



Technology Integration, Teacher Self-Efficacy, and Academic Achievement in Public Primary Schools

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Abstract

The integration of educational technology in primary education has gained momentum in the Philippines following curriculum reforms and the shift toward blended and technology-supported learning. However, in geographically isolated and resource-constrained areas, such as Zone 3 of the Division of Catanduanes, disparities in teacher preparation, training access, and infrastructure continue to influence classroom practice and pupil outcomes. Against this backdrop, this study examined the extent of technology integration and teacher self-efficacy in primary grade instruction and their relationship with pupils' academic achievement. Using a descriptive-correlational design, data were gathered from public primary school teachers in the districts of Bagamanoc, Panganiban, and Viga, focusing on teacher profile variables, levels of technology integration, self-efficacy in technology use, and pupils' academic performance. Findings indicate generally high levels of teacher self-efficacy and technology integration, with significant variations based on educational attainment, experience, and training exposure. Technology integration showed a significant positive relationship with pupils' academic achievement, whereas teacher self-efficacy did not demonstrate a direct association. The results suggest that effective technology use and student engagement, rather than confidence alone, are critical to improving learning outcomes, underscoring the need for sustained, context-responsive professional development.

Keywords: technology integration, teacher self-efficacy, academic achievement, public primary education



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INTRODUCTION

The integration of educational technology has become a central concern in contemporary primary education, driven by its potential to enhance instructional quality, learner engagement, and academic achievement. Globally, technology enhanced instruction is increasingly recognized as a means to support differentiated learning, promote interactive pedagogies, and foster essential twenty first century skills among young learners. Empirical studies consistently demonstrate that when technology is meaningfully integrated into classroom instruction, it can strengthen cognitive engagement, facilitate formative assessment, and improve learning outcomes, particularly in foundational literacy and

numeracy (Aktürk & Delen, 2020; Pino & Mongas, 2025). However, the effectiveness of technology integration is not determined by access alone but is strongly influenced by teachers' competencies, beliefs, and confidence in using digital tools for pedagogical purposes. Within this context, teacher self-efficacy has emerged as a critical psychological construct shaping instructional decision making and technology use. Grounded in Social Cognitive Theory, self-efficacy reflects teachers' beliefs in their capacity to organize and execute actions necessary to integrate technology effectively in classroom instruction. High levels of self-efficacy are associated with instructional persistence, adaptive teaching strategies, and openness to innovation, whereas low self-efficacy may hinder meaningful technology

adoption despite the availability of resources (Li & Zhao, 2024; Williams et al., 2023). Complementarily, the Technology Acceptance Model explains how teachers' perceptions of usefulness and ease of use influence their willingness to integrate technology into instructional practices. Together, these perspectives highlight the complex interaction between teacher cognition, instructional behavior, and student learning outcomes.

In the Philippine basic education context, the push for digital transformation has intensified following curriculum reforms and shifts toward blended and technology supported learning. However, disparities in teacher preparation, training opportunities, and contextual constraints, particularly in geographically isolated and resource constrained areas, continue to shape classroom realities. In provinces such as Catanduanes, where access to sustained professional development and digital infrastructure remains uneven, understanding how teachers integrate technology and how this integration relates to pupil outcomes is both timely and necessary.

Despite a growing body of international literature on technology integration and teacher self-efficacy, several gaps persist. First, most empirical studies focus on secondary or tertiary education, often within STEM or urban contexts, leaving primary grade instruction underrepresented. Second, while previous research documents teachers' levels of technology use and confidence, fewer studies empirically examine how these variables relate to pupils' academic achievement, particularly in early grades where foundational skills are formed. Third, existing studies frequently treat technology integration and self-efficacy as isolated constructs, offering limited insight into how teacher profile variables, such as educational attainment, teaching experience, position, and training exposure, shape these constructs and their instructional consequences.

Within the local literature, studies conducted in Catanduanes and similar contexts have

explored teachers' technological competencies and perceived challenges. However, these investigations remain largely descriptive and do not adequately establish relational links between teacher characteristics, technology integration, self-efficacy, and measurable pupil learning outcomes. Consequently, there is a paucity of empirical evidence explaining whether teachers' confidence in using technology translates into improved academic performance among primary pupils or whether student engagement mediates this relationship. Addressing these gaps is essential for informing context responsive professional development programs and instructional policies.

In response to these gaps, the present study was conducted to assess the extent of technology integration and teacher self-efficacy in the primary grades in Zone 3, Division of Catanduanes, and to determine their association with pupils' academic achievement. Specifically, it examined teachers' demographic and professional profiles, levels of technology integration, self-efficacy in technology use, and pupils' academic performance, as well as the significant differences and relationships among these variables. By situating the inquiry within public primary schools in Bagamanoc, Panganiban, and Viga districts, the study establishes empirical evidence grounded in a localized educational context.

Anchored in the Technology Acceptance Model and Social Cognitive Theory, the study advances a theoretically informed and empirically testable framework that explains how teacher characteristics shape self-efficacy and instructional technology use, ultimately influencing pupil learning outcomes. Through its descriptive correlational design, the research contributes to both local and international discourse by clarifying the role of teacher level factors in technology enhanced primary instruction and by generating evidence-based implications for capacity building initiatives. Ultimately, this study seeks to inform educational stakeholders on how targeted professional development, instructional

support, and learner centered technology integration can strengthen academic outcomes in primary education within resource constrained settings.

Statement of the Problem. This study aimed to assess the extent of technology integration and teacher self-efficacy in the primary grades in Zone 3, Division of Catanduanes, and to determine their association with pupils' academic achievement. It likewise explored the challenges encountered by teachers in implementing technology-enhanced instruction. Specifically, the study sought to answer the following questions:

1. What is the profile of the primary grade teachers in Zone 3 in terms of:
 - 1.1 highest educational attainment;
 - 1.2 position title;
 - 1.3 years of teaching experience; and
 - 1.4 number of relevant trainings attended?
2. What is the level of technology integration in primary grade instruction in terms of:
 - 2.1 teachers' proficiency in integrating technology;
 - 2.2 pupils' engagement with technology-supported learning activities; and
 - 2.3 challenges encountered in technology integration?
3. What is the level of teachers' self-efficacy in integrating technology in primary grade instruction?
4. What is the academic achievement of primary grade pupils in Zone 3?
5. Is there a significant difference in the level of technology integration when teachers are grouped according to their profile variables?
6. Is there a significant difference in teachers' self-efficacy when grouped according to their profile variables?
7. Is there a significant relationship between the level of technology integration and pupils' academic achievement?

8. Is there a significant relationship between teachers' self-efficacy and pupils' academic achievement?

Null Hypotheses. The following null hypotheses were formulated and tested at a 0.05 significance level:

- H₀₁: There is no significant difference in the level of technology integration among teachers when grouped according to their profile variables.
- H₀₂: There is no significant difference in teachers' self-efficacy when grouped according to their profile variables.
- H₀₃: There is no significant relationship between the level of technology integration and pupils' academic achievement.
- H₀₄: There is no significant relationship between teachers' self-efficacy and pupils' academic achievement.

Scope of the Study. This study was conducted in public primary schools within Zone 3, Division of Catanduanes, from June to August 2025. It investigated the extent of technology integration, teachers' self-efficacy in using educational technologies, and pupils' academic achievement in the primary grades. The participants included duly appointed primary grade teachers from Bagamanoc South and North, Panganiban, and Viga East and West Districts. The study focused on teachers' demographic profiles, instructional technology practices, self-efficacy levels, and pupils' academic performance, examining descriptive patterns and relational associations. It was delimited to classroom instruction and teacher competencies, excluding administrative or policy-related ICT issues.

Theoretical/Conceptual Framework. The present study is anchored in the Technology Acceptance Model (TAM) and Social Cognitive Theory (SCT), offering a comprehensive lens to understand how teacher characteristics influence technology integration and, ultimately, primary grade pupils' academic achievement. TAM posits

that individuals' acceptance and use of technology are determined by cognitive beliefs about its usefulness and ease of use, which shape instructional intentions and classroom practices (Chan & Owens, 2022; Song et al., 2022). Complementing this, SCT emphasizes teacher self-efficacy, highlighting how educators' confidence in effectively implementing technology affects their persistence, effort, and adaptability in instructional processes (Li & Zhao, 2024).

Integrating these theoretical perspectives provides a holistic framework for examining how teacher profile variables such as teaching experience, educational attainment, ICT-related training, and exposure to educational technologies inform self-efficacy, which in turn guides the quality and frequency of technology integration. Figure 1 illustrates this relationship, positioning teacher self-efficacy as a mediating mechanism through which teacher characteristics are translated into effective instructional behavior. Technology integration serves as the key behavioral outcome, linking teacher cognition and efficacy to learning strategies and classroom practices. Ultimately, this framework explicates the sequential pathways from teacher profile variables through self-efficacy and technology integration to primary grade pupils' academic achievement. By situating the study within TAM and SCT, it provides a theoretically grounded and empirically testable model for understanding how teacher cognition and efficacy contribute to improved educational outcomes.

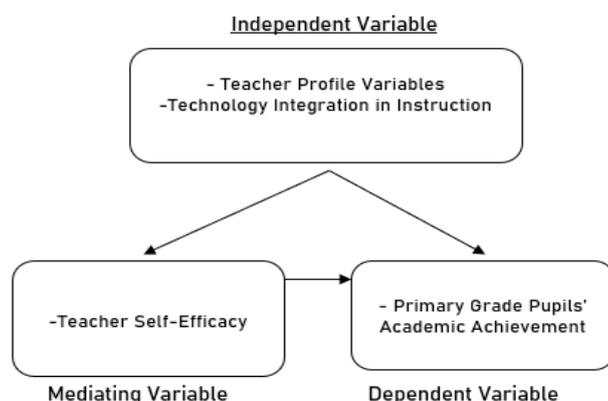


Figure 1
Research Paradigm

LITERATURE REVIEW

Recent educational research underscores the pivotal role of technology integration in enhancing instructional quality and student learning outcomes in primary education (Pino & Mongas, 2025). Effectively integrated technology facilitates interactive and engaging instruction while promoting cognitive engagement and deeper learning among pupils (Pino & Mongas, 2025; Casilao et al., 2025). International studies demonstrate that teachers' beliefs, attitudes, and confidence regarding technology significantly influence both the frequency and quality of instructional practices, as well as the extent to which technology supports learning (Williams et al., 2023; Aktürk & Delen, 2020). Central to these influences is teacher self-efficacy, derived from Social Cognitive Theory, which captures educators' belief in their capability to use technology effectively and resiliently in instructional contexts (Williams et al., 2023; Li & Zhao, 2024). Teacher self-efficacy has been consistently linked to increased technological competence, higher instructional engagement, and adaptive teaching behaviors, serving as a key psychological mechanism through which professional experience and training translate into effective technology use (Forbes et al., 2023; Williams et al., 2023).

Empirical evidence highlights the importance of teacher preparation and structured professional development in building self-efficacy for technology integration. Meta-analytic studies indicate that targeted professional development significantly enhances K-12 teachers' confidence in using technology, which is strongly associated with sustained and meaningful integration in classrooms (Forbes et al., 2023). Furthermore, self-efficacy beliefs correlate with Technological Pedagogical Content Knowledge (TPACK), influencing teachers' decisions to implement technology in content-specific instruction (Abu Bakar et al., 2020).

Despite this body of literature, there is limited research examining the interaction of self-

efficacy and technology integration specifically in primary grade classrooms. Most studies focus on secondary education or STEM contexts, leaving a gap in understanding how teacher profile variables, such as educational attainment, years of experience, and participation in training programs, relate to self-efficacy and observable classroom practices that enhance pupil learning (Pino & Mongas, 2025; Williams et al., 2023).

Within the Philippine context, local studies have explored educational practices, including technology integration, teacher competencies, and contextual challenges, particularly in regions such as Catanduanes (Cordial, Evangelista, & Bermudo, 2025; Cordial, Amaranto, & Bermudo, 2025). Cordial and colleagues provide valuable insights into technological knowledge, integration practices, and associated factors among primary school teachers; however, there is still a lack of comprehensive analysis linking teacher self-efficacy directly to primary pupils' academic achievement (Cordial, Evangelista, & Bermudo, 2025). While these studies document teacher practices and challenges, they do not adequately examine how teacher profile variables influence self-efficacy or how these constructs translate into measurable student learning outcomes, particularly in standardized academic achievement metrics (Cordial, Amaranto, & Bermudo, 2025).

Moreover, although prior research suggests plausible associations between technology integration and learner engagement, much of the evidence remains descriptive rather than analytical, failing to establish causal or correlational links between teacher cognition, instructional behavior, and primary pupils' academic performance (Pino & Mongas, 2025). This highlights a critical gap: the need for empirical studies that not only assess levels of technology integration and self-efficacy but also examine their direct relationships with student outcomes. Specifically, quantitative research investigating whether and how teacher self-efficacy and technology integration explain variance in primary pupils'

academic achievement remains limited (Williams et al., 2023).

The present study addresses these gaps by systematically assessing primary grade teachers' profiles, levels of technology integration, and self-efficacy, and by examining their associations with primary pupils' academic achievement in Zone 3, Division of Catanduanes. Additionally, it investigates differences in technology integration and self-efficacy across teacher profile variables, providing nuanced insights into how demographic and professional factors shape instructional practices. By doing so, this study contributes to local educational research and the global discourse on technology integration and teacher self-efficacy, offering evidence to inform professional development programs and policy frameworks aimed at enhancing primary education through technology-enhanced instruction.

METHODS

Research Design. This study utilized a descriptive-correlational research design, appropriate for quantitatively describing current instructional practices and analyzing associations among key educational variables without manipulation (Johnson & Smith, 2019). The descriptive component provided a systematic overview of primary grade teachers' demographic profiles, levels of technology integration, and self-efficacy, as well as pupils' academic achievement. Simultaneously, the correlational component examined the strength and direction of relationships between technology integration, teacher self-efficacy, and student performance (Creswell & Creswell, 2023). This design allowed the researchers to identify existing patterns and relational linkages in natural educational settings where experimental manipulation is neither feasible nor ethical, thus yielding empirical evidence to inform practice and policy (Osborne, 2020).

Population and Sampling Technique. The population of this study comprised all primary grade teachers in Zone 3, Division of

Catanduanes, totaling 159 educators across fifty-three public elementary schools. Thus, complete enumeration was used as sampling technique. This population represents the target group to which the findings are intended to generalize, offering a comprehensive understanding of technology integration practices, teacher self-efficacy, and their association with primary pupils' academic achievement (Creswell & Creswell, 2020; Tahira, Kazmi, & Zahid, 2020).

To ensure adequate representation and statistical precision, Slovin's formula was employed at a 5% margin of error, resulting in a sample size of 114 teachers. This approach provides an objective and replicable method for sample selection, mitigating potential bias while maintaining the reliability of the study findings (Tahira et al., 2020).

Proportionate allocation was applied to distribute the sample across the district's schools, ensuring that each school's representation corresponded to its share of the total population. This method prevents over- or under-sampling and strengthens the validity of descriptive and correlational analyses examining teacher self-efficacy, technology integration, and their impact on pupils' academic outcomes (Creswell & Creswell, 2020). By combining Slovin's formula with proportionate allocation, the study balances statistical rigor with practical feasibility, ensuring that the findings are generalizable to the entire population of primary grade teachers in Zone 3.

Instrumentation. The present study employed a structured and researcher-developed questionnaire as the main instrument to collect data on primary grade teachers' technology integration, self-efficacy, and the academic achievement of pupils in Zone 3, Division of Catanduanes. The questionnaire was systematically designed into four parts: Part I captured the demographic and professional profile of teachers, including highest educational attainment, position, years of teaching experience, and number of relevant

trainings attended. Part II measured the level of technology integration, encompassing frequency, depth, and pedagogical appropriateness of technology use in instruction. Part III assessed teacher self-efficacy, capturing confidence in effectively integrating technology, persistence, effort, and adaptability during instructional practices. Part IV evaluated pupils' academic achievement, reflecting learning outcomes, engagement, and performance in primary grade instruction.

All items were rated on a four-point Likert scale as outlined in Table 1, with scores ranging from 1 (Very Low) to 4 (Very High), ensuring consistency across constructs and facilitating meaningful comparisons. The instrument underwent content validation by a panel of experts in educational technology, research methodology, and primary education to ensure clarity, relevance, and appropriateness of the items. Subsequently, a pilot test was conducted with ten teachers from a comparable district outside the study area, and the instrument's reliability was assessed, yielding a Cronbach's alpha of 0.929, indicating high internal consistency and reliability.

Table 1
Rating Scale Matrix for Technology Integration, Teacher Self-Efficacy, and Primary Pupils' Academic Achievement

Assigned Point	Numerical Range	Verbal Interpretation
4	3.25 - 4.00	Very High
3	2.50 - 3.24	High
2	1.75 - 2.49	Low
1	1.00 - 1.74	Very Low

**Legend: Technology Integration - Frequency, depth, and pedagogical appropriateness of teachers' use of technology in instruction; Teacher Self-Efficacy - Teachers' confidence in effectively integrating technology, including effort, persistence, and adaptability; Pupils' Academic Achievement - Students' learning outcomes, engagement, and performance in primary grade instruction.*

The standardized administration of procedure had maintained anonymity and minimized social desirability bias, while descriptive and correlational analyses were employed to examine interrelationships among teacher profile variables, technology integration, self-efficacy, and pupils' academic achievement. This

structured and validated instrumentation provides a robust empirical foundation for the study, ensuring that findings are both reliable and generalizable to the broader population of primary grade teachers in Zone 3.

Data Analysis. Data from 114 primary grade teachers in Zone 3, Division of Catanduanes were analyzed using descriptive and inferential statistics consistent with a descriptive–correlational design (Creswell & Creswell, 2023). Frequencies, percentages, and weighted means summarized teacher profiles, technology integration, self-efficacy, and pupils’ academic achievement based on a four-point Likert scale. Group differences were examined using *t*-tests and one-way ANOVA, while Pearson’s *r* determined relationships among key variables. All hypotheses were tested at the 0.05 significance level, ensuring analytical rigor and validity (Field, 2020; Osborne, 2020).

Ethical Considerations. Ethical safeguards were strictly observed throughout the study to protect participants’ rights and welfare. Informed consent was obtained from all teacher-respondents, emphasizing voluntary participation and the right to withdraw at any time without penalty. Anonymity and confidentiality of responses were ensured through coded data and secure data storage. The study complied with institutional research protocols and ethical standards in educational research, minimizing potential harm and ensuring integrity and transparency in data collection and analysis (Creswell & Creswell, 2023; Israel & Hay, 2021).

RESULTS

This section presents the empirical results of the study, systematically describing the demographic and professional profiles of the respondents, their levels of technology integration and self-efficacy, pupils’ academic achievement, and the significant differences and relationships among the key variables.

Profile of Primary Grade Teachers. Table 2 presents the demographic and professional profiles of the 114 primary grade teachers in Zone 3. At the outset, the majority of teachers (71.05%) hold a Bachelor’s Degree with Master’s units, indicating ongoing professional development, while only a small proportion (1.75%) have completed doctorate units. In terms of rank, most teachers occupy the position of Teacher III (61.40%), reflecting mid-level professional experience. With regard to teaching tenure, 35.09% have 10–19 years of experience, suggesting substantial classroom exposure, whereas 29.82% have less than 10 years. Meanwhile, in terms of technology-related training, 63.15% attended 1–4 programs, highlighting limited formal exposure to technological pedagogical skills.

Taken together, these profiles suggest a competent but variably trained workforce, providing context for interpreting technology integration and self-efficacy outcomes.

Table 2
 Profile of Primary Grades Teachers (n=114)

Profile	Frequency	Percentage
Highest Educational Attainment		
Master’s Degree with Doctorate Units	2	1.75
Master’s Degree	15	13.16
Bachelor’s Degree with Master’s Units	81	71.05
Bachelor’s Degree	16	14.04
Total	114	100.00
Position Title		
Master Teacher III	3	2.63
Master Teacher II	2	1.75
Master Teacher I	15	13.16
Teacher III	70	61.40
Teacher II	16	14.04
Teacher I	8	7.02
Total	114	100.00
Number of Years in Teaching		
30 or more	14	12.28
20 but less than 30	26	22.81
10 but less than 20	40	35.09
Less than 10 years	34	29.82
Total	114	100.00
Number of Trainings attended related to technology		
15 or more	7	6.14
10 to 14	5	4.39
5 to 9	30	26.32
1 to 4	72	63.15
Total	114	100.00

Level of Technology Integration in Primary Grade Instruction. Building on this context, Table 3 presents the composite level of technology integration among primary grade teachers. Teachers reported the highest proficiency in technology integration (WM = 3.48, Strongly Agree), indicating confidence in utilizing digital tools and applying them effectively in instructional practices. In comparison, the reception of pupils toward technology-enhanced learning scored 3.01 (Agree), suggesting that students are generally receptive but may require further scaffolding for optimal engagement. At the same time, challenges in technology integration, including access, resources, and pedagogical constraints, scored 2.72 (Agree), reflecting moderate difficulties encountered during implementation. Overall, the weighted mean of 3.07 (Agree) indicates that while teachers demonstrate competence in technology use, there remain areas for improvement to maximize instructional impact.

Table 3
Composite Level of Technology Integration in Primary Grades

Variable	Weighted mean	Verbal Interpretation	Rank
Proficiency in Technology	3.48	Strongly Agree	1
Reception of pupils in technology integration	3.01	Agree	2
Extent of Challenges Experienced in Technology Integration	2.72	Agree	3
Overall weighted mean	3.07	Agree	

Self-Efficacy Across Specific Instructional Competencies. Closely related, Table 4 illustrates the level of primary grade teachers' self-efficacy in integrating technology into instruction. The overall weighted mean of 3.32 (Strongly Agree) indicates that teachers are confident in their ability to use technological tools effectively. Notably, teachers reported the highest self-efficacy in selecting efficient teaching approaches for guiding students' learning and assessing pupils using technology (WM = 3.40, Strongly Agree), reflecting strong instructional competence. However, proficiency in using gadgets, applications, and software scored slightly lower (WM = 3.14, Agree), suggesting room for skill enhancement. Thus, these results imply that while teachers possess

substantial confidence and adaptability in technology integration, targeted professional development could further strengthen specific competencies to optimize learning outcomes.

Table 4
Primary Grade Teachers' Self-Efficacy in Integrating Technology in Instruction (n=114)

Indicators	Frequency				Weighted Mean	Verbal Interpretation	Rank
	4(SA)	3 (A)	2(D)	1 (SD)			
I have adequate knowledge about technology integration.	44	59	11	0	3.29	Strongly Agree	8
I have adequate knowledge of technology use.	40	61	12	1	3.23	Agree	9
I am proficient in use of gadgets, apps, and software.	33	66	13	2	3.14	Agree	10
I know how to choose efficient teaching approaches to guide my students for learning.	53	55	5	1	3.40	Strongly Agree	1.5
I know how to choose efficient teaching approaches to guide my students in using technology.	54	51	8	1	3.39	Strongly Agree	3
I know how to choose efficient teaching approaches to guide my students to integrate technology in their studies.	49	53	11	1	3.33	Strongly Agree	5
I can teach combining related technologies and teaching approaches.	47	57	10	0	3.32	Strongly Agree	6.5
I can teach literacy combining related technologies and teaching approaches.	45	61	8	0	3.32	Strongly Agree	6.5
I can assess the learning of the pupils with use of technology.	52	56	6	0	3.40	Strongly Agree	1.5
I plan my lessons with appropriate technology.	51	55	8	0	3.38	Strongly Agree	4
Overall weighted mean					3.32	Strongly Agree	

Academic Performance Across Core Learning Areas. From the learner perspective, Table 5 presents the academic achievement of primary grade pupils in Zone 3, with an overall weighted mean of 3.06 (Agree/High), indicating generally high learning outcomes. Pupils demonstrated the strongest performance in understanding reading materials and following instructions (WM = 3.18, High), highlighting solid comprehension and attentiveness.

Table 5
Academic Achievement of Primary Grade Pupils in Zone 3 (n=114)

Indicators	Frequency				Weighted Mean	Verbal Interpretation	Rank
	4(SA)	3 (A)	2(D)	1 (SD)			
The pupils can understand what they read.	28	79	7	0	3.18	Agree/High	1.5
The pupils can apply the concept learned.	24	81	9	0	3.13	Agree/High	4.5
The pupils can solve one-step problem.	23	80	11	0	3.11	Agree/High	6
The pupils can retell the story read.	17	78	18	1	2.97	Agree/High	7
The pupils can compute direct number problem.	18	69	27	0	2.92	Agree/High	8.5
The pupils can assist their classmates in their activity.	25	79	10	0	3.13	Agree/High	4.5
The pupils can follow instructions.	30	76	7	1	3.18	Agree/High	1.5
The pupils can perform activities with less supervision of the teacher.	23	59	31	1	2.91	Agree/High	10
The pupils can write correct sentence.	21	65	26	2	2.92	Agree/High	8.5
The pupils can spell simple words.	30	72	10	2	3.14	Agree/High	3
Overall weighted mean					3.06	Agree/High	

Similarly, skills such as spelling simple words (WM = 3.14, High) and applying learned concepts

(WM = 3.13, High) were also notable. Conversely, lower scores were observed in performing activities with minimal teacher supervision (WM = 2.91, High), suggesting the need for fostering greater independence. Overall, these results reflect effective classroom instruction while identifying areas for targeted support to enhance pupil autonomy and problem-solving abilities.

Variation in Technology Integration Across Position Titles. Turning to group comparisons, Tables 6 to 8 present the analyses of differences in technology integration among primary grade teachers across key profile variables. Specifically, Table 6 shows that proficiency in technology integration significantly varied based on teachers' highest educational attainment ($F = 31.16, p = .0179$), years of teaching experience ($F = 17.05, p = .0025$), and number of trainings attended ($F = 6.43, p = .0013$). In contrast, no significant difference was observed across position titles ($F = 1.07, p = .3889$).

Table 6
Analysis of Differences in Technology Integration Proficiency among Primary Grade Teachers Based on Profile Variables

Variables	Statistical Test	Computed Value	P-value @.05	Decision	Interpretation
Highest Educational Attainment	F-test	31.16	.0179	Reject Ho	Significant Difference
Position Title	F-test	1.07	.3889	Fail to Reject Ho	No Significant Difference
Number of Years in Teaching	F-test	17.05	.0025	Reject Ho	Significant Difference
Number of Trainings attended related to technology	F-test	6.43	.0013	Reject Ho	Significant Difference

In a related analysis, Table 7 examines pupils' engagement in technology-enhanced instruction. Significant differences were found across highest educational attainment ($F = 6.31, p = .0015$), position title ($F = 3.72, p = .0058$), and number of trainings attended ($F = 3.64, p = .0217$). However, years of teaching did not yield significant differences ($F = 1.43, p = .2490$).

Furthermore, Table 8 highlights challenges in technology integration. All profile variables showed significant differences ($p < .05$), reflecting that teachers' background and experience shape both the difficulties they encounter and their ability to manage technology integration effectively. Collectively,

these findings underscore the interplay between teacher qualifications, professional experience, and training in facilitating technology-rich instructional practices.

Table 7
Analysis of Differences in Technology Integration: Pupils' Engagement with Technology Across Teacher Profile Variables

Variables	Statistical Test	Computed Value	P-value @.05	Decision	Interpretation
Highest Educational Attainment	F-test	6.31	.0015	Reject Ho	Significant Difference
Position Title	F-test	3.72	.0058	Reject Ho	Significant Difference
Number of Years in Teaching	F-test	1.43	.2490	Fail to Reject Ho	No Significant Difference
Number of Trainings attended related to technology	F-test	3.64	.0217	Reject Ho	Significant Difference

Table 8
Analysis of Differences in Technology Integration Challenges Among Primary Grade Teachers Across Profile Variables

Variables	Statistical Test	Computed Value	P-value @.05	Decision	Interpretation
Highest Educational Attainment	F-test	11.39	.0016	Reject Ho	Significant Difference
Position Title	F-test	3.30	.0014	Reject Ho	Significant Difference
Number of Years in Teaching	F-test	4.40	.0098	Reject Ho	Significant Difference
Number of Trainings attended related to technology	F-test	14.60	.0005	Reject Ho	Significant Difference

Consistent with these results, the findings from Tables 6 to 8 indicate that teachers' educational qualifications, teaching experience, and participation in professional trainings significantly affect their technology integration proficiency, pupil engagement, and the challenges they face. Position titles had minimal influence on proficiency but impacted student engagement and perceived challenges. Thus, these results underscore the importance of teacher qualifications and targeted professional development in enhancing technology-based instruction.

Summary of Group Differences in Teacher Self-Efficacy. Extending this analysis, Table 9 presents the differences in teachers' self-efficacy across profile variables. Significant variations were observed based on highest educational attainment ($F = 6.19, p = .0017$), position title ($F = 3.45, p = .0089$), and years of teaching experience ($F = 10.64, p = .0094$). Conversely, the number of trainings attended did not yield significant differences ($F = 1.10, p =$

.3601), implying that formal training alone may not substantially enhance self-efficacy.

Table 9
One-way ANOVA Test Analysis of Differences in Teachers' Self-Efficacy Across Profile Variables

Variables	Statistical Test	Computed Value	P-value @.05	Decision	Interpretation
Highest Educational Attainment	F-test	6.19	.0017	Reject Ho	Significant Difference
Position Title	F-test	3.45	.0089	Reject Ho	Significant Difference
Number of Years in Teaching	F-test	10.64	.0094	Reject Ho	Significant Difference
Number of Trainings attended related to technology	F-test	1.10	.3601	Fail to Reject Ho	No Significant Difference

Correlation between Technology Integration and Pupils' Academic Performance. With respect to relationships, Table 10 presents the correlation between teachers' technology integration and pupils' academic achievement. Significant positive relationships were found for proficiency ($r = .354$) and pupils' reception ($r = .590$), whereas challenges showed no significant relationship ($r = .029$). Accordingly, teacher skill and student engagement emerge as critical drivers of academic performance

Table 10
Pearson r Test of Correlation Analysis Between Teachers' Technology Integration and Primary Pupils' Academic Achievement

Variables	Statistical Test	Computed Value	Critical Value @ .05	Decision	Interpretation
Proficiency in integration	Pearson r	.354	0.172	Reject Ho	Significant Positive Relationship
Reception of pupils in integration	Pearson r	.590	0.172	Reject Ho	Significant Positive Relationship
Challenges in technology integration	Pearson r	.029	0.172	Fail to Reject Ho	No Significant Relationship

Correlation between Teachers' Self-Efficacy and Pupils' Academic Performance. Finally, Table 11 presents the correlation between teachers' self-efficacy in technology integration and primary pupils' academic achievement. The analysis yielded a Pearson correlation coefficient of .032, which was below the critical value at the 0.05 significance level, leading to a failure to reject the null hypothesis. This indicates that teachers' confidence and perceived capability in integrating technology did not significantly influence students' academic performance. The result suggests that while teacher self-efficacy is essential for

instructional practice, it may not directly translate into measurable improvements in pupils' learning outcomes without complementary factors such as engagement, resources, and pedagogical strategies.

Table 11
Pearson r Test of Correlation Analysis Between Teachers' Self-Efficacy in Technology Integration and Primary Pupils' Academic Achievement

Variables	Statistical Test	Computed Value	Critical Value @ .05	Decision	Interpretation
Teachers' Self-Efficacy VS Academic Achievement	Pearson r	.032	.172	Fail to Reject Ho	No Significant Relationship

DISCUSSION

The present study provides a comprehensive examination of primary grade teachers' technology integration, self-efficacy, and their relationships with pupils' academic achievement within the context of Zone 3, Division of Catanduanes. By integrating teacher profile variables, instructional practices, and learner outcomes, the findings offer nuanced insights into how technology-enhanced instruction operates in real classroom settings, particularly in a developing regional context.

The demographic and professional profile of respondents (Table 2) reveals a teaching workforce characterized by moderate to high professional maturity, with the majority holding bachelor's degrees supplemented by master's units and occupying mid-level teaching ranks. This profile suggests a pool of teachers who are academically prepared and professionally experienced, yet still in need of advanced specialization and sustained capacity building. Consistent with prior studies, such qualifications are often associated with openness to innovation and instructional adaptability (Aktürk & Delen, 2020; Williams et al., 2023). However, the limited proportion of teachers with advanced graduate degrees and the relatively low exposure to technology-related trainings indicate structural constraints that may affect the depth and sophistication of technology integration. This aligns with local Philippine studies emphasizing disparities between formal qualifications and access to

sustained, high-quality professional development (Cordial et al., 2025).

Within this professional context, teachers demonstrated a generally favorable level of technology integration (Table 3). High proficiency scores suggest that teachers are capable of utilizing digital tools for instructional purposes, supporting findings that teachers' basic technological competence has improved in recent years due to increased digital exposure (Pino & Mongas, 2025). Nonetheless, the comparatively lower scores for pupils' reception and perceived challenges indicate that effective integration extends beyond teacher skill alone. As emphasized in the literature, technology integration is a relational and pedagogical process that depends on student engagement, instructional design, and contextual supports rather than mere tool usage (Abu Bakar et al., 2020; Casilao et al., 2025). The presence of moderate challenges further suggests systemic issues such as infrastructure limitations, resource availability, and pedagogical alignment – common barriers in public primary schools.

Teachers' self-efficacy in technology integration (Table 4) emerged as notably high, reflecting strong confidence in instructional decision-making and assessment using digital tools. Grounded in Social Cognitive Theory, self-efficacy represents teachers' belief in their capability to organize and execute actions required for effective teaching (Williams et al., 2023). The findings corroborate previous research indicating that experienced teachers often develop high instructional confidence even when specific technical skills remain uneven (Li & Zhao, 2024). However, the slightly lower ratings for operational skills (e.g., using gadgets and software) highlight an important distinction between pedagogical confidence and technical fluency. This suggests that while teachers feel capable of integrating technology conceptually, targeted training remains necessary to strengthen their functional competence – an implication echoed by meta-analytic evidence on professional development effectiveness (Forbes et al., 2023).

From the learner perspective, pupils' academic achievement (Table 5) was generally high, particularly in comprehension and guided task performance. These outcomes suggest that technology-enhanced instruction, as implemented, supports foundational learning skills. However, lower performance in independent task execution indicates that instructional approaches may still be teacher-centered, with limited opportunities for autonomous learning. International studies similarly note that without deliberate pedagogical redesign, technology may reinforce traditional instructional patterns rather than promote higher order thinking and learner autonomy (Pino & Mongas, 2025). This finding implies that technology integration should increasingly focus on student-centered strategies to maximize its transformative potential.

The analyses of group differences (Tables 6–8) provide critical insights into the structural determinants of technology integration. Significant differences based on educational attainment, teaching experience, and training participation confirm that technology integration is a developmental process shaped by cumulative professional capital. Teachers with higher qualifications and longer experience exhibited greater proficiency and fewer challenges, consistent with evidence that pedagogical maturity enhances adaptive technology use (Aktürk & Delen, 2020). Interestingly, position title exerted limited influence on proficiency but affected pupil engagement and perceived challenges, suggesting that leadership roles may shape classroom dynamics and access to resources rather than technical competence per se. These findings reinforce the conclusion that equitable and sustained professional development, and not merely hierarchical advancement, is essential for effective technology integration.

Teachers' self-efficacy also varied significantly across educational attainment, position, and years of experience (Table 9), underscoring the experiential nature of confidence development. Contrary to expectations and some prior

studies, the number of trainings attended did not significantly influence self-efficacy. This finding suggests that the quality, relevance, and contextual alignment of training may matter more than frequency alone, echoing critiques of one-off professional development programs that lack follow-through and practical application (Forbes et al., 2023). Consequently, professional learning initiatives should prioritize sustained, practice-oriented models that integrate mentoring, classroom application, and reflective support.

The correlational analyses further clarify the mechanisms linking instruction and learning outcomes. The significant positive relationships between technology integration proficiency, pupil reception, and academic achievement (Table 10) affirm that technology contributes to learning when it is competently implemented and positively received by students. These results align with international evidence demonstrating that student engagement mediates the impact of instructional technology on academic performance (Casilao et al., 2025; Pino & Mongas, 2025). Notably, the absence of a significant relationship between perceived challenges and achievement suggests that teachers' difficulties do not necessarily translate into poorer student outcomes, possibly due to compensatory instructional strategies or institutional support.

In contrast, teachers' self-efficacy did not exhibit a significant direct relationship with pupils' academic achievement (Table 11). These findings nuance existing literature that often assumes a linear relationship between teacher confidence and student outcomes. Instead, the results suggest that self-efficacy functions as an enabling condition rather than a direct predictor of achievement. Without corresponding instructional quality, student engagement, and resource adequacy, confidence alone may not yield measurable learning gains. This interpretation supports emerging research arguing for multi-factor models that integrate psychological, pedagogical, and contextual variables in

explaining student performance (Williams et al., 2023).

Taken together, the findings lead to several integrative conclusions. First, technology integration in primary education is effective when anchored in teacher competence and student engagement rather than confidence alone. Second, professional qualifications, experience, and meaningful training remain critical levers for enhancing instructional practice. Finally, technology's impact on learning is maximized when pedagogically aligned and supported by conducive learning environments.

Accordingly, the study recommends that education stakeholders prioritize sustained, context-responsive professional development that integrates technical skill-building with pedagogical innovation. Policies should emphasize mentoring, collaborative learning communities, and classroom-based coaching to translate teacher confidence into effective practice. At the classroom level, teachers are encouraged to design technology-enhanced activities that foster learner autonomy and higher-order thinking. By aligning teacher development, instructional practice, and learner engagement, technology integration can more effectively contribute to improved academic outcomes in primary education.

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REFERENCES

- Abu Bakar, N. S., Maat, S. M., & Rosli, R. (2020). Mathematics teacher's self-efficacy of technology integration and technological pedagogical content knowledge. *Journal on Mathematics Education*, *11*(2), 259–276. <https://doi.org/10.22460/jome.v11i2.15832>
- Aktürk, A. O., & Delen, A. (2020). Öğretmenlerin teknoloji kabul düzeyleri ile öz-yeterlik inançları arasındaki ilişki [The relationship between teachers' technology acceptance levels and self-efficacy beliefs]. *Bilim, Eğitim, Sanat ve Teknoloji Dergisi (BEST Dergi)*, *4*(2), 67–80.
- Casilao, M. C., Delmo, V. C., & Talingting, S. D. (2025). Digital literacy and instructional efficacy among primary school teachers. *International Journal of Educational Technology and Research*, *4*(1), 1–15.
- Chan, T., & Owens, D. (2022). Technology acceptance and digital teaching practices among K-12 educators amid pandemic transitions. *Education and Information Technologies*. <https://doi.org/10.1007/s10639-024-12954-y>
- Cordial, J. F., Amaranto, L. V., & Bermudo, P. J. V. (2025). Teachers' awareness, compliance, and challenges in upholding the code of ethics: Insights from public elementary schools in Panganiban District, Catanduanes, Philippines. *Pedagogy Review: An International Journal of Educational Theories, Approaches and Strategies*, *6*(1), 134–146. <https://doi.org/10.62718/vmca.pr-ijetas.6.1.SC-1025-013>
- Cordial, J. F., Evangelista, J. T., & Bermudo, P. J. V. (2025). Technological knowledge, integration practices, and challenges of primary school teachers in Zone III, Division of Catanduanes: Insights from the TPACK framework. *Pedagogy Review: An International Journal of Educational Theories, Approaches and Strategies*, *6*(1), 101–115. <https://doi.org/10.62718/vmca.pr-ijetas.6.1.SC-1125-001>
- Creswell, J. W., & Creswell, J. D. (2020). *Research design: Qualitative, quantitative, and mixed methods approaches* (5th ed.). SAGE Publications.
- Creswell, J. W., & Creswell, J. D. (2023). *Research design: Qualitative, quantitative, and mixed methods approaches* (6th ed.). SAGE Publications.
- Field, A. (2020). *Discovering statistics using IBM SPSS statistics* (5th ed.). SAGE Publications.
- Forbes, E. V., Scherer, R., Sider, S., & Johnson, E. (2023). Professional development for technology integration: A systematic review and meta-analysis. *Review of Educational Research*, *93*(1), 1–40.

- <https://doi.org/10.3102/00346543221147781>
- Israel, M., & Hay, I. (2021). *Research ethics for social scientists* (2nd ed.). SAGE Publications.
<https://doi.org/10.4135/9781849209779>
- Johnson, M., & Smith, J. (2019). *Descriptive and correlational research design in behavioral sciences*. Sage Publications.
- Li, X., & Zhao, Y. (2024). Enhancing teachers' self-efficacy beliefs in AI-based technology integration: A professional development perspective. *Teaching and Teacher Education*, 144, 104582.
<https://doi.org/10.1016/j.tate.2024.104582>
- Osborne, J. W. (2020). *Best practices in quantitative methods* (2nd ed.). SAGE Publications.
- Pino, W. C., & Mongas, C. J. S. (2025). Technology integration and pupils' cognitive engagement. *International Journal of Multidisciplinary Research and Analysis*, 8(4), 1833–1842.
<https://doi.org/10.47191/ijmra/v8-i04-39>
- Song, J., Mensah, I., & Al-Amin, M. (2022). Mobile augmented reality acceptance and technology integration readiness among educators. *Education and Information Technologies*, 28(5), 5123–5144.
<https://doi.org/10.1007/s10639-023-12116-6>
- Tahira, S., Kazmi, S. F., & Zahid, A. (2020). Sample size determination using Slovin's formula. *International Journal of Research in Educational Studies*, 6(2), 45–52. <https://www.ijresonline.com/>
- Williams, M. K., Christensen, R., McElroy, D., & Rutledge, D. (2023). Teacher self-efficacy in technology integration as a critical component in designing technology-infused teacher preparation programs. *Contemporary Issues in Technology and Teacher Education*, 23(1). <https://citejournal.org/volume-23/issue-1-23/general/teacher-self-efficacy-in-technology-integration-as-a-critical-component-in-designing-technology-infused-teacher-preparation-programs>