



UTILIZATION OF EDUCATIONAL TECHNOLOGY TOOLS AND PLATFORMS AND TECHNOLOGICAL STRATEGIES OF PRIMARY TEACHERS IN RELATION TO PUPILS' ACADEMIC PERFORMANCE

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ABSTRACT

This study investigated the demographic profiles, utilization of educational technology tools, and integration of technological strategies among primary school teachers (Grades 1–3) in relation to the academic performance of their pupils within the Guimba West District, Nueva Ecija. Adopting a quantitative descriptive-correlational research design, the study executed a total enumeration sampling of N=102 public primary school teachers and tracked the official academic records of 2,580\$ pupils across the first and second quarters of the academic year. Quantitative analysis via weighted mean, Pearson product-moment correlation (r), and one-way Analysis of Variance (ANOVA) revealed that the teacher-respondents were predominantly female, aged 41–50, held the rank of Teacher III, possessed master's units or degrees, and demonstrated outstanding performance ratings. Both the baseline utilization of educational technology tools and the deeper integration of technological strategies were implemented to a "Very High Extent" across all assessed dimensions. Concurrently, pupils' academic performance advanced sharply from the first quarter to the second quarter. Inferential testing demonstrated that teachers' advanced educational attainment was significantly and positively linked to student engagement ($p=.037$), assessment and feedback ($p=.019$), and collaboration and communication ($p=.048$). Crucially, technology integration exhibited a statistically significant relationship with the academic performance of low- and middle-performing pupils ($r=0.335$; $t=0.421$, $p<.001$) but was non-significant for high achievers. One-way ANOVA confirmed that the level of technology integration resulted in highly significant differences in performance outcomes exclusively for at-risk pupils whose grades fell below 74 ($p=.000$) and between 75–79 ($p=.000$). These results validate educational technology as a specialized pedagogical scaffold that narrows achievement gaps rather than a uniform academic accelerator. Structural training and targeted digital interventions are proposed to sustain equity in primary education.

KEYWORDS: *Differentiated instruction, educational technology integration, ICT competence, primary education, professional development, pupils' academic performance.*

INTRODUCTION

The defining characteristic of 21st-century basic education is the systemic infusion of information and communication technologies (ICT) into the classroom ecosystem. Rather than operating as passive, standalone mechanisms for presenting digitized text, modern hardware and software function as dynamic structural scaffolds intended to optimize instructional delivery and bridge pervasive learning divides. Globally, international benchmarks established by organizations such as the Organisation for Economic Co-operation and Development (OECD) advocate for a paradigm shift where technology is leveraged to foster high-level cognitive engagement, inquiry-based learning, and personalized student development.

In the landscape of the Philippines, this transition is guided by state initiatives, most notably DepEd Order No. 16, s. 2023, which regulates the ongoing implementation of the DepEd Computerization Program (DCP). The DCP seeks to modernize public school classrooms by distributing infrastructure, including interactive screens, laptops, and localized network packets, to promote educational equity. However, substantial discrepancies persist between international, macro-level policy ideals and the practical realities observed within provincial and rural public schools.

While existing literature thoroughly establishes the potential of technology to boost student motivation, lower cognitive load, and heighten classroom engagement, empirical evidence reveals that simple physical access to hardware can cause a performance plateau. In localized Philippine contexts, schools face persistent structural constraints. Scholars note that despite the provisioning of technological infrastructure, teachers and pupils are frequently constrained by poor connectivity, erratic electricity, and a shortage of contextualized digital learning content.

Consequently, primary teachers, particularly those managing large class sizes and high learner variability in regional settings like the Guimba West District in Nueva Ecija, are forced to assume dual responsibilities. They must serve simultaneously as educational specialists and default technical support providers. This burden is exacerbated by a noted lack of continuous professional development; many educators must adapt standard digital utilities to meet local student needs without systemic pedagogical training.

Furthermore, contemporary literature questions the assumption that educational technology exerts a linear, uniform positive impact on all student segments. Emerging frameworks demonstrate that while ICT can serve as a precision leveling mechanism for marginalized or struggling learners, it can simultaneously introduce massive distractions or offer negligible benefits to high-achieving students who already possess strong autonomous learning capacities.

In the primary grades (Grades 1–3), where foundational literacy and numeracy competencies are codified, this non-linear dynamic remains under-researched. There is a pronounced empirical gap regarding how explicit dimensions of technology-driven *Differentiated Instruction* (such as personalized content, engaging activities, and accessibility adjustments) and broader *Technological Strategies* interact with specific strata of pupil performance. This study directly addresses this void by investigating how primary school teachers in Guimba West District utilize educational technology tools and integrate technical strategies, determining the precise empirical relationship these instructional practices share with quarterly academic outcomes.



Theoretical and Conceptual Framework

This study is structurally grounded in three intersecting educational frameworks: the Technological Pedagogical Content Knowledge (TPACK) model, the Substitution, Augmentation, Modification, and Redefinition (SAMR) model, and Constructivist Learning Theory. The TPACK framework posits that effective classroom technology integration does not result from isolated technical knowledge. Instead, it requires a complex synergy at the intersection of content knowledge (CK), pedagogical knowledge (PK), and technological knowledge (TK). In this investigation, the operational facets of technology use—such as Content Delivery, Student Engagement, and Assessment—are directly informed by specific sub-components of TPACK, namely Technological Content Knowledge (TCK) and Technological Pedagogical Knowledge (TPK). The model recognizes that a teacher's demographic and professional profile (e.g., educational attainment, formal ICT training) directly conditions their ability to formulate and execute these intersectional insights.

Complementing TPACK, the SAMR model offers a structural lens to categorize the depth and transformative quality of technology adoption. At the *Enhancement* levels (Substitution and Augmentation), educators utilize digital platforms to complete traditional tasks without significant functional changes, such as displaying a static slide instead of a chalkboard or distributing a standard digital quiz. At the *Transformation* levels (Modification and Redefinition), technology alters the classroom structure, enabling student-driven information tracking, adaptive problem-solving, and localized collaboration that would be impossible without digital tools. Finally, the study integrates Constructivist Learning Theory, specifically Lev Vygotsky's concept of the Zone of Proximal Development (ZPD) and Social Equity Theory. These principles indicate that digital platforms achieve their highest utility when operating as an adaptive scaffolding mechanism. By adjusting instruction to match the unique learning pace, readiness levels, and specific deficits of diverse primary learners, educational technology shifts from a rigid delivery mechanism into a flexible tool for structural equity.



Statement of the Problem

This study sought to evaluate the utilization of educational technology tools, platforms, and technological strategies among primary teachers in relation to the academic performance of their pupils within the Guimba West District. Specifically, it addressed the following research objectives:

1. Describe the profile of the primary teacher-respondents in terms of age, sex, educational attainment, teaching position, years of teaching experience, Individual Performance Commitment and Review Form (IPCRF) rating, and relevant training in ICT.
2. Measure the extent to which teachers utilize educational technology tools and platforms for differentiated instruction across the dimensions of personalized content/learning paths, engaging/interactive learning, and flexibility/accessibility.
3. Determine the extent of technology integration across six key technological strategy domains: content delivery, student engagement, assessment and feedback, collaboration and communication, personalization and differentiation, and creativity and critical thinking.
4. Categorize and describe the academic performance of primary pupils during the first and second quarters of the academic year.
5. Test for significant relationships between the teacher-respondents' profile characteristics and their baseline utilization of educational technology tools.
6. Test for significant relationships between the teacher-respondents' profile characteristics and their integration of advanced technological strategies.
7. Evaluate the significance of the relationship between teachers' technology integration and the academic performance of their pupils.



- Assess whether significant differences exist in pupils' academic performance when grouped according to the specific level of technology integration demonstrated by their teachers.
- Formulate data-driven technological strategies to optimize modern tools for highly effective differentiated instruction within public primary environments.

Hypothesis

To address these objectives, three null hypotheses were tested at a 95% confidence level ($\alpha = 0.05$)

- H_0 : There is no significant relationship between the teacher-respondents' profile characteristics and their technology integration for diverse learning needs.
- H_0 : There is no significant relationship between teachers' technology integration and the academic performance of their primary pupils.
- H_0 : There is no significant difference in the academic performance of primary pupils when grouped according to the level of technology integration applied by their respective teachers.

METHODOLOGY

Research Design and Locale

This study utilized a quantitative descriptive-correlational research design. This design allows for a comprehensive description of existing baseline variables while evaluating the presence, strength, and significance of statistical relationships without manipulating the environment or drawing premature causal assumptions. The study was officially situated across public elementary schools located within the Guimba West District, under the administrative jurisdiction of the Schools Division of Nueva Ecija, Philippines. This district encompasses a combination of distinct spatial zones (Zones I, II, and III), containing rural and semi-rural public primary schools characterized by diverse resource settings and standard DepEd instructional distributions.

Respondents and Sampling Procedure

The primary target population of this investigation comprised all active public school teachers handling Grades 1, 2, and 3 within the thirty (30) public elementary schools of the Guimba West District. To ensure maximum data integrity and eliminate potential sampling error, the *Total Enumeration* sampling technique was executed. Consequently, a total census sample of $N=102$ primary school teachers participated fully in the study. The secondary data cluster tracked the academic performance profiles of all primary pupils structurally assigned to these specific teacher-respondents. This resulted in an aggregate pool of 2,580 primary pupils whose continuous quarterly marks were analyzed.

Research Instruments and Data Collection

Data gathering was executed using a two-pronged collection structure: a comprehensive, structured three-part survey instrument for the primary educators, and official institutional school records for the student cohorts. The survey was self-constructed to address the local parameters of the Guimba West District and underwent formal validation by an expert panel composed of five specialists in educational technology, psychometrics, and research methodology. To establish internal reliability, a rigorous pilot test was carried out among primary teachers outside the target district. Cronbach's alpha analysis yielded internal consistency coefficients of $\alpha = .915$ for Part II (Utilization of Educational Technology Tools) and $\alpha = .941$ for Part III (Integration of Technological Strategies), demonstrating strong instrument reliability well above accepted academic standards.

- Part I: Demographic and Professional Profile:** Tracked teacher age, sex, formal educational attainment, current designation, total years in active service, latest annual IPCRF rating, and recent ICT-related training hours.
- Part II: Utilization of Educational Technology Tools and Platforms:** Evaluated ten items per dimension across three main sub-scales: Personalized Content/Learning Paths, Engaging/Interactive Learning, and Flexibility/Accessibility. Items were scored on a 4-point Likert scale (3.26–4.00: Very High Extent; 2.51–3.25: High Extent; 1.76–2.50: Low Extent; 1.00–1.75: Very Low Extent).
- Part III: Integration of Technological Strategies:** Measured specific instructional actions across six domains: Content Delivery, Student Engagement, Assessment and Feedback, Collaboration and Communication, Personalization and Differentiation, and Creativity and Critical Thinking, utilizing the same 4-point scale.
- Student Performance Data:** Official academic performance metrics were derived directly from School Form 5 (SF5), recording individual general averages across the first and second quarters of School Year 2025–2026.

Statistical Treatment of Data

Quantitative data were processed and analyzed using IBM SPSS Statistics. Research Objectives 1 through 4 were addressed using descriptive statistical measures, including frequency counts, percentages, overall means, and standard deviations. For the inferential dimensions (Objectives 5 through 7), Pearson Product-Moment Correlation Coefficients (r) were applied to determine the direction, strength, and significance of relationships between the ordinal profile indicators and the continuous technological indices. Research Objective 8 was analyzed using a one-way Analysis of Variance (ANOVA) to assess if grouping pupils by their teachers' level of technology integration resulted in statistically significant variances in academic performance across defined grading strata.

Ethical Considerations

This research strictly followed standard ethical guidelines to protect the rights, autonomy, and well-being of all human subjects. Formal clearance was obtained from the Schools Division Superintendent of Nueva Ecija and the District Supervisor of Guimba West. Written informed consent was gathered from all 102 teacher-respondents prior to survey distribution, ensuring participation was entirely voluntary. Student grades extracted from School Form 5 were anonymized, scrubbed of identifiable descriptors, and compiled into aggregate trends to maintain data privacy. All procedures were aligned with national privacy regulations under the Data Privacy Act of 2012 (Republic Act No. 10173).



RESULTS

Profile of the Teacher-Respondents

The primary demographic characteristics of the teacher-respondents (N=102) are comprehensively outlined in the following data matrices.

Table 1. Distribution of Teacher-Respondents by Age

Age Bracket	Frequency (f)	Percentage (%)
21–30 Years Old	18	17.65
31–40 Years Old	28	27.45
41–50 Years Old	41	40.20
51–60 Years Old	12	11.76
61 Years Old and Above	3	2.94
Total	102	100.0

Table 2: Distribution of Teacher-Respondents by Sex

Sex	Frequency (f)	Percentage (%)
Male	2	2.0
Female	100	98.0
Total	102	100.0

Table 3. Distribution of Teacher-Respondents by Educational Attainment

Educational Attainment Level	Frequency (f)	Percentage (%)
Bachelor's Degree Graduate	7	6.90
Completed Master’s Degree Units	54	52.90
Master’s Degree Graduate	27	26.50
Completed Doctoral Degree Units	14	13.70
Total	102	100.0

Table 4. Distribution of Teacher-Respondents by Professional Teaching Position

Position Rank	Frequency (f)	Percentage (%)
Teacher I	14	13.70
Teacher II	24	23.60
Teacher III	64	62.70
Total	102	100.0

Table 5. Distribution of Teacher-Respondents by Years of Teaching Experience

Total Years in Active Service	Frequency (f)	Percentage (%)
1–5 Years	15	14.70
6–10 Years	22	21.60
11–15 Years	26	25.50
16 Years and Above	39	38.20
Total	102	100.0

Table 6. Distribution of Teacher-Respondents by Annual Performance Rating (IPCRF)

Performance Category	Frequency (f)	Percentage (%)
Satisfactory	2	1.96
Very Satisfactory	14	13.73
Outstanding	86	84.31
Total	102	100.0

Table 7: Distribution of Teacher-Respondents by Relevant Training in ICT (Past Year)

Total Formal Training Hours Accumulated	Frequency (f)	Percentage (%)
No Formal Training Completed	33	32.40
1–8 Hours	42	41.20
9–16 Hours	18	17.60
17 Hours and Above	9	8.80
Total	102	100.0

The demographic profiles indicate a highly mature, experienced, and professionally stable teaching workforce within the primary schools of the Guimba West District. The largest cohort of educators falls within the 41–50 age range (40.20%), with a pronounced female concentration of 98.0%. Professionally, the district is populated by senior personnel, with 62.70% holding the rank of Teacher III and 38.20% maintaining an active service record spanning more than 16 years. Academically, the group is highly qualified, with 52.90% completing post-baccalaureate master's coursework and an additional 26.50% graduating with a full master’s degree. This depth of experience is reflected in annual evaluations, where 84.31% achieved an Outstanding performance rating. In contrast, formal ICT training metrics reveal a sharp decline within the district. Nearly one-third of the primary teachers (32.40%) reported zero formal hours of technology-related professional development over the preceding year.



Utilization of Educational Technology Tools and Platforms

The systematic application of baseline digital resources for executing differentiated primary instruction was evaluated across three core sub-dimensions.

Table 8. Extent of Tool Utilization for Personalized Content and Learning Paths

Item Statement: The teacher utilizes digital platforms to...	Mean	SD	Descriptive Interpretation
1. adapt lessons using technology to address different pupil learning needs.	3.89	0.31	Very High Extent
2. use digital platforms that allow pupils to progress at their own pace.	3.91	0.29	Very High Extent
3. provide remedial tasks for struggling learners using online tools.	3.88	0.35	Very High Extent
4. design enrichment activities for fast learners through technology resources.	3.85	0.50	Very High Extent
5. monitor individual pupil progress through technology-based reports.	3.91	0.29	Very High Extent
6. prepare lessons that adjust difficulty levels based on pupil performance.	3.91	0.29	Very High Extent
7. use platforms that recommend personalized activities to pupils.	3.88	0.32	Very High Extent
8. provide digital exercises targeting areas where pupils need improvement.	3.88	0.35	Very High Extent
9. use technology that helps me manage differentiated tasks within the same class.	3.90	0.33	Very High Extent
10. adjust teaching strategies depending on feedback generated by technology.	3.89	0.34	Very High Extent
Overall Weighted Mean	3.89	0.29	Very High Extent

Table 9. Extent of Tool Utilization for Engaging and Interactive Learning

Item Statement: The teacher utilizes digital platforms to...	Mean	SD	Descriptive Interpretation
1. use interactive educational games to make learning fun and engaging.	3.84	0.39	Very High Extent
2. include multimedia elements like videos and animations to capture attention.	3.90	0.30	Very High Extent
3. design digital quizzes that provide immediate feedback to pupils.	3.86	0.37	Very High Extent
4. implement virtual rewards to motivate pupils during digital tasks.	3.89	0.31	Very High Extent
5. encourage active participation through digital touchscreens or boards.	3.86	0.37	Very High Extent
6. utilize digital storytelling platforms to present lesson concepts.	3.86	0.37	Very High Extent
7. offer interactive simulations that explain real-world applications.	3.88	0.35	Very High Extent
8. use collaborative online spaces where primary pupils work together.	3.85	0.38	Very High Extent
9. provide digital puzzles or challenges to stimulate critical thinking.	3.88	0.35	Very High Extent
10. adjust activity pacing dynamically based on real-time student interaction.	3.88	0.35	Very High Extent
Overall Weighted Mean	3.87	0.32	Very High Extent

Table 10. Extent of Tool Utilization for Flexibility and Accessibility

Item Statement: The teacher utilizes digital platforms to...	Mean	SD	Descriptive Interpretation
1. provide online learning materials for pupils to review outside class hours.	3.78	0.46	Very High Extent
2. use technology to support pupils with varied learning paces.	3.83	0.37	Very High Extent
3. provide access to supplementary lessons anytime through digital platforms.	3.77	0.44	Very High Extent
4. adjust teaching schedules and activities using online tools when necessary.	3.81	0.39	Very High Extent
5. prepare alternative tasks for absent pupils through technology.	3.80	0.40	Very High Extent
6. utilize digital resources to assist learners with difficulties.	3.80	0.40	Very High Extent
7. enable technology to extend learning beyond the classroom.	3.81	0.42	Very High Extent
8. provide downloadable tasks for reinforcement at home.	3.80	0.40	Very High Extent
9. use technology to help me manage large classes more efficiently.	3.83	0.37	Very High Extent
10. help pupils benefit from digital resources that support individualized learning.	3.81	0.42	Very High Extent
Overall Weighted Mean	3.81	0.37	Very High Extent

The data matrices demonstrate a comprehensive baseline utilization of technology platforms, characterized by consistently elevated means across all primary structural indicators. Personalized Content and Learning Paths achieved the highest overall baseline rating (M = 3.89, SD = 0.29), driven by targeted practices where platforms are leveraged to permit self-paced student progression (M = 3.91), automate individual tracking analytics (M = 3.91), and adjust task difficulty (M = 3.91). The integration of multimedia and gamification components also registered a notable presence (M = 3.87, SD = 0.32), with the targeted use of contextualized animations



and videos emerging as the highest individual item within that metric ($M = 3.90$). While Flexibility and Accessibility recorded the lowest comparative mean ($M = 3.81$, $SD = 0.37$), its score remains firmly within the "Very High Extent" band, indicating that public primary educators actively use digital infrastructure to extend instructional support beyond physical classroom hours.

Integration of Technological Strategies

The deeper integration of technology to accommodate diverse student needs was evaluated across six strategic pedagogical domains.

Table 11. Technological Strategies in Terms of Content Delivery

Item Statement: The teacher integrates technology to...	Mean	SD	Descriptive Interpretation
1. use presentation tools (e.g., PowerPoint, Canva) to explain topics clearly.	3.88	0.32	Very High Extent
2. integrate digital images, charts, or videos to illustrate lessons.	3.82	0.38	Very High Extent
3. use technology to assist me in simplifying abstract concepts.	3.85	0.36	Very High Extent
4. present lessons through multimedia slides to improve clarity.	3.87	0.34	Very High Extent
5. incorporate e-books or digital texts in classroom instruction.	3.25	0.77	High Extent
6. use visual technologies for better understanding.	3.76	0.45	Very High Extent
7. use recorded audio or video to reinforce lesson content.	3.78	0.44	Very High Extent
8. provide interactive demonstrations using digital platforms.	3.78	0.41	Very High Extent
9. employ projectors, TVs, or screens to deliver lessons effectively.	3.84	0.37	Very High Extent
10. utilize technology for pupils to retain information more effectively.	3.82	0.38	Very High Extent
Overall Weighted Mean	3.77	0.32	Very High Extent

Table 12. Technological Strategies in Terms of Student Engagement

Item Statement: The teacher integrates technology to...	Mean	SD	Descriptive Interpretation
1. capture student attention at the start of lessons using digital content.	3.80	0.38	Very High Extent
2. maintain high learner engagement through interactive digital exercises.	3.81	0.39	Very High Extent
3. encourage passive students to participate using digital polling or games.	3.79	0.41	Very High Extent
4. utilize immersive media to make lesson topics more relatable.	3.77	0.42	Very High Extent
5. sustain academic focus in large class cohorts through digital media.	3.75	0.46	Very High Extent
6. build an interactive learning environment using specialized applications.	3.77	0.44	Very High Extent
7. give primary students opportunities to control digital interface objects.	3.75	0.46	Very High Extent
8. design gamified learning tasks that sustain long-term student focus.	3.77	0.42	Very High Extent
9. increase peer-to-peer classroom interactions via technology.	3.75	0.44	Very High Extent
10. use digital platforms to support student curiosity and questioning.	3.78	0.41	Very High Extent
Overall Weighted Mean	3.77	0.40	Very High Extent

Table 13: Technological Strategies in Terms of Assessment and Feedback

Item Statement: The teacher integrates technology to...	Mean	SD	Descriptive Interpretation
1. administer formative assessments using digital formats or devices.	3.74	0.46	Very High Extent
2. provide real-time automated feedback to pupils on their performance.	3.77	0.42	Very High Extent
3. track long-term performance trends through digital dashboards.	3.74	0.44	Very High Extent
4. design customized digital remedial assessments for struggling pupils.	3.73	0.47	Very High Extent
5. offer alternative digital media for students to demonstrate mastery.	3.75	0.44	Very High Extent
6. implement automated grading systems to accelerate grading workflows.	3.77	0.42	Very High Extent



7. allow pupils to review missed assessment items on digital platforms.	3.77	0.42	Very High Extent
8. extract diagnostic tracking reports to modify subsequent lessons.	3.78	0.41	Very High Extent
9. engage parents in pupil tracking using digital reports.	3.76	0.43	Very High Extent
10. scaffold low-performing pupils during testing using online hints.	3.75	0.44	Very High Extent
Overall Weighted Mean	3.76	0.41	Very High Extent

Table 14. Technological Strategies in Terms of Collaboration and Communication

Item Statement: The teacher integrates technology to...	Mean	SD	Descriptive Interpretation
1. organize group tasks using shared digital workspaces or documents.	3.74	0.44	Very High Extent
2. establish safe communication channels for pupils to ask questions.	3.76	0.43	Very High Extent
3. facilitate digital peer-review activities for simple writing or drawings.	3.71	0.48	Very High Extent
4. bridge classroom communication with parents using messaging platforms.	3.77	0.44	Very High Extent
5. run real-time group-based learning competitions via digital games.	3.75	0.46	Very High Extent
6. enable shy or introverted pupils to communicate using digital entries.	3.77	0.42	Very High Extent
7. coordinate cross-classroom or shared learning projects using technology.	3.65	0.54	Very High Extent
8. share group outputs on digital display screens for class discussion.	3.75	0.44	Very High Extent
9. guide collaborative digital sorting activities to teach group logic.	3.75	0.44	Very High Extent
10. maintain consistent communication regarding remedial targets online.	3.74	0.44	Very High Extent
Overall Weighted Mean	3.74	0.43	Very High Extent

Table 15. Technological Strategies in Terms of Personalization and Differentiation

Item Statement: The teacher integrates technology to...	Mean	SD	Descriptive Interpretation
1. use adaptive learning platforms to customize instruction for each pupil.	3.74	0.44	Very High Extent
2. assign digital enrichment tasks for advanced learners.	3.75	0.45	Very High Extent
3. provide remedial online lessons for struggling pupils.	3.75	0.45	Very High Extent
4. select technology tools suited to students’ interests and preferences.	3.78	0.44	Very High Extent
5. use learning analytics to identify and address individual progress.	3.78	0.41	Very High Extent
6. offer varied digital materials (videos, games, readings) for diverse learners.	3.74	0.49	Very High Extent
7. integrate self-paced modules to accommodate varying learning speeds.	3.73	0.45	Very High Extent
8. guide pupils in setting personalized learning goals using technology.	3.78	0.41	Very High Extent
9. modify resource access profiles depending on student performance levels.	3.75	0.44	Very High Extent
10. provide voice-guided digital tasks for low-literacy primary learners.	3.76	0.43	Very High Extent
Overall Weighted Mean	3.76	0.41	Very High Extent

Table 16. Technological Strategies in Terms of Creativity and Critical Thinking

Item Statement: The teacher integrates technology to...	Mean	SD	Descriptive Interpretation
1. use digital tools for project-based learning and innovation.	3.57	0.50	Very High Extent
2. encourage pupils to create digital outputs (e.g., posters, videos).	3.71	0.48	Very High Extent
3. design technology-based problem-solving activities.	3.73	0.47	Very High Extent
4. guide students in researching and evaluating online information critically.	3.75	0.43	Very High Extent
5. encourage exploration and experimentation using creative apps.	3.75	0.44	Very High Extent
6. promote digital storytelling to develop creativity and communication.	3.78	0.41	Very High Extent
7. integrate coding or design activities to enhance logical thinking.	3.74	0.44	Very High Extent
8. challenge pupils to develop solutions to real-world problems using technology.	3.77	0.42	Very High Extent
9. use technology to stimulate inquiry and reflective thinking.	3.78	0.41	Very High Extent
10. encourage pupils to use digital tools ethically and responsibly to express ideas.	3.79	0.41	Very High Extent
Overall Weighted Mean	3.74	0.40	Very High Extent



The evaluation of deeper technological integration confirms that primary school teachers systematically implement strategic tech interventions. Content Delivery (M = 3.77, SD = 0.32) and Student Engagement (M = 3.77, SD = 0.40) registered the highest baseline strategic means. Within the delivery domain, the use of visual software utilities like PowerPoint and Canva to explain instructional concepts achieved an individual high score (M = 3.88), while the use of integrated e-books and long-form digital texts recorded a comparative low score (M = 3.25, SD = 0.77). The indices for Assessment and Feedback (M = 3.76) and Personalization and Differentiation (M = 3.76) highlight a strong trend toward tracking macro-level student data and using learning analytics to shape instruction (M = 3.78) rather than executing isolated, real-time alterations during instructional hours. Finally, the domains of Creativity and Critical Thinking (M = 3.74) and Collaboration (M = 3.74) indicate that while teachers emphasize digital storytelling (M = 3.78) and ethical digital usage rules (M = 3.79), complex project-based primary structures scored notably lower (M = 3.57, SD = 0.50).

Academic Performance of the Primary Pupils

The continuous academic achievement metrics tracking the \$2,580\$ primary grade pupils across the consecutive quarters are displayed below.

Table 17. Categorized Academic Performance Profile of Primary Pupils (n = 2,580\$)

Grading Strata & Performance Descriptor	1st Quarter Freq (f)	1st Quarter Pct (%)	2nd Quarter Freq (f)	2nd Quarter Pct (%)
74 and Below (Did Not Meet Expectations)	58	2.2	37	1.4
75–79 (Fairly Satisfactory)	106	4.1	74	2.9
80–84 (Satisfactory)	606	23.5	452	17.5
85–89 (Very Satisfactory)	1,065	41.3	953	36.9
90–100 (Outstanding)	745	28.9	1,064	41.2
Total	2,580	100.0	2,580	100.0

The student grade metrics reveal a distinct positive shift in academic performance from the first quarter to the mid-year assessment period. In the first quarter, the largest segment of pupils was positioned within the Very Satisfactory bracket (f = 1,065, 41.3%), followed by the Outstanding category (f = 745, 28.9%). By the completion of the second quarter, the Outstanding cohort expanded significantly, becoming the dominant academic classification with 1,064 pupils (41.2%). Crucially, the lower achievement tiers contracted: the cohort of students who Did Not Meet Expectations shrank from 2.2% down to 1.4%, while the Fairly Satisfactory tier fell from 4.1% to 2.9%. This indicates a systemic upward migration of grades across the student body.

Inferential Analyses

Table 18. Correlation Analysis Between Teacher Profile and Technology Tool Utilization

Profile Dimension	Personalized Content (r)	Personalized Content (p)	Student Engagement (r)	Student Engagement (p)	Flexibility & Access (r)	Flexibility & Access (p)
Age	-.095	.344	-.102	.307	-.014	.888
Sex	.122	.221	.097	.328	.100	.318
Educational Attainment	.140	.160	.172	.084	.216*	.029
Teaching Position	.071	.478	.084	.401	.059	.555
Years of Experience	-.040	.689	-.019	.849	.027	.787
IPCRF Performance	.052	.604	.010	.920	.114	.253
ICT-Related Training	.156	.117	.224*	.024	.142	.154

* Correlation is significant at the 0.05 level (2-tailed).

The correlation matrix in Table 18 shows that baseline demographic indicators (such as age, sex, current teaching position, and total years of service) have no statistically significant relationship with the utilization of educational technology tools (p > 0.05). However, two specific intersections exhibited significant positive correlations. First, a teacher's formal Educational Attainment shared a significant positive relationship with the execution of Flexibility and Accessibility strategies (r = 0.216, p = .029). Second, the total number of accrued ICT-Related Training hours was significantly correlated with higher levels of student engagement (r = 0.224, p = .024).

Table 19. Correlation Analysis Between Teacher Profile and Advanced Technological Strategy Integration

Advanced Technological Strategies	Age (r / p)	Sex (r / p)	Ed. Attainment (r / p)	Rank (r / p)	Experience (r / p)	IPCRF (r / p)	ICT Train (r / p)
Content Delivery	-.084 / .399	.120 / .230	.056 / .579	-.052 / .604	.010 / .924	.062 / .537	.074 / .462
Student Engagement	.027 / .785	.170 / .087	.207* / .037	.077 / .441	.061 / .546	.028 / .782	.150 / .132
Assessment & Feedback	-.029 / .769	.105 / .292	.233* / .019	.051 / .612	.082 / .413	.013 / .895	.119 / .234



Collaboration & Comm.	-.091 / .363	.008 / .938	.196* / .048	.056 / .579	.028 / .779	.022 / .823	.159 / .110
Personalization & Diff.	-.130 / .194	.035 / .725	.190 / .055	.027 / .787	.017 / .867	.105 / .293	.114 / .256
Creativity & Critical Thinking	-.101 / .312	.160 / .107	.042 / .674	-.014 / .888	.108 / .280	.095 / .341	.174 / .081

* Correlation is significant at the 0.05 level (2-tailed).

When evaluating deeper integration strategies (Table 19), a teacher's formal educational attainment emerged as a strong predictor of pedagogical quality. Advanced graduate coursework exhibited a statistically significant positive correlation with three primary strategic dimensions: Student Engagement ($r = 0.207$, $p = .037$), Assessment and Feedback ($r = 0.233$, $p = .019$), and Collaboration and Communication ($r = 0.196$, $p = .048$). The remaining profile variables, including active chronological age and total years of teaching experience, displayed no statistically meaningful relationships with any strategy domain. This provides empirical grounds to reject the first null hypothesis (H_02) exclusively for educational attainment.

Table 20. Correlation Mapping of Technology Integration Against Strata of Pupil Academic Performance

Pupil Achievement Strata (Quarterly Averages)	Pearson Correlation (r)	Significance Level (p-value)	Statistical Interpretation
Below 74.0 (Did Not Meet Expectations)	0.421**	.001	Significant Positive Correlation
75.0–79.0 (Fairly Satisfactory)	0.389**	.000	Significant Positive Correlation
80.0–84.0 (Satisfactory)	0.335**	.000	Significant Positive Correlation
85.0–89.0 (Very Satisfactory)	0.102	.305	No Significant Correlation
90.0–100.0 (Outstanding)	-.045	.651	No Significant Correlation

Correlation is highly significant at the 0.01 level (2-tailed).

The correlation mapping in Table 20 reveals a non-linear relationship between technology integration and pupil performance. Highly significant, moderate-to-strong positive associations were observed exclusively within the lower and middle performance tiers. The correlation was strongest for the lowest performing tier ($r = 0.421$, $p = .001$), followed closely by the Fairly Satisfactory ($r = 0.389$, $p = .000$) and Satisfactory ($r = 0.335$, $p = .000$) cohorts. Conversely, for high-achieving pupils earning Very Satisfactory ($p = .305$) or Outstanding ($p = .651$) marks, the correlation dropped to non-significant levels. Therefore, the second null hypothesis (H_0) is rejected for the lower achievement strata but retained for the high-performing cohorts.

Table 21. One-Way ANOVA of Pupils' Academic Performance Grouped by Level of Technology Integration

Pupil Grade Stratum	F-value	p-level	Statistical Interpretation
Below 74	8.345	.000	With Significant Difference
75–79	2.701	.000	With Significant Difference
80–84	1.264	.202	With No Significant Difference
85–89	0.758	.824	With No Significant Difference
90–100	0.615	.948	With No Significant Difference

The one-way Analysis of Variance (ANOVA) results presented in Table 21 confirm that the specific level of technology integration practiced by educators results in highly significant differences in performance outcomes for at-risk pupils. Statistically significant variance differences emerged exclusively among pupils whose grades fell below 74 ($F = 8.345$, $p = .000$) and within the 75-79 bracket ($F = 2.701$, $p = .000$). For average and high-achieving student segments, including the 80-84 tier ($p = .202$), 85-89 tier ($p = .824$), and the Outstanding 90-100 bracket ($p = .948$), no statistically meaningful differences were observed. This data provides empirical justification to reject the third null hypothesis (H_03) for struggling learners, while retaining it for stable and high-performing cohorts.

DISCUSSION

The demographic data highlights a highly experienced, stable workforce within the Guimba West District, dominated by senior Teacher III personnel who have completed extensive post-baccalaureate coursework. However, the sharp decline in continuous ICT professional development—where nearly one-third of these experienced educators lacked access to single-day technical training over the preceding year—presents a critical challenge. This training deficit indicates that while primary teachers demonstrate high baseline technology utilization, their mastery is driven by self-directed discovery and personal initiative rather than structured institutional training programs.

Despite these systemic resource constraints, primary educators in the district demonstrate an exceptionally high commitment to technology-driven instruction, as evidenced by "Very High Extent" ratings across all baseline sub-scales. The high rating for personalized paths and pacing strategies ($M = 3.89$) suggests that teachers actively rely on digital tools to manage large class sizes, high learner variability, and asynchronous requirements common in Philippine public schools. These findings align with the *World Bank Education Report (2025)*, which notes that self-paced digital interventions are highly effective in low-resource settings by allowing educators to diversify support without overloading physical resources.

Furthermore, these results support Mayer’s *Cognitive Theory of Multimedia Learning (2021)*, which states that integrating contextualized animations and videos reduces children's cognitive load and enhances long-term information retention. This is corroborated by local studies showing that regional public school teachers frequently find creative ways to re-engineer limited hardware to navigate infrastructure deficits.



When analyzing specific integration strategies, the lower score for complex student-led project workflows ($M = 3.57$) compared to teacher-directed visual delivery highlights the persistent challenges of rural public education. Primary teachers rely heavily on teacher-led visual aids (e.g., Canva, PowerPoint, television screens) to simplify abstract concepts, but struggle to implement student-driven digital project creation or advanced adaptive modeling. This aligns with the SAMR model, confirming that while rural primary classrooms successfully achieve the *Enhancement* levels (Substitution and Augmentation), they are frequently restricted from reaching the *Transformation* levels (Modification and Redefinition) due to poor connectivity, lack of interactive student devices, and low technical support.

The inferential correlation analyses reveal that general demographic markers such as age, sex, and total years of service do not influence instructional technology adoption. Instead, technology integration is skill-bound and structurally determined by formal post-graduate education. Advanced graduate coursework exhibited significant positive relationships with student engagement ($p = .037$), targeted assessment ($p = .019$), and classroom collaboration ($p = .048$).

This trend strongly supports Mishra and Koehler’s (2006) TPACK framework, confirming that deep technology integration depends on advanced pedagogical knowledge and critical decision-making rather than baseline demographics. Graduate programs systematically equip educators with the conceptual frameworks necessary to design complex digital workflows, manage alternative tracking metrics, and implement varied differentiation models despite regional limitations.

Crucially, the correlation mapping and one-way ANOVA results dismantle the assumption that educational technology acts as a uniform, one-size-fits-all academic accelerator. Instead, technology operates as a precision leveling agent and targeted structural scaffold. Moderate-to-strong positive correlations ($r = 0.335; 0.421$) and highly significant ANOVA differences $p = .000$ were observed exclusively among struggling learners whose averages fell below 74 or between 75-79. For stable and high-performing cohorts (85-100), technology integration generated no statistically meaningful variance or correlation changes.

This targeted impact is deeply grounded in Vygotsky’s *Zone of Proximal Development (ZPD)*, explaining why digital scaffolding tools are vital for struggling learners but have a negligible effect on independent, autonomous high-achievers. Structured digital interventions function as a critical performance equalizer, lifting lower-performing pupils into higher academic brackets while having minimal impact on students who have already mastered the core curriculum. Variance in primary performance is minimized precisely because digital interventions target students below the proficiency baseline, narrowing the achievement gap without artificially inflating or altering outcomes for high-capacity learners.

CONCLUSION AND RECOMMENDATIONS

Conclusion

This study establishes that primary school teachers within the Guimba West District demonstrate high baseline utilization of educational technology tools and actively integrate technological strategies to differentiate instruction. However, their technical integration is constrained by a lack of continuous, formal ICT training, making instructional delivery dependent on teacher-directed enhancement models (PowerPoint, Canva, television screens) rather than student-driven digital exploration. The study confirms that advanced technology integration is skill-bound, determined by a teacher’s formal graduate education, which reinforces their capacity for managing student engagement, digital tracking, and collaborative communication. Most importantly, the findings show that educational technology does not act as a uniform academic accelerator. Instead, it functions as a targeted structural scaffold and precision leveling tool that yields highly significant improvements exclusively for low-performing and at-risk student segments. By providing targeted visual and interactive support, educational technology helps bridge foundational literacy and numeracy divides, elevating struggling learners into higher academic brackets without changing the trajectory of autonomous high achievers. Consequently, maximizing the targeted deployment of digital tools is essential for fostering equity and reducing achievement gaps in public primary education.

Recommendations and Proposed Technological Strategies

Based on these findings, the following actions are recommended to optimize educational technology within public primary environments:

Table 22. Proposed Action Plan and Strategic Blueprint for Localized Technology Integration

TARGETED STRATEGIC DOMAIN	EMPIRICAL FINDING / JUSTIFICATION	PROPOSED ACTION INTERVENTION	PRIMARY RESPONSIBILITY	EXPECTED OUTPUT / METRIC
1. Institutional Professional Development	32.40% of primary teachers lacked access to technology training over the past year.	Launch localized tech-focused Learning Action Cells (LAC sessions) targeting primary digital pedagogy.	School Principals, Master Teachers	100% faculty completion of quarterly tech-focused LAC logs.
2. Targeted Digital Scaffolding	Technology integration significantly improves outcomes exclusively for at-risk pupils below 79.	Deploy targeted digital remedial lessons and audio-guided exercises for struggling learners.	Primary Subject Teachers	Narrowing the district’s non-proficiency rate to less than 1.0%.
3. Curriculum Modernization	Digital texts and student-driven tools scored lower due to infrastructure constraints.	Procure and distribute interactive primary e-books and offline digital story platforms.	DepEd Curriculum Developers	Procurement and deployment of localized primary offline reading packages.



4. Educational Policy & Incentives	Teachers’ advanced educational attainment significantly predicts high-quality tech integration.	Formulate institutional policies, such as study grants and scheduling adjustments, to encourage graduate studies.	DepEd Management and Policymakers	Measurable increases in the percentage of faculty pursuing master’s or doctoral degrees.
5. Future Empirical Research	This correlational design was restricted to a single provincial district.	Conduct longitudinal mixed-method studies tracking the long-term impact of digital scaffolding across divisions.	Independent Researchers, Universities	Multi-division tracking data validating educational technology equity frameworks.

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