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## RESEARCH ARTICLE

### Teachers' Experiences and Instructional Practices in Utilizing Information and Communication Technology (ICT) for Mathematics Teaching

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#### Abstract

The integration of Information and Communication Technology (ICT) in Mathematics education has become increasingly significant in enhancing learner engagement, conceptual understanding, and instructional delivery in elementary schools. In the Philippine educational context, teachers are encouraged to utilize digital technologies and innovative teaching approaches to support learner-centered instruction and improve learning outcomes in Mathematics. This qualitative phenomenological study explored the experiences and instructional practices of public elementary school teachers in utilizing ICT for Mathematics teaching in Diffun District I, Division of Quirino. Specifically, the study examined teachers' instructional strategies, classroom experiences, challenges encountered, coping mechanisms, and professional perspectives regarding ICT integration in Mathematics instruction. Twelve public elementary school teachers were purposively selected as participants. Data were gathered through semi-structured interviews, classroom observations, and document analysis of lesson plans and digital instructional materials. Braun and Clarke's thematic analysis framework was employed in analyzing the collected data. Findings revealed that teachers utilized ICT to enhance learner engagement, simplify mathematical concepts, and promote interactive classroom participation through multimedia presentations, educational applications, online resources, and digital activities. However, participants also experienced challenges related to insufficient technological resources, unstable internet connectivity, limited ICT infrastructure, inadequate technical support, and lack of advanced ICT training. Despite these challenges, teachers demonstrated adaptability, innovation, and professional commitment by maximizing available resources, engaging in collaborative learning, and continuously improving their technological competencies. The study concluded that effective ICT integration in Mathematics education requires sustained institutional support, continuous teacher training programs, strengthened technological infrastructure, and accessible digital learning resources. The findings contribute to the growing discourse on ICT integration, Mathematics pedagogy, and educational innovation in Philippine elementary education.

**Keywords:** Information and Communication Technology, ICT integration, Mathematics teaching, elementary education, instructional practices, teacher experiences, qualitative research, public elementary schools

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## INTRODUCTION

The rapid advancement of technology has significantly transformed educational practices worldwide, including the methods and strategies used in classroom instruction. In contemporary education, Information and Communication Technology (ICT) has become an essential instructional tool that supports learner-centered teaching, enhances classroom interaction, and improves learners' conceptual understanding across various subject areas. In Mathematics education, ICT integration provides opportunities for interactive learning experiences, visual representation of mathematical concepts, collaborative problem-solving activities, and immediate feedback mechanisms that strengthen learners' comprehension and engagement.

In the Philippines, the Department of Education continuously promotes the integration of technology into classroom instruction to improve educational quality and align teaching practices with 21st-century learning competencies. Teachers are encouraged to utilize digital resources, multimedia tools, online applications, and technology-enhanced instructional materials to facilitate meaningful and engaging learning experiences. The integration of ICT in Mathematics teaching is particularly important because Mathematics is often perceived by learners as difficult, abstract, and challenging. Through ICT-assisted instruction, teachers can simplify complex concepts, improve learner participation, and create more dynamic and interactive classroom environments.

However, despite the recognized benefits of ICT integration, many public elementary school teachers continue to experience challenges related to technological accessibility, inadequate infrastructure, insufficient ICT resources, limited training opportunities, and varying levels of technological competence. In rural and geographically isolated schools, technological limitations such as unstable internet connectivity, lack of digital devices, and limited technical support significantly affect teachers' ability to fully integrate ICT into classroom instruction. These challenges require teachers to demonstrate flexibility, innovation, and professional adaptability in utilizing available technological resources for effective teaching.

Previous studies emphasized that successful ICT integration depends largely on teachers' technological competence, pedagogical knowledge, instructional readiness, and institutional support systems (Mishra & Koehler, 2006). Similarly, Tondeur et al. (2021) explained that teachers' confidence, professional development opportunities, and access to technological resources significantly influence the effectiveness of ICT integration in classroom instruction. In Mathematics education, ICT-supported instruction has been associated with improved learner engagement, critical thinking, problem-solving skills, and conceptual understanding.

Despite the increasing emphasis on technology-enhanced learning, limited qualitative studies specifically explore the lived experiences and instructional practices of elementary Mathematics teachers utilizing ICT in public school settings in the Philippine context. Most existing studies focus primarily on quantitative assessments of technology use, learner performance, or digital readiness, leaving a gap in understanding teachers' actual classroom experiences, challenges, and pedagogical adaptations during ICT integration.

Hence, this study aimed to explore the experiences and instructional practices of public elementary school teachers in utilizing Information and Communication Technology (ICT) for Mathematics teaching in Diffun District I, Division of Quirino. Specifically, the study investigated teachers' instructional strategies, classroom experiences, implementation challenges, coping mechanisms, and professional insights regarding ICT integration in Mathematics instruction. The findings of the study are expected to contribute to the development of teacher training programs, ICT-enhancement initiatives, and educational policies that strengthen technology integration and instructional innovation in Philippine elementary education.

## RESEARCH QUESTIONS

This study sought to answer the following questions:

1. How do teachers utilize Information and Communication Technology (ICT) in teaching Mathematics in public elementary schools?
2. What instructional practices and strategies do teachers employ in integrating ICT into Mathematics instruction?
3. What experiences and challenges do teachers encounter in utilizing ICT for Mathematics teaching?
4. How do teachers address instructional and technological challenges during ICT integration?
5. What recommendations may be proposed to strengthen ICT integration in Mathematics education in public elementary schools?

## METHODOLOGY

This study utilized a qualitative phenomenological research design to explore the lived experiences and instructional practices of teachers utilizing Information and Communication Technology (ICT) for Mathematics teaching in public elementary schools. The phenomenological approach was appropriate because it enabled the researcher to understand teachers' personal experiences, instructional realities, and pedagogical perspectives regarding ICT integration in Mathematics instruction. The study was conducted in selected public elementary schools in Diffun District I, Division of Quirino. The locale was selected due to its active implementation of ICT-supported instruction and diverse educational contexts among public elementary schools. The participants consisted of twelve public elementary school teachers selected through purposive sampling. Participants were included based on the following criteria: currently teaching Mathematics in elementary grade levels, possessing at least three years of teaching experience, and actively utilizing ICT in classroom instruction. Data were gathered through semi-structured interviews, classroom observations, and document analysis of lesson plans, digital instructional materials, and assessment tools. Interviews were audio-recorded with participants' consent and transcribed verbatim for thematic analysis. The study employed Braun and Clarke's (2006) thematic analysis framework involving data familiarization, coding, theme generation, theme review, and interpretation. To ensure the trustworthiness of the study, credibility was established through member checking and triangulation of data sources, while dependability was strengthened through audit trails. Confirmability and transferability were further ensured through reflective journaling and thick descriptions of the participants' classroom experiences and instructional contexts.

### **Teachers' Experiences and Instructional Practices in Utilizing Information and Communication Technology (ICT) for Mathematics Teaching in Public Elementary Schools of Diffun District I, Division of Quirino**

## RESULTS AND FINDINGS

### **Theme 1: ICT Integration Enhances Learner Engagement and Mathematical Understanding**

The findings revealed that teachers perceived Information and Communication Technology (ICT)

as an effective instructional tool in improving learner engagement, participation, and comprehension in Mathematics classes. Participants emphasized that the use of multimedia presentations, educational videos, interactive games, online applications, and digital visualizations made mathematical concepts easier to explain and more interesting for elementary learners. Teachers noted that ICT-based instruction increased learners' motivation and participation, particularly during problem-solving activities and interactive classroom discussions. One participant shared:

"Mas nagiging interesado ang mga bata kapag gumagamit kami ng videos at interactive activities sa Math."

Another teacher explained:

"Kapag may visual presentations at animations, mas mabilis nilang naiintindihan ang proseso sa solving."

A participant also stated:

"Malaking tulong ang ICT para gawing mas enjoyable at hindi nakakatakot ang Mathematics."

Classroom observations revealed that learners became more participative during ICT-assisted lessons, especially when teachers utilized visual representations, digital quizzes, and collaborative technology-based activities. Teachers also observed improved learner confidence and classroom interaction during technology-supported discussions.

The findings suggest that ICT integration positively supports learner-centered Mathematics instruction by making abstract concepts more concrete, interactive, and meaningful for elementary learners. These findings align with Constructivist Learning Theory, which emphasizes active learner engagement and meaningful knowledge construction through interactive learning environments (Vygotsky, 1978). Similarly, the findings support the study of Tondeur et al. (2021), which emphasized that ICT integration enhances learner motivation, conceptual understanding, and classroom participation in Mathematics education.

## **Theme 2: Instructional Challenges and Technological Limitations in ICT Integration**

Despite the positive contributions of ICT to Mathematics instruction, teachers encountered several challenges in integrating technology effectively in their classrooms. Participants identified insufficient technological resources, unstable internet connectivity, limited ICT equipment, lack of technical support, and inadequate teacher training as significant barriers to ICT utilization.

One participant explained:

"Minsan mahirap magturo gamit ang ICT dahil kulang ang gadgets at mahina ang internet connection."

Another teacher shared:

"Hindi lahat ng guro ay sanay sa paggamit ng advanced technology kaya kailangan pa ng mas maraming training."

A participant also stated:

"Kapag nagkaroon ng technical problems, naapektuhan ang daloy ng lesson at nasasayang ang oras."

Teachers also expressed concerns regarding the limited availability of projectors, laptops, printers, and digital learning materials in some schools. Some participants revealed that they personally searched for online instructional resources and created improvised digital materials to supplement classroom instruction.

The findings indicate that while ICT offers significant instructional benefits, technological limitations and infrastructural challenges continue to affect effective implementation in public elementary schools. These findings support the report of OECD (2019), which highlighted that technology integration in education remains dependent on adequate infrastructure, teacher readiness, and institutional support. Furthermore, Ertmer and Ottenbreit-Leftwich (2019) emphasized that teachers' confidence and successful technology integration are influenced by access to resources, professional development opportunities, and supportive learning environments.

### **Theme 3: Teacher Adaptability, Professional Development, and Innovative ICT Practices**

The findings further revealed that teachers demonstrated adaptability, creativity, and professional initiative in integrating ICT into Mathematics instruction despite existing challenges. Participants emphasized the importance of continuous learning, peer collaboration, and self-improvement in enhancing their ICT competence and instructional confidence.

One teacher shared:

"Patuloy kaming nag-aaral kung paano gamitin ang iba't ibang applications para mas mapadali ang pagtuturo."

Another participant explained:

"Malaking tulong ang sharing of strategies ng mga kapwa guro tungkol sa paggamit ng ICT."

A participant also stated:

"Kahit limitado ang resources, gumagawa kami ng paraan para maging interactive ang Math lessons."

Teachers described participating in webinars, Learning Action Cell (LAC) sessions, online tutorials, and peer mentoring activities to improve their technological and pedagogical skills. Participants also highlighted the importance of administrative support and school-based ICT initiatives in promoting innovation and instructional improvement.

The findings demonstrate that teachers' adaptability and willingness to continuously improve significantly contribute to effective ICT integration in Mathematics education. Teachers' innovative practices reflect their commitment to improving learner outcomes and addressing instructional challenges despite limited technological resources. The findings align with the Technological Pedagogical Content Knowledge (TPACK) framework, which emphasizes the integration of technological, pedagogical, and content knowledge in effective teaching practices (Mishra & Koehler, 2006). Similarly, Darling-Hammond et al. (2020) argued that continuous professional development and collaborative learning environments enhance teachers' instructional competence and educational innovation.

## **DISCUSSION**

The findings of the study revealed that ICT integration significantly enhanced learner engagement, participation, and comprehension in Mathematics instruction among public elementary school learners in Diffun District I, Division of Quirino. Teachers perceived ICT as an effective instructional tool that made mathematical concepts more interactive, visual, and meaningful for learners. Through the use of multimedia presentations, digital activities, educational applications, and technology-supported problem-solving tasks, teachers were able to simplify abstract mathematical concepts and encourage active learner participation. The findings affirm Constructivist Learning Theory, which posits that learners acquire knowledge more effectively through interactive and experiential learning opportunities (Vygotsky, 1978). Likewise, the findings support Tondeur et al. (2021), who emphasized that ICT integration improves learner motivation, classroom interaction, and conceptual understanding in Mathematics education.

However, the study also highlighted several instructional and technological challenges affecting ICT integration in public elementary schools. Teachers experienced difficulties related to insufficient technological resources, unstable internet connectivity, inadequate ICT infrastructure, limited access to digital devices, and insufficient teacher training opportunities. These challenges negatively affected lesson continuity, classroom management, and instructional efficiency. The findings suggest that effective ICT integration requires not only teacher competence but also adequate institutional and infrastructural support systems. Similar findings were emphasized by OECD (2019), which reported that technological integration in education remains dependent on access to digital infrastructure, technical support, and sustained professional development initiatives. Furthermore, Ertmer and Ottenbreit-Leftwich (2019) argued that teachers' ability to effectively integrate technology is influenced by both internal factors such as confidence and external factors such as resources and institutional support.

Despite these challenges, the findings demonstrated that teachers remained adaptable, resourceful, and professionally committed in utilizing ICT for Mathematics teaching. Participants actively sought opportunities for professional growth through webinars, peer mentoring, online tutorials, and Learning Action Cell (LAC) sessions. Teachers also improvised instructional strategies and maximized available technological resources to create engaging and learner-centered Mathematics lessons. These practices reflect teachers' resilience and commitment to improving instructional quality despite technological limitations. The findings support the TPACK framework proposed by Mishra and Koehler (2006), which emphasizes that effective technology integration requires the intersection of technological knowledge, pedagogical competence, and content mastery. Moreover, the findings align with Darling-Hammond et al. (2020), who emphasized that collaborative professional learning and continuous teacher development strengthen instructional innovation and teacher effectiveness.

Overall, the findings demonstrate that ICT integration in Mathematics instruction provides significant opportunities for improving learner engagement and instructional delivery in elementary education. However, the sustainability and effectiveness of ICT-based teaching practices remain dependent on adequate technological infrastructure, teacher capacity-building initiatives, and institutional support mechanisms.

## CONCLUSION AND IMPLICATIONS

### Conclusion

The study concluded that teachers in public elementary schools of Diffun District I, Division of Quirino perceived ICT as an effective instructional tool that enhances learner engagement, participation, and mathematical understanding. Teachers utilized multimedia presentations, educational applications, interactive activities, and digital resources to make Mathematics instruction more meaningful, visual, and learner-centered. ICT integration contributed to improved classroom interaction, learner motivation, and conceptual comprehension among elementary learners.

However, the study also concluded that teachers continue to encounter several challenges in utilizing ICT effectively, including insufficient technological resources, unstable internet connectivity, inadequate ICT infrastructure, lack of technical support, and limited professional training opportunities. These challenges affected instructional delivery, lesson continuity, and the overall integration of technology into classroom instruction.

Despite these limitations, teachers demonstrated adaptability, resilience, and professional commitment by continuously improving their technological and pedagogical competencies through collaboration, self-directed learning, and participation in professional development activities. The study therefore concludes that effective ICT integration in Mathematics education requires sustained institutional support, strengthened technological infrastructure, continuous teacher training programs, and accessible digital learning resources to maximize the benefits of technology-enhanced instruction in elementary education.

### Implications of the Study

The findings of the study provide significant implications for educational leaders, curriculum planners, policymakers, and teacher education institutions. Schools may strengthen ICT infrastructure by providing adequate technological resources, stable internet connectivity, digital learning materials, and technical support systems to improve technology integration in classroom instruction. Educational administrators may also prioritize the implementation of school-based ICT programs and technology-enhancement initiatives that support both teachers and learners. The study further suggests the need for continuous professional development programs focusing on ICT integration, digital pedagogy, educational applications, and technology-supported assessment strategies. Learning Action Cell (LAC) sessions, peer mentoring activities, and collaborative professional learning communities may also be strengthened to improve teachers' technological confidence and instructional competence.

Moreover, the findings contribute to the growing discourse on ICT integration and Mathematics education in the Philippine elementary school context. The study may serve as a basis for future research on digital learning, technology-supported pedagogy, learner outcomes, and educational innovation in public basic education.

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