description	Standard Deviation
	Standard 2: Provide performance tasks that require students to locate and analyze information and use a variety of media to communicate results clearly			
1	Use slide presentations, videos, audio, and other media appropriately in the classroom.	3.65	H	0.89
2	Teach students to use various multimedia materials for reports and class presentations.	3.16	M	1.07
	Composite	**3.41**	**H**	**0.98**

Note: 4.21 – 5.00 (Very High, VH), 3.41 – 4.20 (High, H), 2.61 – 3.40 (Moderate, M), 1.81 – 2.60 (Low, L), 1.00 – 1.80 (Very Low, VL)

The first indicator, "using slide presentations, videos, audio, and other media in the classroom appropriately," has a mean of ($\bar{x}$ = 3.65, SD = 0.89), which falls under the "high" category. This suggests that teachers generally use multimedia resources to enhance their lessons. However, the second indicator, "teaching students to use various multimedia materials for reports and class presentations," has a mean of ($\bar{x}$ = 3.16, SD = 0.89), classified as "moderate." These data show that while some teachers are competent in this area, others may still have less experience or confidence in using multimedia tools with students. The composite mean of ($\bar{x}$ = 3.41, SD = 0.98), classified as "high," reflects strong ICT competency among teachers in this standard. However, the variation in competency levels across the two indicators reveals that while teachers are confident in using multimedia, there are differences in how effectively they teach students to apply these tools for communication and presentation purposes. Dela Fuente and Biñas' (2020) study emphasized that teachers' ICT competency involves the personal use of technology and the ability to guide students in utilizing it effectively for academic tasks. The study also stresses the importance of structured ICT integration programs to improve teacher competency and support multimedia-based learning.

Table 11 reveals the ICT competence of elementary mathematics teachers in terms of pedagogical aspects, specifically Standard 3, which emphasizes conducting open and flexible learning environments where technology is used to support a variety of interactions among students, cooperative learning, and peer instruction.

Table 11. *Level of ICT Competency of Elementary Math Teachers in Terms of Pedagogical – Standard 3 (n=165)*

No.	Indicators	Mean	Verbal Description	Standard Deviation
	Standard 3: Conduct open and flexible learning environments where technology is used to support a variety of interactions among students, cooperative learning, and peer instruction.			
1	To facilitate cooperative learning and the exchange of ideas and information.	3.45	H	0.92
2	Use various synchronous and asynchronous communication tools (email, chat, whiteboards, forums, blogs).	3.33	M	0.94
	Composite	**3.39**	**M**	**0.93**

Note: 4.21 – 5.00 (Very High, VH), 3.41 – 4.20 (High, H), 2.61 – 3.40 (Moderate, M), 1.81 – 2.60 (Low, L), 1.00 – 1.80 (Very Low, VL)

The table shows that teachers demonstrate a "high" level of competency in facilitating cooperative learning and exchanging ideas and information, with a mean score of ($\bar{x}$ = 3.45, SD = 0.92). The data signify that most teachers effectively integrate technology to encourage collaboration and peer interaction. However, teachers' competency in using communication tools such as email, chat, forums, and blogs is assessed as "moderate" with a mean of ($\bar{x}$ = 3.33, SD = 0.94), indicating that some teachers are still developing proficiency in utilizing these technologies for instructional purposes. A study by Dahal et al. (2022) found that collaborative tools such as Moodle forums, Google Apps, and peer review systems significantly enhance cooperative learning by enabling students to exchange feedback and ideas more efficiently.

Generally, teachers' competency level in utilizing ICT to create open and flexible learning environments is "moderate." While teachers have foundational proficiency, the integration of diverse communication tools for interaction and instruction is not yet fully maximized. A study by Pasayloon (2023) reinforces this finding, stating that teachers who actively integrate ICT in cooperative learning environments often face difficulties effectively structuring peer interaction due to technical proficiency and institutional support gaps.

Table 12 depicts the ICT competency levels of elementary mathematics teachers in terms of pedagogical aspects, specifically Standard 4, which focuses on evaluating the use of ICT integration in the teaching-learning process and utilizing the results to refine learning activities.

Table 12. *Level of ICT Competency of Elementary Math Teachers in Terms of Pedagogical – Standard 4 (n=165)*

No.	Indicators	Mean	Verbal Description	Standard Deviation
	Standard 4: Evaluate the usage of ICT integration in the teaching-learning process and use results to refine the design of learning activities.			
1	Design rubrics for assessing student performance in the use of various technologies.	3.29	M	0.89
2	Use electronic means of administering quizzes and examinations.	3.25	M	0.98
3	Analyze assessment data using spreadsheets and statistical applications.	3.20	M	1.01
	Composite	**3.25**	**M**	**0.96**

Note: 4.21 – 5.00 (Very High, VH), 3.41 – 4.20 (High, H), 2.61 – 3.40 (Moderate, M), 1.81 – 2.60 (Low, L), 1.00 – 1.80 (Very Low, VL)

The data reveal that teachers demonstrate a "moderate" level of competency across all indicators, with a mean of ($\bar{x}$ = 3.29, SD = 0.89) in designing rubrics for assessing student performance using various technologies, ($\bar{x}$ = 3.25, SD = 0.98) in using electronic means to administer quizzes and examinations, and ($\bar{x}$ = 3.20, SD = 1.01) in analyzing assessment data using spreadsheets and statistical applications. The overall competency level in this standard is classified as "moderate," with a composite mean of ($\bar{x}$ = 3.25, SD = 0.96). These findings suggest that while teachers exhibit a moderate skill level in all indicators, additional support or training may be beneficial.

Correspondingly, Bowen et al. (2022) highlight the significant role of technology in enhancing peer evaluation processes, particularly through electronic rubrics. Integrating ICT into assessment practices facilitates efficient, consistent, and data-informed educational decision-making. Additionally, Dahal et al. (2022) emphasize that digital tools such as Google Forms, Kahoot, and Quizizz effectively administer assessments. Furthermore, Gasigwa, Maniraho, and Habimana (2022) underscore the practicality of Microsoft Excel in educational contexts, noting its wide availability and ease of use for fundamental statistical analysis compared to more advanced software.

Table 13 presents the ICT competency levels of elementary mathematics teachers in terms of pedagogical aspects, specifically Standard 5, which emphasizes using computers and other technologies to collect and communicate information with students, colleagues, parents, and other stakeholders. The data indicate that teachers demonstrate a "high" level of competency across the given indicators, with a composite mean of ($\bar{x}$ = 3.43, SD = 0.99).

Table 13. *Level of ICT Competency of Elementary Math Teachers in Terms of Pedagogical – Standard 5 (n=165)*

No.	Indicators	Mean	Verbal Description	Standard Deviation
	Standard 5: Use computers and other technologies to collect and communicate information to students, colleagues, parents, and others.			
1	Use emails, group sites, blogs, etc., to disseminate information directly to students, colleagues, and parents.	3.46	H	0.98
2	Use emails, group sites, blogs, etc., to collect information and feedback directly from students, colleagues, and parents.	3.41	H	1.01
	Composite	**3.43**	**H**	**0.99**

Note: 4.21 – 5.00 (Very High, VH), 3.41 – 4.20 (High, H), 2.61 – 3.40 (Moderate, M), 1.81 – 2.60 (Low, L), 1.00 – 1.80 (Very Low, VL)

The table shows that teachers exhibit "high" competency in using emails, group sites, and blogs to share information with students, colleagues, and parents ($\bar{x}$ = 3.46, SD = 0.98). This suggests that ICT tools are effectively utilized for communication and information-sharing purposes. Similarly, their ability to use these platforms to gather feedback from students, colleagues, and parents is also rated "high" ($\bar{x}$ = 3.41, SD = 1.01), indicating active engagement with ICT tools to facilitate two-way communication. This suggests that ICT has become essential for strengthening collaboration among education teachers, students, and stakeholders. A study by Gamit (2023) supports these findings, highlighting that teachers frequently use ICT-based communication tools, such as email and group sites, to interact with parents and students.

Table 14 presents the ICT competency levels of elementary mathematics teachers in terms of pedagogical aspects, specifically Standard 6, which refers to the application of technology to facilitate a variety of appropriate assessment and evaluation strategies while recognizing the diversity of learners. The results indicate that teachers exhibit a moderate level of ICT competency in this area, with a composite mean of ($\bar{x}$ = 2.99, SD = 1.03). Specifically, they demonstrate a moderate ability to utilize electronic assessment tools, such as online testing and digital project submissions ($\bar{x}$ = 3.09, SD = 1.03). Similarly, their competency in setting up online databases or repositories for student work is also at a "moderate" level ($\bar{x}$ = 2.89, SD = 1.03). This suggests that teachers may have varying familiarity and confidence in using ICT for assessment and evaluation. The findings reflect a partial adoption of technology-driven assessment strategies, where some teachers may be more adept at using electronic tools while others may still be adapting to these digital methods.

Table 14. *Level of ICT Competency of Elementary Math Teachers in Terms of Pedagogical – Standard 6 (n=165)*

No.	Indicators	Mean	Verbal Description	Standard Deviation
	Standard 6: Apply technology to facilitate various appropriate assessment and evaluation strategies, recognizing the diversity of learners.			
1	Explore using electronic assessment tools like online testing and submission of projects via email or online facilities.	3.09	M	1.03
2	Set up online databases or repositories of student works.	2.89	M	1.03
	Composite	**2.99**	**M**	**1.03**

Note: 4.21 – 5.00 (Very High, VH), 3.41 – 4.20 (High, H), 2.61 – 3.40 (Moderate, M), 1.81 – 2.60 (Low, L), 1.00 – 1.80 (Very Low, VL)

A study by Amini and Oluyide (2020) revealed that teachers in well-supported educational environments effectively utilize advanced digital assessment tools, including automated grading systems, learning management systems (LMS), and adaptive testing platforms. Their research found that teachers who frequently engaged with professional development programs and had regular access to ICT resources reported having higher confidence and proficiency in electronic assessment strategies.

Table 15 displays the ICT competency levels of elementary mathematics teachers in the professional domain, specifically Standard 1, which refers to proactively engaging in exploring and learning new and emerging technologies. The results show a "moderate" level of competency, with a composite mean of ($\bar{x}$ = 3.25, SD = 0.92). Among the indicators, teachers exhibit the highest competency in identifying educational sites and portals relevant to their subject area ($\bar{x}$ = 3.42, SD = 0.90), which falls within the "high" category. This suggests that teachers are relatively confident in locating online resources that support their teaching.

Table 15. *Level of ICT Competency of Elementary Math Teachers in Terms of Professional Domain – Standard 1 (n=165)*

No.	Indicators	Mean	Verbal Description	Standard Deviation
	Standard 1: Proactively engage in exploring and learning new and emerging technologies.			
1	Identify educational sites and portals suitable for their subject area.	3.42	H	0.90
2	Join online communities and subscribe to relevant mailing lists and online journals.	3.21	M	0.93
3	I recommend useful and credible websites to colleagues.	3.21	M	0.96
4	Review new and existing software for education.	3.15	M	0.91
	Composite	**3.25**	**M**	**0.92**

Note: 4.21 – 5.00 (Very High, VH), 3.41 – 4.20 (High, H), 2.61 – 3.40 (Moderate, M), 1.81 – 2.60 (Low, L), 1.00 – 1.80 (Very Low, VL)

However, engagement in joining online communities, subscribing to mailing lists and journals ($\bar{x}$ = 3.21, SD = 0.96), recommending credible websites to colleagues ($\bar{x}$ =3.21, SD = 0.96), and reviewing educational software ($\bar{x}$ = 3.15, SD = 0.91) are all rated as "moderate." These results suggest that while teachers recognize the importance of digital engagement for professional growth, there is still room for further enhancement. According to Gamit (2023), professional development in ICT relies heavily on teachers' willingness to explore new technologies. The study found that while teachers acknowledge the need for continuous learning, their engagement in online professional communities and resource-sharing platforms remains limited due to time constraints and institutional barriers.

Similarly, Pasayloon (2023) emphasized that teachers who actively participate in online discussions and digital knowledge-sharing platforms develop higher ICT competencies. However, the study also revealed that many educators hesitate to engage in online learning communities due to a lack of structured support and training on utilizing these platforms effectively. Overall, the findings indicate that while teachers actively explore digital resources, their engagement in collaborative and evaluative aspects of ICT competency is not yet fully established, highlighting the need for more structured professional learning opportunities to enhance their engagement with online communities, resource-sharing platforms, and educational software evaluation.

Table 16 provides an overview of the ICT competency level of elementary mathematics teachers in the professional domain, explicitly focusing on Standard 2, which measures the ability to evaluate and reflect on the use of technology for development and innovation. The composite score of ($\bar{x}$ =3.10, SD = 0.97) indicates a "moderate" ICT competency level in this domain. It suggests that while many teachers are comfortable using technology for professional purposes, there is still room for improvement, particularly in integrating research into their teaching practices.

Table 16. *Level of ICT Competency of Elementary Math Teachers in Terms of Professional Domain – Standard 2 (n=165)*

No.	Indicators	Mean	Verbal Description	Standard Deviation
	Standard 2: Continuously evaluate and reflect on the use of technology in the profession for development and innovation.			
1	Teach students to use various multimedia materials for reports and class presentations.	3.24	M	0.94
2	Follow online tutorials or online degree programs.	3.16	M	0.95
3	Research the use of technology in the classroom.	2.89	M	1.04
	Composite	**3.10**	**M**	**0.97**

Note: 4.21 – 5.00 (Very High, VH), 3.41 – 4.20 (High, H), 2.61 – 3.40 (Moderate, M), 1.81 – 2.60 (Low, L), 1.00 – 1.80 (Very Low, VL)

The first indicator, "teaching students to use multimedia materials for reports and presentations," yielded an average score of ($\bar{x}$ =3.24, SD = 0.94), indicating a "moderate" level of competency. The second indicator, "following online tutorials or degree programs," has a slightly lower average score of ($\bar{x}$ =3.16, SD = 0.95), still under the "moderate" competency level. These data disclose that most teachers are moderately adept at using online resources for their professional development. The third indicator, "researching the use of technology in the classroom," has the lowest average score of ($\bar{x}$ =2.89, SD = 1.04), highlighting that some teachers struggle with integrating ICT into educational research.

According to Novella (2022), teachers acknowledge the importance of ICT for professional growth but often lack sufficient training to incorporate it into research and innovation effectively. Similarly, Gamit (2023) emphasized that structured training programs and professional development workshops significantly enhance teachers' ability to integrate digital tools into their research and instructional practices. Overall, while elementary mathematics teachers demonstrate moderate ICT competency in this domain, continuous professional development and targeted ICT training initiatives are essential to help them fully leverage technology for reflective practice, research, and innovation.

Table 17 provides an overview of the ICT competency level of elementary mathematics teachers in the professional domain regarding Standard 3, which assesses the ability to share experiences, collaborate with peers, and engage stakeholders in advancing technology use in education.

Table 17. *Level of ICT Competency of Elementary Math Teachers in Terms of Professional Domain – Standard 3 (n=165)*

No.	Indicators	Mean	Verbal Description	Standard Deviation
	Standard 3: Share experiences and expertise and collaborate with peers and stakeholders in advancing the use of technology in education and beyond.			
1	Share lesson plans, worksheets, templates, and teaching materials through course websites	3.02	M	1.05
2	Publish (formal /informal) research on the use of ICT in education	2.67	M	1.04
	Composite	**2.84**	**M**	**1.04**

Note: 4.21 – 5.00 (Very High, VH), 3.41 – 4.20 (High, H), 2.61 – 3.40 (Moderate, M), 1.81 – 2.60 (Low, L), 1.00 – 1.80 (Very Low, VL)

The first indicator, "sharing lesson plans and teaching materials through course websites," has an average score of ($\bar{x}$ =3.02, SD=1.05), reflecting a "moderate" level of competency. This signifies that many teachers are comfortable sharing their resources online, although their overall level of proficiency is still in the moderate range. The second indicator, "publishing formal or informal research on the use of ICT in education," has a lower average score of ($\bar{x}$=2.67, SD = 1.04), also categorized as "moderate" competency. This lower score suggests fewer teachers feel confident publishing research on ICT use in education.

The composite score of ($\bar{x}$ =2.84, SD = 1.04) remains within the "moderate" range. This gap underscores the importance of collaborative digital environments in strengthening teachers' digital competencies and fostering research engagement. While professional learning communities and ICT-sharing platforms provide opportunities for knowledge sharing, many teachers struggle to formalize their ICT experiences into published research due to time constraints and limited institutional support (De Juana-Espinosa et al., 2023; Dela Fuente & Biñas, 2020).

Table 18 summarizes ICT competency levels among elementary mathematics teachers, categorized into four domains. The overall ICT competency level is rated "moderate" ($\bar{x}$= 3.30, SD = 0.95), indicating that while teachers demonstrate competency in ICT operations and ethical digital practices, their application of technology in pedagogy and professional collaboration requires further improvement.

Table 18. *Summary Table of the Level of ICT Competency of Elementary Math Teachers Across Four Domains (n=165)*

No.	Domain	Mean	Verbal Description	Standard Deviation
1	Technological Operations and Concepts	3.43	H	0.95
2	Social and Ethical Practices	3.45	H	0.89
3	Pedagogy	3.26	M	0.98
4	Professional Domain	3.06	M	0.98
	Overall	**3.30**	**M**	**0.95**

Note: 4.21 – 5.00 (Very High, VH), 3.41 – 4.20 (High, H), 2.61 – 3.40 (Moderate, M), 1.81 – 2.60 (Low, L), 1.00 – 1.80 (Very Low, VL)

Among the domains, Social and Ethical Practices receive the highest rating ($\bar{x}$ = 3.45, SD = 0.89). This domain includes understanding and adhering to ethical standards, promoting the responsible use of ICT, and ensuring digital safety and security. This result is likewise evident in the study of Guillo and Guillo (2017). Likewise, the Mijares (2022) survey, which supports these findings, emphasizes the significance of integrating social and ethical considerations into ICT use in education to foster a safe and responsible digital environment for students.

In Technological Operations and Concepts, teachers likewise show "high" competency ($\bar{x}$= 3.43, SD = 0.95). This indicates that teachers use and manage ICT tools and resources effectively and powerfully understand basic hardware and software operations (Mijares, 2022). According to the TPACK framework, this high technological knowledge (TK) level is essential for integrating technology into teaching practices. However, Tzafilkou et al. (2023) emphasized that while educators demonstrate technical competence, their ability to apply these skills effectively in subject-specific teaching remains inconsistent. This underscores the importance of structured professional development programs focusing on technology-enhanced instruction and subject-specific ICT applications to ensure that all teachers can effectively integrate digital tools into their teaching practices (Li et al., 2024).

Meanwhile, Pedagogy is ranked third and "moderate" with a mean of ($\bar{x}$ = 3.26, SD = 0.95), reflecting challenges in effectively integrating ICT into instructional strategies. While teachers can use digital tools, their ability to design interactive, student-centered learning experiences using technology remains limited. A study by De Juana-Espinosa et al. (2023) confirms this, stating that many educators require ongoing professional development to utilize ICT in subject-specific teaching effectively.

The Professional Domain is "moderate" and receives the lowest rating with a mean of ($\bar{x}$ = 3.06, SD = 0.98), suggesting limited engagement in digital professional development, online collaboration, and research on ICT integration. This finding implies that teachers use technology for instructional purposes but lack confidence or opportunities to leverage ICT for professional networking and research dissemination. De Juana-Espinosa et al. (2023) and Tzafilkou et al. (2023) found that teachers receiving formal ICT training are more likely to participate in online learning communities and research initiatives, reinforcing the need for structured professional development programs.

3.2 Extent of Effect of the Barriers to ICT Integration

Table 19 presents the extent of the effect of barriers in ICT integration into mathematics instruction, identifying key challenges that hinder the effective use of ICT in teaching. The composite mean score of ($\bar{x}$ =3.34) (SD = 1.12) indicates that, overall, the identified barriers are classified as somewhat of a barrier (SB) to ICT integration. However, some barriers are more significant than others, which have critical implications for improving ICT-based mathematics instruction.

Table 19. *The extent of the Effect of the Barriers in ICT Integration to Math Instruction (n=165)*

No.	Identified Barriers	Mean	Verbal Description	Standard Deviation
1	Poor internet connectivity	3.58	B	1.25
2	Lack of access to ICT resources	3.45	B	1.04
3	Limited time to integrate ICT into the curriculum	3.39	SB	1.06
4	Insufficient training on ICT use	3.38	SB	1.07
5	Lack of technical support	3.37	SB	1.09
6	Limited ability to manipulate ICT tools	3.35	SB	1.13
7	Resistance to change from traditional methods	2.89	SB	1.22
	Composite	**3.34**	**SB**	**1.12**

Note: 4.21 – 5.00 (Very High, VH), 3.41 – 4.20 (High, H), 2.61 – 3.40 (Moderate, M), 1.81 – 2.60 (Low, L), 1.00 – 1.80 (Very Low, VL)

The indicators classified as somewhat barriers (SB) to ICT integration in mathematics instruction include limited time for ICT integration ($\bar{x}$ = 3.39, SD = 1.06), insufficient ICT training ($\bar{x}$ = 3.38, SD = 1.07), lack of technical support ($\bar{x}$ = 3.37, SD = 1.09), limited ability to manipulate ICT tools ($\bar{x}$ = 3.35, SD = 1.13), and resistance to change from traditional methods ($\bar{x}$ = 2.89, SD = 1.22). One significant challenge is the difficulty in using ICT and math software, which stems from a lack of awareness about available technological tools and how to integrate them into mathematics instruction effectively (Das, 2019). In addition, the moderate competency in using ICT tools and the absence of strong technical support further discourage teachers from fully incorporating technology into their lessons. To address these issues, teachers should be equipped with digital skills to effectively support students in digital education (Tzafilkou et al., 2023). However, beyond technical challenges, time constraints present another major obstacle. The heavy workload, school duties, and rigid timetables leave little room for teachers to explore new digital methods or develop ICT-based lesson plans, ultimately limiting their ability to be creative with technology in the classroom (Alghasab et al., 2020).

Additionally, in response to this concern, the Department of Education (DepEd) in the Philippines issued DepEd Order No. 005, s. 2024, which aims to rationalize teachers' workloads by limiting actual classroom teaching to six hours per day and assigning non-teaching tasks to administrative personnel. While this policy is a step in the right direction, its implementation has faced challenges, as adherence to these guidelines has not been consistent across schools. This inconsistency may continue to affect teachers' ability to prioritize ICT integration.

The barriers (B) identified as significant obstacles to ICT integration include poor internet connectivity ($\bar{x}$ = 3.58, SD = 1.25) and lack of access to ICT resources ($\bar{x}$ = 3.45, SD = 1.04). These barriers significantly hinder teachers' ability to utilize digital tools, conduct online assessments, and access educational materials, ultimately limiting students' exposure to technology-enhanced learning experiences. Moreover, the variation in internet accessibility across schools suggests that some teachers cannot consistently use web-based resources, forcing them to rely on traditional teaching methods. This lack of connectivity is problematic, as the internet facilitates collaborative learning, dynamic visualization of concepts, and expanded access to digital resources, bridging traditional and modern instructional methods (Das, 2021). Similarly, the insufficient availability of ICT devices further restricts hands-on digital learning opportunities for students. To address this, providing adequate infrastructure is crucial in meeting teaching-learning needs (Zamir & Ali, 2023). Supporting this idea, Mijares (2021) highlights the necessity of allocating funds for ICT facilities, tools, and software to facilitate the teaching and learning process.

3.3 Relationship between Mathematics Teachers' ICT Competency Level and the Extent to which Barriers Affect ICT Integration in Mathematics Instruction

Table 20 presents Spearman's rank order correlation analysis, which examines the relationship between mathematics teachers' ICT competency levels and the extent to which the barriers affect ICT integration into mathematics instruction. The data reveal that all computed correlation coefficients (r_s) are very low, with p-values exceeding the 0.05 significance level. As a result, the null hypothesis (Ho1) is not rejected, indicating no significant relationship between ICT competency levels and barriers to ICT integration. These results suggest that teachers' ICT competencies, whether in technical operations, ethical practices, pedagogy, or professional domains, do not significantly influence how barriers affect ICT integration in mathematics instruction. This could mean that other factors may play a more dominant role in ICT adoption than the teachers' competency.

Table 20. *Relationship between Math Teachers' ICT Competency Level and the Extent to Which Barriers Affect ICT Integration in Math Instruction*

Barriers and Competence in…	r_s	P-value	Decision	Remark
Tech. Operations & Concepts	0.043	0.585	Accept H_{o1}	Not significant
Social And Ethical Practices	0.022	0.779	Accept H_{o1}	Not significant
Pedagogy	0.007	0.934	Accept H_{o1}	Not significant
Professional Domain	0.046	0.556	Accept H_{o1}	Not significant
Overall	**0.025**	**0.752**	**Accept H_{o1}**	**Not significant**

Spearman's Rank Order Correlation at 0.05 Level of Significance

These findings align with research indicating that ICT competency alone does not significantly impact barriers to integration. A balanced approach, incorporating technological, pedagogical, and content knowledge (TPACK), along with strong infrastructure and school policies, is essential for successful implementation. Studies by Mijares (2022) and De Juana-Espinosa et al. (2023) asserted that factors such as internet access, funding, and institutional support are more influential in ICT adoption than individual teacher skills.

3.4 Difference in Mathematics Teachers' ICT Competency Levels when They Are Grouped According to Their Profile

Table 21 illustrates whether ICT competency levels significantly differ based on teachers' sex, age, years of experience, and number of ICT-related training sessions. Regarding sex, the Mann-Whitney U test result ($p = 0.129$) indicates that the difference in ICT competency between male and female teachers is not statistically significant. This finding implies that sex does not appear to determine ICT competency among mathematics teachers. This aligns with studies suggesting equal access to ICT knowledge and skills across genders (Alieto et al., 2024). Similarly, Mijares (2020) found no significant differences in ICT competencies between male and female teachers, reinforcing that gender does not influence ICT skill levels. Likewise, Dela Fuente and Biñas (2020) reported that both male and female teachers exhibited comparable ICT skills, further supporting the conclusion that gender is not a determining factor in ICT competence.

Regarding age, a significant difference is observed in ICT competency levels among different age groups ($H = 31.25$, $p < 0.001$). The post-hoc analysis reveals that younger teachers (25-34) have significantly higher ICT competency than older ones (45-54 and 55-64). This means that younger teachers may be more adept at using ICT due to their greater exposure to technology in their education and early career stages. In contrast, older teachers might face challenges adapting to digital tools. These findings align with previous research emphasizing a generational digital divide in education. Studies by Novella (2022) and Gamit (2023) revealed that teachers who have grown up in technology-driven environments are more comfortable integrating ICT tools into their teaching. Meanwhile, older educators may experience difficulties adopting digital methods, reinforcing the need for continuous professional development to bridge this gap.

Table 21. *Difference in Math Teachers' ICT Competency Levels when They are Grouped According to Their Profile (n=165)*

Variables	n	Median	Comp. Value	Decision	Remark
Sex					
Male	31	3.55	U=1713	Accept H_{o2}	Not significant
Female	134	3.22	p=0.129		
Age					
25-34	62	3.57	H=31.25	Reject H_{o2}	Significant
35-44	47	3.30	df=3		
45-54	38	3.01	p<.001		
55-64	18	2.64			
	Post-Hoc Analysis (DSCF Pairwise Comparison)				
	(25-34) vs. (35-44); p = 0.123 (not significant)				
	(25-34) vs. (45-54); p<.001 (significant)				
	(25-34) vs. (55-64); p<.001 (significant)				
	(35-44) vs. (45-54); p = 0.159 (not significant)				
	(35-44) vs. (55-64); p = 0.020 (significant)				
	(45-54) vs. (55-64); p = 0.346 (not significant)				
Number of Years of Mathematics Teaching Experience					
1-5	46	3.11	H=7.972	Accept H_{o2}	Not significant
6-10	48	3.11	df=4		
11-15	26	3.59	p=0.093		
16-20	25	3.37			
>20	20	3.57			
Number of ICT-related Training					
0	30	3.11	H=17.64		
1	37	3.11	df=4	Reject H_{o2}	Significant
2	41	3.59	p=0.001		
3	29	3.37			
≥4	28	3.57			
	Post-Hoc Analysis (DSCF Pairwise Comparison)				
	(0) vs. (1); p = 0.945 (not significant)				
	(0) vs. (2); p = 0.268 (not significant)				
	(0) vs. (3); p = 0.064 (not significant)				
	(0) vs. (≥4); p = 0.003 (significant)				
	(1) vs. (2); p = 0.555 (not significant)				
	(1) vs. (3); p = 0.103 (not significant)				
	(1) vs. (≥4); p = 0.011 (significant)				
	(2) vs. (3); p = 0.963 (not significant)				
	(2) vs. (≥4); p = 0.728 (not significant)				
	(3) vs. (≥4); p = 0.949 (not significant)				

Mann-Whitney U Test and Kruskal-Wallis Test at 0.05 Level of Significance

Meanwhile, regarding the number of years of mathematics teaching, the Kruskal-Wallis test (H = 7.972, p = 0.093) indicates no significant difference in ICT competency across teaching experience groups. This signifies that experience in teaching mathematics does not necessarily equate to higher ICT competency. Similarly, the study of Mijares (2020) found that teachers' ICT competency levels were statistically similar regardless of their length of service. This means regular ICT usage and continuous training play a more significant role in digital proficiency than tenure alone. The findings suggest that ICT skills are more influenced by professional development efforts than the years spent teaching. Studies emphasize that ICT training is more crucial than teaching experience in developing digital competency. Mijares (2020) found that teachers who undergo regular training are better at integrating technology into instruction. Novella (2022) also asserted that frequent ICT training helps bridge the digital divide between new and experienced educators. Moreover, Hero (2020) noted that multiple ICT training sessions boost teachers' confidence in digital tools, enhancing student engagement. Kennedy (2023) postulated that schools with structured ICT training programs achieve higher ICT adoption and integration in teaching.

4.0 Conclusion

Teachers possess the technical skills to use technology; however, their moderate competence in the pedagogical and professional domains highlights the need for further professional development and support to strengthen ICT integration in their teaching practices. Barriers such as poor internet connectivity and limited access to ICT resources hinder their ability to utilize digital tools and online resources, forcing reliance on traditional methods and limiting students' exposure to technology-enhanced learning. Relying solely on conventional methods restricts student engagement and hinders the development of crucial 21st-century skills in the digital age. Successfully integrating ICT into math instruction requires better support for teachers, including improved access to technology, ongoing professional development, and strong school support, ensuring that ICT integration becomes a sustainable reality in elementary classrooms. As the quote suggests, "The future of education is digital—we must embrace it to remain relevant and responsive to learners' needs." Embracing this digital shift is essential for preparing students for the future and enhancing their learning experiences.

5.0 Contribution of Authors

The authors confirm their equal contribution to every part of this research. All authors reviewed and approved the final version of this paper.

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7.0 Conflict of Interest

This study has no conflict of interest of any sort.

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