ICT Integration and Learners' Academic Performance in Mathematics

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Abstract

Examining how technology is used in math classes can show us if it helps students learn better. With this context, this study aimed to investigate the level of ICT Integration in Mathematics and learners' academic performance in 12 public elementary schools in the district of Hinigaran-I during the School Year 2024-2025. Data for this descriptive-comparative correlational study was collected from 229 teachers using a self-made data-gathering instrument that has passed the rigorous validity and reliability tests. Notably, younger teachers demonstrated higher levels of ICT integration in digital instruction and assessment than their older counterparts, reflecting a generational shift towards more effective technology adoption. Furthermore, single and married teachers showed a high level of ICT integration, although single teachers marginally outperformed their married peers in digital instruction. Additionally, the data highlights a significant difference in digital assessment integration related to length of service, with newer teachers exhibiting more frequent use of digital tools. The findings indicate that increased use of digital teaching tools, combined with more targeted professional development for teachers, particularly longer-serving educators, will help close the ICT integration gap while improving student learning outcomes in mathematics. The study results call for professional development in ICT for teachers, especially targeting those with longer service, as they adapt to contemporary educational technologies that can facilitate improved learner engagement and performance in mathematics.

Keywords: ICT Integration, Academic Performance, Mathematics, Digital Instruction and Assessment, Public Elementary Schools.

Bio-profile

Fritz V. Sta. Maria is a licensed public elementary school teacher assigned to a school under the Schools Division of Negros Occidental. He is finishing his Master's degree in Administration and Supervision and takes several roles in his school as an ICT Coordinator, LRMDS Coordinator, and LIS/BEIS Coordinator. His dedication to integrating technology in the classroom is a result of his enthusiasm for elevating learning experiences with creative teaching practices.

Introduction

Rationale

Around the globe, employing ICT in educational systems is viewed as a fundamental modernizing strategy. The same can be said for the Philippines, which has made some advancements with changing the 'traditional' view of education into a more technologically blended system (Espinosa et al., 2023).

In alignment with the Department of Education's commitment on the use of Information and Communication Technology (ICT) in teaching and learning, the Division of Negros Occidental has issued several memoranda to support this effort. Division Memorandum No 862, s. 2022 highlighted the instruction of many subjects like Mathematics, English, and Science into the ICT-driven integration of 21st-century skills and ICT proficiency. This instruction points to the need to equip educators with the required resources and methodologies to improve teaching with technology.

Despite the benefits, Philippine classrooms face ICT implementation challenges like limited access and lack of teachers' training on digital use, worsening the problem. This study identifies gaps and opportunities to improve math teaching and learning in the digital age.

Literature Review

This section provides an overview of the knowledge on ICT integration in Mathematics and Academic performance, incorporating local and foreign literature and studies that have significantly influenced the variables studied.

Tang and Chaw (2020) explain that digital technologies can enhance differentiated instruction by enabling teachers to tailor content and tasks according to learner performance. This method helps all learners progress in mathematics and is valuable no matter their previous knowledge. This also allows for personalized learning pathways and ensures students can pursue content that addresses their specific learning needs.

Digital assessment means measuring the student's understanding with technology-supported tools. According to Martin and Tapp (2020), one of the key advantages of online quizzes, e-portfolios, and online platforms is that they allow learning progress to be tracked in real-time. These assessments provide us with immediate feedback critical in determining learning loss. Lopez (2023) investigated the effectiveness of digital assessments in public schools. Students felt more able to answer in math when tested through game-based apps rather than through pen-and-paper tests.

Collaboration among teachers in creating and sharing digital instructional content and materials improved the students' learning outcomes (Miller & Sanchez, 2023). Delos Reyes (2021) added that the collaborative design of the digital learning materials improved the alignment with the learners' needs.

Theoretical Underpinnings

This study is anchored in Davis' Technology Acceptance Model (TAM) (1989). This model explains the acceptance and integration of ICT in mathematics education. The model can be used to understand how perceived usefulness and ease of use impact the digital instruction, digital assessment tools, and preparation of instructional material, ultimately contributing to the learners' academic performance.

The theoretical framework on Davis' Technology Acceptance Model appears ok for a study on ICT Integration and Learners' Academic Performance in Mathematics. But it needs reinforcement, say, just one paragraph, on the Vygotsky's constructivist theory that explains how ICT supports active, student-centered learning in ICT.

According to Vygotsky, the most important principle of constructivism is that human cognitive development requires social interaction and cultural tools and is applied in integrating information and communication technology (ICT) in education. Media technology is itself a mediating instrument for student-centered learning environments and students do actively engage with content, work with others, and discover concepts at their own pace. Some examples of ICT-aided collaborative interactions include but are not limited to, collaborative software, online discussions, and multimedia resources through which students can operate in their Zone of Proximal Development (ZPD)-a term referring to the range of an individual's current abilities and where development is possible with proper assistance and digital scaffolding (Vygotsky, 1978; Kim, 2001). Thus, ICT makes possible both individual learning experiences and meaningful social interactions, which are two core principles of Vygotsky's constructivist framework (Blake & Pope, 2008).

Objectives

This study aimed to determine the levels of ICT integration and learners' academic performance in mathematics in 12 public elementary schools in the district of Hinigaran-I during the School Year 2024-2025. More specifically, this study sought to determine 1) the level of ICT integration in mathematics in digital instruction, digital assessment, and instructional materials preparation; 2) the level of ICT integration in mathematics when grouped according to the same constructs in objective no. 2; 3) the level of learners' academic performance in mathematics during the second quarter of School Year 2024-2025; 4) if there is a significant difference in the level of ICT integration in mathematics when grouped according to the same constructs in objectives 2 and 3; and 5) if there is a significant relationship between the levels of ICT integration and academic performance in mathematics.

Methodology

This section discusses the research design, respondents, data-gathering instrument, data collection procedure, analytical schemes, data analysis, statistical treatment, and ethical considerations.

Research Design

This study employed a descriptive-comparative correlational research design to determine the level of ICT integration in mathematics and its relation to learners' academic performance. Aggarwal and Ranganathan (2020), the key objective of a descriptive study is to describe a population or phenomenon by its attributes, so this design was suitable for reflecting the real scenario in the chosen schools.

Respondents

The study employed purposive sampling, specifically total population sampling, where the entire interest group was surveyed. Two hundred twenty-nine teachers from twelve public elementary schools were included as respondents. Purposive sampling is commonly used when the researcher needs to gain insights from individuals experienced in the phenomenon being investigated (Etikan, Musa, & Alkassim, 2016).

Instrument

The survey questionnaire covered 30 items to determine the level of ICT integration in mathematics with 10 items each: digital instruction, digital assessment, and instructional materials preparation. The following scores and verbal interpretations were used: Each item was rated on a scale of 1 to 5, where five (5) is interpreted as always, 4 (four) as often, 3 (three) as sometimes, 2 (two) as rarely, and 1 (one) as almost never.

Data Gathering Procedure

A necessary permit was secured from the office of the Schools Division Superintendent through the PSDS of a district after establishing the validity and reliability tests of the research instrument. Upon approval, the letter was scanned and sent to the school heads of the concerned schools. The required copies of the questionnaire were reproduced and administered to the teachers. Afterward, the questionnaires were immediately collected, and a 100% retrieval rate was obtained.

Data Analysis and Statistical Treatment

Objective No. 1 used the descriptive analytical scheme and mean to determine the level of ICT integration in mathematics in terms of digital instruction, digital assessment, and instructional materials preparation. Objective No. 2 also used a descriptive analytical scheme and mean to determine the level of ICT integration in mathematics when grouped according to digital instruction, digital assessment, and instructional materials preparation. Objective No. 3 likewise used a descriptive analytical scheme and mean s statistical tool to determine the level of learners'

academic performance in mathematics during the second quarter of the School Year 2024-2025. Objective No. 4 utilized the descriptive analytical scheme and Mann-Whitney U Test to determine whether or not there is a significant difference in the level of ICT integration in mathematics when grouped and compared according to the aforementioned constructs. Objective No. 5 utilized a descriptive analytical scheme and Spearman Rho to determine if there is a significant relationship between the levels of ICT integration and academic performance in mathematics.

Ethical Considerations

This research study ensured that the teacher-respondents participated voluntarily, and no one was forced to answer the survey questionnaire. In addition, consent was secured, as stated in the questionnaire. For the confidentiality of the data collected, the researcher guaranteed that the record of the responses remained private, and only the researcher had access to all the information. The researcher also ensured that stating a name when answering the questionnaire was optional to preserve the anonymity of the respondents. Likewise, the names of the schools were coded using letters only. After the study, all the gathered data containing the respondents' personal information was deleted from the software to protect the respondents from harm, emotional distress, embarrassment, and physical discomfort. The results were presented to the district through the In-Service Training for Teachers.

Results and Discussions

This section provides a presentation and discussion of the study's results following the sequence of the research objectives.

Table 1
Level of ICT integration in mathematics in the area of Digital instruction

Digital Instruction Items	Mean	Interpretation
As a teacher, I…		
1. integrate interactive multimedia presentations into my daily lessons.	4.21	High
2. use educational software to enhance the teaching of numeracy skills.	4.18	High
3. use digital tools to support differentiated instruction in the classroom.	4.21	High
4. incorporate educational games and apps to make learning engaging for students.	4.11	High
5. use digital simulations to teach complex concepts in a simplified manner.	4.02	High

6. allow students to use tablets or computers for learning activities.	4.00	High
7. utilize online resources and videos to supplement classroom instruction.	4.05	High
8. regularly update and adapt my digital teaching methods based on student feedback.	3.97	High
9. use the interactive whiteboard to enhance classroom instruction.	1.84	Low
10. encourage students to create digital content such as presentations or videos.	4.03	High
Overall Mean	**3.86**	**High**

Table 1 presents the level of ICT integration in Mathematics in digital instruction. The overall mean of 3.86 is interpreted as High level (HL). The result implies that teachers can utilize a range of digital aids for teaching and learning to enrich teaching and address various learning needs in mathematics. Garcia (2022) agrees that limited access to and training on using tools such as interactive whiteboards could remain a disadvantage for many public schools, especially those in less urbanized areas.

Table 2
Level of ICT Integration in Mathematics in Digital Assessment

Digital Assessment Items	Mean	Interpretation
As a teacher, I…		
1. use online quizzes and assessments to evaluate student understanding.	3.78	High
2. employ digital tools for formative assessment to monitor student progress.	3.82	High
3. provide digital feedback on assignments and assessments to support student learning.	3.91	High
4. use data from digital assessments to inform instructional planning.	3.81	High
5. incorporate e-portfolios to track and evaluate student growth over time.	2.48	Low
6. use educational apps to assess students' skills and knowledge regularly.	3.66	High
7. involve students in self-assessment and peer-assessment using digital tools.	3.76	High
8. analyze digital assessment data to identify areas needing improvement.	3.77	High

9. use digital platforms to administer and grade assessments efficiently.	3.76	High
10. adapt digital assessment tools to meet the diverse needs of students.	3.79	High
Overall Mean	**3.65**	**High**

Table 2 shows the level of ICT integration in Mathematics in digital assessment. The overall mean of 3.65 is interpreted as HL. The result implies that teachers are effectively using digital tools to assess student understanding and support learning. In line with this, Brown and Clarkson (2022) highlighted how e-portfolios can be used in mathematics to help students reflect on progress, which, in turn, may contribute to helping students become more aware of their areas of strength and areas in need of development.

Table 3
Level of ICT Integration in Mathematics in Instructional Materials Preparation

Instructional Materials Preparation Items	**Mean**	**Interpretation**
As a teacher, I…		
1. design and create digital instructional materials tailored to curriculum objectives.	4.38	High
2. use digital tools to develop interactive worksheets and learning activities.	4.38	High
3. incorporate multimedia elements into lesson plans to enhance instructional materials.	4.32	High
4. utilize online resources to source and integrate up-to-date teaching materials.	4.23	High
5. regularly update digital instructional materials to reflect current educational trends.	4.00	High
6. design digital materials that cater to various learning styles and needs.	4.08	High
7. create digital resources that support collaborative learning among students.	4.03	High
8. use digital platforms to share instructional materials with colleagues for feedback and improvement.	4.04	High
9. integrate varied and interactive digital instructional materials.	4.11	High
10. ensure that digital instructional materials are accessible to all students, including those with special needs.	4.21	High
Overall Mean	**4.18**	**High level**

Table 3 displays the level of ICT integration in mathematics in instructional materials preparation. The overall mean of 4.18 is interpreted as HL. The result implies that teachers have

a high level of proficiency and desire to use ICT in preparing instructional materials for Mathematics. This is supported by Boholano (2020), who states that the development of teaching materials is directed at incorporating digital media, interactive worksheets, and online up-to-date content into lessons that simplify complex mathematics concepts and make them more accessible.

Table 4
Level of ICT Integration in Mathematics in Digital instruction when grouped according to Age

| Digital Instructions | Age | | | |
| | Younger | | Older | |
Items	Mean	Interpretation	Mean	Interpretation
As a teacher, I…				
1. integrate interactive multimedia presentations into my daily lessons.	4.38	High	4.09	High
2. use educational software to enhance the teaching of numeracy skills.	4.30	High	4.09	High
3. use digital tools to support differentiated instruction in the classroom.	4.39	High	4.09	High
4. incorporate educational games and apps to make learning engaging for students.	4.17	High	4.07	High
5. use digital simulations to teach complex concepts in a simplified manner.	4.09	High	3.96	High
6. allow students to use tablets or computers for learning activities.	4.07	High	3.94	High
7. utilize online resources and videos to supplement classroom instruction.	4.21	High	3.94	High
8. regularly update and adapt my digital teaching methods based on student feedback.	4.12	High	3.86	High
9. use the interactive whiteboard to enhance classroom instruction.	1.87	Low	1.82	Low
10. encourage students to create digital content such as presentations or videos.	4.2	High	3.91	High
Overall Mean	**3.98**	**High**	**3.78**	**High**

Table 4 shows the level of ICT integration in mathematics in digital instruction when grouped according to age. The younger group of teachers reported a higher overall mean of 3.98, interpreted as HL, compared to the older group, which had an overall mean of 3.78, also interpreted as HL. The result implies that younger teachers use a wider range of digital tools more frequently and actively than older teachers, which reflects their comfort and familiarity

with emerging technologies. Tang and Chaw (2020) argue that we can harness the power of digital tools to support differentiated instruction by allowing teachers to personalize or adapt content and activities to meet individual learner needs.

Table 5

Level of ICT Integration in Mathematics in Digital Assessment when grouped according to Age

| Digital Assessment Items | Age | | | |
| | Younger | | Older | |
	Mean	Interpretation	Mean	Interpretation
As a teacher, I…				
1. use online quizzes and assessments to evaluate student understanding.	3.95	High	3.65	High
2. employ digital tools for formative assessment to monitor student progress.	3.98	High	3.70	High
3. provide digital feedback on assignments and assessments to support student learning.	4.04	High	3.81	High
4. use data from digital assessments to inform instructional planning.	3.92	High	3.73	High
5. incorporate e-portfolios to track and evaluate student growth over time.	2.61	Moderate	2.38	Low
6. use educational apps to assess students' skills and knowledge regularly.	3.83	High	3.54	High
7. involve students in self-assessment and peer-assessment using digital tools.	3.82	High	3.71	High
8. analyze digital assessment data to identify areas needing improvement.	3.94	High	3.65	High
9. use digital platforms to administer and grade assessments efficiently.	4.01	High	3.57	High
10. adapt digital assessment tools to meet the diverse needs of students.	4.03	High	3.62	High
Overall Mean	**3.81**	**High**	**3.54**	**High**

Table 5 illustrates the level of ICT integration in mathematics in digital assessment when grouped according to age. The younger group of teachers showed a higher overall mean of 3.81, interpreted as HL, than older teachers, with an overall mean of 3.54, likewise interpreted as HL. The result implies that younger teachers practice integrating ICT in digital assessment more than older teachers, especially in providing digital feedback to support learning. Younger teachers might be more familiar with and comfortable using digital tools. Digital platforms can enhance the effectiveness of active learning and self-regulated learning (Wang & Tahir, 2020). However,

only limited use is made of e-portfolios and further tools, indicating that while basic digital assessments are widely performed, advanced tools like e-portfolios remain underutilized.

Table 6
Level of ICT Integration in Mathematics in Instructional Materials Preparation when grouped according to Age

| Instructional materials preparation | Age | | | |
| | | Younger | | Older |
Items	Mean	Interpretation	Mean	Interpretation
As a teacher, I…				
1. design and create digital instructional materials tailored to curriculum objectives.	4.50	Very high	4.29	High
2. use digital tools to develop interactive worksheets and learning activities.	4.51	Very high	4.29	High
3. incorporate multimedia elements into lesson plans to enhance instructional materials.	4.41	High	4.26	High
4. utilize online resources to source and integrate up-to-date teaching materials.	4.36	High	4.13	High
5. regularly update digital instructional materials to reflect current educational trends.	4.06	High	3.95	High
6. design digital materials that cater to various learning styles and needs.	4.15	High	4.03	High
7. create digital resources that support collaborative learning among students.	4.16	High	3.94	High
8. use digital platforms to share instructional materials with colleagues for feedback and improvement.	4.19	High	3.93	High
9. integrate varied and interactive digital instructional materials.	4.19	High	4.05	High
10. ensure that digital instructional materials are accessible to all students, including those with special needs.	4.35	High	4.11	High
Overall Mean	**4.29**	**High**	**4.10**	**High**

Table 6 presents the level of ICT integration in mathematics in instructional materials preparation when grouped according to age. The younger group reported a higher overall mean of 4.29, interpreted as HL, compared to the older group, with an overall mean of 4.10, also interpreted as HL. The result implies that younger teachers are generally more proactive in developing and utilizing digital tools to prepare instructional materials. The result is consistent

with Espinosa and Catipay (2023), who found that teacher collaboration in digital content creation improves consistency and effectiveness in instructional delivery.

Table 7
Level of ICT Integration in Mathematics in   Digital instruction when grouped according to Civil Status

| Digital Instructions | Civil Status | | | |
| | Single | | Married | |
Items	Mean	Interpretation	Mean	Interpretation
As a teacher, I…				
1. integrate interactive multimedia presentations into my daily lessons.	4.28	High	4.18	High
2. use educational software to enhance the teaching of numeracy skills.	4.29	High	4.13	High
3. use digital tools to support differentiated instruction in the classroom.	4.31	High	4.18	High
4. incorporate educational games and apps to make learning engaging for students.	4.12	High	4.10	High
5. use digital simulations to teach complex concepts in a simplified manner.	4.00	High	4.02	High
6. allow students to use tablets or computers for learning activities.	4.05	High	3.98	High
7. utilize online resources and videos to supplement classroom instruction.	4.22	High	3.99	High
8. regularly update and adapt my digital teaching methods based on student feedback.	4.11	High	3.92	High
9. use an interactive whiteboard to enhance classroom instruction.	2.03	Low	1.77	Low
10. encourage students to create digital content such as presentations or videos.	4.25	High	3.95	High
Overall Mean	**3.96**	**High**	**3.82**	**High**

Table 7 shows the level of ICT integration in mathematics in digital instruction when grouped according to civil status. The single group reported a higher overall mean of 3.96, interpreted as HL, compared to the married group, with an overall mean of 3.82, also interpreted as HL. The result implies that single teachers generally utilize available digital tools in classroom instruction more than married teachers. Tan and Manalo (2024) stressed the need for ongoing professional learning and infrastructure support to effectively use sophisticated digital tools. Without such support, teachers are unlikely to be able to make effective use of such tools, even if they are otherwise digitally capable.

Table 8

Level of ICT Integration in Mathematics in   Digital Assessment when grouped according to Civil Status

| Digital Assessment | Civil Status | | | |
| | Single | | Married | |
Items	Mean	Interpretation	Mean	Interpretation
As a teacher, I…				
1. use online quizzes and assessments to evaluate student understanding.	3.88	High	3.74	High
2. employ digital tools for formative assessment to monitor student progress.	3.92	High	3.77	High
3. provide digital feedback on assignments and assessments to support student learning.	4.08	High	3.84	High
4. use data from digital assessments to inform instructional planning.	3.95	High	3.75	High
5. incorporate e-portfolios to track and evaluate student growth over time.	2.49	Low	2.48	Low
6. use educational apps to assess students' skills and knowledge regularly.	3.95	High	3.55	High
7. involve students in self-assessment and peer-assessment using digital tools.	4.06	High	3.63	High
8. analyze digital assessment data to identify areas needing improvement.	3.89	High	3.72	High
9. use digital platforms to administer and grade assessments efficiently.	3.86	High	3.71	High
10. adapt digital assessment tools to meet the diverse needs of students.	4.08	High	3.68	High
Overall Mean	**3.82**	**High**	**3.59**	**High**

Table 8 displays the ICT integration in mathematics in digital assessment when grouped by civil status. The single group revealed a higher overall mean of 3.82, interpreted as HL, compared to the married group, with an overall mean of 3.59, interpreted as HL. The result implies that a single group is comparatively higher, especially in areas like providing feedback digitally and utilizing data received from digital assessments for instructional planning, which could indicate that they were relatively active in the use of digital assessment compared to the married group. Wang and Lee (2020) concluded that despite the potential of the use of digital tools like an e-portfolio, access and integration continue to hinder the wide-scale utilization of such tools.

Table 9

Level of ICT Integration in Mathematics in   Instructional materials preparation when grouped according to Civil Status

| Instructional materials preparation | Civil Status | | | |
| | **Single** | | **Married** | |
Items	**Mean**	**Interpretation**	**Mean**	**Interpretation**
As a teacher, I…				
1. design and create digital instructional materials tailored to curriculum objectives.	4.46	High	4.35	High
2. use digital tools to develop interactive worksheets and learning activities.	4.46	High	4.35	High
3. incorporate multimedia elements into lesson plans to enhance instructional materials.	4.42	High	4.28	High
4. utilize online resources to source and integrate up-to-date teaching materials.	4.26	High	4.21	High
5. regularly update digital instructional materials to reflect current educational trends.	3.98	High	4.00	High
6. design digital materials that cater to various learning styles and needs.	4.18	High	4.04	High
7. create digital resources that support collaborative learning among students.	4.22	High	3.96	High
8. use digital platforms to share instructional materials with colleagues for feedback and improvement.	4.14	High	4.00	High
9. integrate varied and interactive digital instructional materials.	4.22	High	4.07	High
10. ensure that digital instructional materials are accessible to all students, including those with special needs.	4.29	High	4.18	High
Overall Mean	**4.26**	**High**	**4.14**	**High**

Table 9 presents the level of ICT integration in mathematics in instructional materials preparation when grouped according to civil status. The single group with an overall mean of 4.26, interpreted as HL, was higher than the married group with an overall mean of 4.14, interpreted as HL. The result implies that single teachers had greater integration in preparing instructional materials. Miller and Sanchez (2023) found that collaboration between teachers to create and share digital instructional content enhanced material quality and student outcomes across districts. The text emphasized how important it is for teachers to collaborate when developing instructional material that is engaging and pedagogically sound.

Table 10

Level of ICT Integration in Mathematics in Digital instruction when grouped according to Length of Service

| Digital Instructions | Length of Service | | | |
| | Shorter | | Longer | |
Items	Mean	Interpretation	Mean	Interpretation
As a teacher, I…				
1. integrate interactive multimedia presentations into my daily lessons.	4.37	High	4.06	High
2. use educational software to enhance the teaching of numeracy skills.	4.32	High	4.04	High
3. use digital tools to support differentiated instruction in the classroom.	4.40	High	4.04	High
4. incorporate educational games and apps to make learning engaging for students.	4.23	High	4.00	High
5. use digital simulations to teach complex concepts in a simplified manner.	4.14	High	3.91	High
6. allow students to use tablets or computers for learning activities.	4.14	High	3.86	High
7. utilize online resources and videos to supplement classroom instruction.	4.23	High	3.89	High
8. regularly update and adapt my digital teaching methods based on student feedback.	4.13	High	3.83	High
9. use an interactive whiteboard to enhance classroom instruction.	1.89	Low	1.80	Low
10. encourage students to create digital content such as presentations or videos.	4.21	High	3.86	High
Overall Mean	**4.00**	**High**	**3.73**	**High**

Table 10 shows the level of ICT integration in mathematics in digital instruction when grouped according to length of service. The shorter service teachers, with an overall mean of 4.00, interpreted as HL, were slightly higher than the longer service teachers, with an overall mean of 3.73, and were also interpreted as HL. The result implies that shorter-service teachers may provide slightly better integration of digital instruction than longer-service teachers. Dela Cruz (2023) mentioned that few schools only have access to some digital tools. In such contexts, teachers may have no option but to revert to traditional mechanisms, thus limiting the effective embedding of ICT in the learning system.

Table 11

Level of ICT Integration in Mathematics in   Digital Assessment when grouped according to Length of Service

| Digital Assessment | Length of Service | | | |
| | Shorter | | Longer | |
Items	Mean	Interpretation	Mean	Interpretation
As a teacher, I…				
1. use online quizzes and assessments to evaluate student understanding.	3.97	High	3.59	High
2. employ digital tools for formative assessment to monitor student progress.	3.98	High	3.66	High
3. provide digital feedback on assignments and assessments to support student learning.	4.10	High	3.73	High
4. use data from digital assessments to inform instructional planning.	3.97	High	3.65	High
5. incorporate e-portfolios to track and evaluate student growth over time.	2.55	Moderate	2.42	Low
6. use educational apps to assess students' skills and knowledge regularly.	3.81	High	3.53	High
7. involve students in self-assessment and peer-assessment using digital tools.	3.82	High	3.69	High
8. analyze digital assessment data to identify areas needing improvement.	3.96	High	3.58	High
9. use digital platforms to administer and grade assessments efficiently.	3.98	High	3.54	High
10. adapt digital assessment tools to meet the diverse needs of students.	4.06	High	3.53	High
Overall Mean	**3.82**	**High**	**3.49**	**High**

Table 11 displays the level of ICT integration in mathematics in digital assessment when grouped according to length of service. The shorter service teachers, with an overall mean of 3.82, interpreted as HL, were higher than the longer service teachers, with an overall mean of 3.49, interpreted as HL. The result implies that shorter service teachers are more likely to be using digital assessments in Mathematics than the longer ones. Martin and Tapp (2020), who claim the benefits of real-time feedback through tools such as e-portfolios. They added that such tools enable quick tracking of student progress and spotting gaps.

Table 12

Level ICT Integration in Mathematics in   Instructional Materials Preparation when grouped according to Length of Service

| Instructional materials preparation | Length of Service | | | |
| | Shorter | | Longer | |
Items	Mean	Interpretation	Mean	Interpretation
As a teacher, I…				
1. design and create digital instructional materials tailored to curriculum objectives.	4.50	Very high	4.27	High
2. use digital tools to develop interactive worksheets and learning activities.	4.51	Very high	4.25	High
3. incorporate multimedia elements into lesson plans to enhance instructional materials.	4.42	High	4.22	High
4. utilize online resources to source and integrate up-to-date teaching materials.	4.40	High	4.07	High
5. regularly update digital instructional materials to reflect current educational trends.	4.05	High	3.94	High
6. design digital materials that cater to various learning styles and needs.	4.15	High	4.01	High
7. create digital resources that support collaborative learning among students.	4.16	High	3.91	High
8. use digital platforms to share instructional materials with colleagues for feedback and improvement.	4.18	High	3.91	High
9. integrate varied and interactive digital instructional materials.	4.19	High	4.03	High
10. ensure that digital instructional materials are accessible to all students, including those with special needs.	4.32	High	4.11	High
Overall Mean	**4.29**	**High**	**4.07**	**High**

Table 12 presents the level of ICT integration in Mathematics in instructional materials preparation when grouped according to length of service. The shorter service teachers, with an overall mean of 4.29, interpreted as HL, were higher than the longer service teachers, with an overall mean of 4.07, also interpreted as HL. The result implies that short-service teachers possess greater knowledge of using digital platforms and tools to prepare instructional materials. According to the Department of Education's Learning Resource Management and Development System (LRMDS, 2022), although teachers were developing their digital materials, there is a necessity for technical training and peer review systems for them to collaborate and share to ensure quality.

Table 13

Level of Learners' Academic Performance in Mathematics in the Second Quarter of School Year 2024-2025

Learners' Academic Performance		
School	**Mean**	**Interpretation**
A	84.64	Very Satisfactory
B	85.94	Very Satisfactory
C	86.17	Very Satisfactory
D	85.53	Very Satisfactory
E	86.11	Very Satisfactory
F	86.85	Very Satisfactory
G	86.95	Very Satisfactory
H	84.16	Very Satisfactory
I	84.25	Very Satisfactory
J	85.2	Very Satisfactory
K	85.14	Very Satisfactory
L	84.75	Very Satisfactory
Overall Mean	**85.47**	**Very Satisfactory**

Table 13 shows learners' academic performance in the second quarter of School Year 2024–2025 in Mathematics of twelve elementary schools labeled from A to L, with an overall performance mean score of 85.47, interpreted as "very satisfactory." The result implies that while all schools demonstrated a "very satisfactory" level of academic performance in Mathematics, a small performance gap and differences remain. As stated by Asare et al. (2023), the interactive nature of digital learning helps students be involved and acquire and retain mathematical content, which benefits academic performance.

Table 14

Differences in the Level of ICT Integration in Mathematics in Digital Instruction when grouped and compared according to Variables

Digital Instruction							
Variables	**Categories**	**N**	**Mean Rank**	**Mann Whitney U-test**	**Sig. Level**	**p-value**	**Interpretation**
Age	Younger	96	126.83	5248.50		0.021	Significant
	Older	133	106.46				
					0.05		
Civil Status	Single	65	123.75	4761.50		0.207	Not Significant
	Married	164	111.53				

| Length of Service | Shorter | 111 | 129.68 | 4919.00 | | 0.001 | Significant |
| | Longer | 118 | 101.19 | | | | |

Table 14 displays the differences in the level of ICT integration in Mathematics in digital instruction when grouped and compared according to age, civil status, and length of service. The result showed that age and length of experience are significant contributors to the levels of integration of digital instruction into Mathematics, whereas civil status has no such substantial effect. This implies that younger and shorter service teachers are more accustomed to digital tools and platforms. In line with Hsu and Ching (2021), "Young educators tend to be more confident with the use of digital tools and resources for the classroom because their comfort with technology and belief in the use of those technologies to support learning is correlated with age."

Table 15

Differences in the Level of ICT Integration in Mathematics in Digital Assessment when grouped and compared according to Variables

Digital Assessment							
Variables	**Categories**	**N**	**Mean Rank**	**Mann Whitney U-test**	**Sig. Level**	***p-value***	**Interpretation**
Age	Younger	96	128.53	5085.00		0.009	Significant
	Older	133	105.23				
Civil Status	Single	65	128.22	4470.50	0.05	0.057	Not Significant
	Married	164	109.76				
Length of Service	Shorter	111	128.53	5047.00		0.003	Significant
	Longer	118	102.27				

Table 15 displays the differences in the level of ICT integration in Mathematics as to digital assessment when grouped and compared according to age, civil status, and length of service. The result revealed that age and length of service are statistically relevant to the level of ICT integration in Mathematics for digital assessment. At the same time, civil status does not seem to exert any influence. This implies that individuals with younger and shorter service in the educational field may tend to be more inclined to adopt digital assessment methods, highlighting

a generational shift in teaching practices. Wang & Ma (2020) revealed that younger teachers were found to be more comfortable than older teachers in using online assessment platforms.

Table 16

Differences in the Level of ICT integration in mathematics in Instructional materials preparation when grouped and compared according to Variables

Instructional materials preparation							
Variables	**Categories**	**N**	**Mean Rank**	**Mann Whitney U-test**	**Sig. Level**	**p-value**	**Interpretation**
Age	Younger	96	124.94	5429.50		0.053	Not Significant
	Older	133	107.82				
Civil Status	Single	65	129.08	4414.50	0.05	0.042	Significant
	Married	164	109.42				
Length of Service	Shorter	111	125.33	5402.00		0.022	Significant
	Longer	118	105.28				

Table 16 displays the differences in the level of ICT integration in Mathematics as to instructional materials preparation when grouped and compared according to age, civil status, and length of service. The result indicated that civil status and length of service are statistically relevant to ICT integration in Mathematics for instructional materials preparation, while age has no significant effect. This implies that single and shorter service teachers are more willing to adopt the digital tools to prepare their instructional materials. Single and shorter service teachers may have more time to create digital materials or the flexibility to pursue and implement digital instructional tools. Santos (2022) found that teachers with fewer personal commitments (i.e., single) and those with more experience in using ICT tend to invest more time in integrating new technologies into their teaching practice.

Table 17

Relational Analysis Between the Level of ICT Integration in Mathematics and the Learners' Academic Performance

Correlation	N	rho	Level of Sig.	*p*-value	Interpretation
ICT integration in mathematics	229				
Learners' Academic Performance	229	0.868	0.05	0.000	Significant

Table 17 presents the relational analysis between the level of ICT integration in Mathematics and learners' academic performance. The data reveals a significant relationship between ICT integration and learners' academic performance in Mathematics. This relationship suggests incorporating ICT tools and resources into the learning environment can improve academic results. Educators might focus on integrating technology into curricula to enhance understanding, engagement, and retention of information. This result is in line with the previous study of Boadu and Boateng (2024) identified that using ICT tools in mathematics classrooms positively influenced students' achievement.

Conclusions

Digital instruction, digital assessment, and the preparation of instructional materials are the three areas of ICT integration in mathematics where teachers were found to practice high levels of ICT integration. Younger and shorter service teachers showed greater integration of ICT in mathematics, especially in digital instruction, digital assessment, and the preparation of instructional materials. There was no significant difference in digital instruction and assessment concerning teachers' civil status -- single or married. However, single teachers had higher ICT integration levels regarding the preparation of instructional materials. In addition, there was a significant relationship between the level of ICT integration in mathematics and the learners' academic performance. This means that using more digital teaching tools can help students learn better. Findings highlight how continuous professional development, even more so for older and longer service teachers, has a bridging impact on the ICT integration divide, leading to more effective use of ICT across all teaching profiles.

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Conflict of Interest

The author declares the absence of any conflict of interest that could have influenced the content or conclusions of this study. He affirms that no financial, personal, or professional relationship with other individuals or organizations has compromised the research work's objectivity, integrity, or impartiality. Finally, no external parties influenced the study design, data collection, analysis, or interpretation.

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