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Technology Integration, Competence and Effectiveness of Mathematics Teachers: Predictors of Learners' Engagement

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ABSTRACT

Technology is now common in Philippine mathematics classrooms, but its use often stops at replacing traditional tools. This descriptive-correlational study examined the extent of technology integration, technological competence, and teaching effectiveness of mathematics teachers as predictors of Grade 9 learners' engagement in Area 2 of the DepEd Schools Division of Leyte during School Year 2025–2026. Through stratified random sampling, 114 mathematics teachers and 381 Grade 9 learners answered a profile sheet and four Likert scales measuring SAMR-based integration, competence in six domains, effectiveness in four dimensions, and engagement in three dimensions (Cronbach's α = .88 to .93). Data were analyzed using descriptive statistics, chi-square, and Pearson correlation. Integration declined from Very High at substitution (*M* = 3.64) and High at augmentation (*M* = 3.47) to Moderate at modification (*M* = 2.73) and Very Low at redefinition (*M* = 1.85). Competence was Very High in basic operations (*M* = 3.72) but lowest in content development (*M* = 3.18). Teaching effectiveness was High to Very High, strongest in relational expertise (*M* = 3.54). Engagement was High in the affective dimension (*M* = 3.13), Moderate in the behavioral dimension (*M* = 2.85), and weakest in the cognitive dimension (*M* = 2.51). Training, school, educational attainment, and position were associated with integration and competence, while school and family socioeconomic factors were associated with engagement. All correlations were positive and significant; integration was most strongly related to competence (*r* = .72), and engagement was most strongly related to teaching effectiveness (*r* = .63) and integration (*r* = .51). Technology appears to strengthen engagement through effective teaching rather than independently of it. A district-based Learning Action Cell in mathematics is proposed.

Introduction

Digital tools have become ordinary features of the Philippine mathematics classroom. Projectors, slide decks, graphing applications, and online quizzes are now common in public secondary schools, and national policy treats digital literacy and technology-enhanced instruction as priorities of basic education (Department of Education, 2022a; Republic Act No. 10929, 2016). Access, however, does not guarantee transformation. Technology can simply replace the chalkboard and the printed worksheet, or it can be used to redesign tasks so that learners explore, model, and collaborate in ways that would otherwise be impossible. The Substitution, Augmentation, Modification, and Redefinition (SAMR) model captures this difference (Hamilton et al., 2020), and research consistently finds that classroom practice tends

to stop at the lower levels even where devices are available (Drijvers, 2023; Musasa et al., 2024).

Whether technology raises learners' engagement depends largely on the teacher. Teachers need technological competence to select and manage tools, and they need broader teaching effectiveness, including clear explanation, sound content knowledge, and supportive relationships, to turn those tools into meaningful learning (Li & Wang, 2024; Mendez & Lopez, 2023). Engagement itself is multidimensional, involving learners' feelings toward learning, their participation and persistence, and their investment in deep, strategic thinking (Fredricks et al., 2020). Grade 9 is a particularly important point for engagement in mathematics, as learners meet abstract content in algebra and geometry that requires sustained cognitive effort.

In the Schools Division of Leyte, the division has issued numerous memoranda on digitalization and training (Schools Division of Leyte, 2025), yet there is little local evidence on how far teachers have moved along the SAMR continuum, how their technological competence and effectiveness compare, and which of these variables are most closely associated with learners' engagement. This study addressed that gap. It examined the extent of technology integration, technological competence, and teaching effectiveness of mathematics teachers as predictors of the engagement of Grade 9 learners in Area 2 of the DepEd Schools Division of Leyte during School Year 2025–2026. Specifically, it described the profiles of the teachers and learners; assessed integration at the four SAMR levels, competence in six skill domains, effectiveness in four dimensions, and engagement in three dimensions; tested the relationships between profile variables and these constructs; and tested the relationships among integration, competence, effectiveness, and engagement. The findings served as the basis for a district-based Learning Action Cell (LAC) in mathematics.

Literature Review

Technology Integration and the SAMR Continuum

Technology integration in mathematics is best understood as a pedagogical process rather than the mere presence of devices. Digital tools support visualization, interactivity, and multiple representations of abstract ideas, which helps learners build conceptual understanding (Drijvers, 2023; Barana et al., 2022). The SAMR model distinguishes uses that improve efficiency and presentation (substitution and augmentation) from uses that redesign or create new tasks (modification and redefinition), and the higher levels are associated with analysis, conjecture, and collaborative problem-solving (Hamilton et al., 2020; Li & Wang, 2024). Dynamic geometry, graphing platforms, and online collaborative environments move instruction from transmission toward inquiry (Tabieh & Hamzeh, 2022; Rahimi & Rezvani, 2023). Philippine studies associate technology integration with higher engagement and performance in secondary mathematics (Garcia et al., 2023), but contextual barriers such as weak infrastructure, limited training, and thin administrative support constrain integration in many schools (Musasa et al., 2024).

Technological Competence and Teaching Effectiveness

Teachers' technological competence spans basic operations, setup and troubleshooting, productivity software, web resources, communication media, and content development. The

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Technological Pedagogical Content Knowledge (TPACK) framework treats effective use as the intersection of technological, pedagogical, and content knowledge (Koehler et al., 2021; Mishra & Koehler, 2006). Without adequate competence, technology use remains superficial (Setiyani et al., 2020), and Filipino teachers, while generally confident in basic digital tasks, show gaps in advanced competencies such as content development and troubleshooting (Chandra & Ali, 2024). Competence has been found to predict both teaching effectiveness and learner engagement in mathematics (Li & Wang, 2024). Teaching effectiveness is itself multidimensional, covering teaching-related behavior, subject matter expertise, relational expertise, and personality. Teachers who explain clearly, adapt their strategies, and build supportive relationships sustain learners' interest and participation (Zhang et al., 2024; Mendez & Lopez, 2023; Uya, 2023).

Learner Engagement

Engagement comprises affective, behavioral, and cognitive dimensions: interest and belonging, participation and persistence, and self-regulated, strategic learning (Fredricks et al., 2020). Interactive digital environments with immediate feedback can strengthen all three, particularly when learners manipulate mathematical objects and collaborate (Aldahmash & Alshahrani, 2022). Technology does not produce engagement on its own; engagement rises when teachers exercise strong pedagogical control over digital tools (Rahimi & Rezvani, 2023), and well-designed digital environments narrow rather than widen gaps between groups of learners (Davis & Chang, 2022; Fernandez, 2024).

Theoretical and Legal Framework

Constructivist learning theory anchored the study, holding that learners construct mathematical knowledge through exploration and interaction, which the higher SAMR levels make possible (Drijvers, 2023). TPACK explained how competence becomes effective practice (Koehler et al., 2021), and student engagement theory framed the outcome (Fredricks et al., 2020). The Unified Theory of Acceptance and Use of Technology (Venkatesh et al., 2021) and Social Cognitive Theory (Bandura, 2020) further account for how expectations, facilitating conditions, and self-efficacy shape teachers' adoption of technology. Globally, the study aligns with Sustainable Development Goal 4 (United Nations, 2015) and the ISTE Standards for Educators (International Society for Technology in Education, 2020). Nationally, it is supported by the Excellence in Teacher Education Act (Republic Act No. 11713, 2022), the Information Technology Education Act (Republic Act No. 10929, 2016), the Department of Information and Communications Technology Act (Republic Act No. 10844, 2015), and DepEd's policy on the Learning Action Cell as a school-based continuing professional development strategy (Department of Education, 2022b).

Methodology

Research Design

The study used a quantitative descriptive-correlational design. The descriptive component profiled the respondents and described the levels of technology integration, technological competence, teaching effectiveness, and engagement; the correlational component tested

relationships among these variables without manipulating them (Creswell & Creswell, 2018; Fraenkel et al., 2019). In this design, a "predictor" is a variable that is significantly associated with the outcome; causal claims are not warranted.

Respondents and Sampling

The respondents were 114 mathematics teachers and 381 Grade 9 learners from Area 2 of the DepEd Schools Division of Leyte in School Year 2025–2026, selected through stratified random sampling with the two respondent groups as strata (Creswell & Creswell, 2018). Respondents came from nine named national high schools and a larger group of other selected schools in the area.

Instruments

A profile sheet recorded the teachers' age, sex, civil status, highest educational attainment, position, years in teaching, school, and number of relevant trainings, and the learners' age, sex, school, parents' educational attainment and occupation, and combined monthly family income. Four four-point Likert scales (4 = strongly agree to 1 = strongly disagree) measured the main constructs: a 20-item SAMR-based scale of technology integration (Hamilton et al., 2020), a 30-item scale of technological competence across six domains (Chandra & Ali, 2024; Li & Wang, 2024), a 20-item scale of teaching effectiveness across four dimensions (Mendez & Lopez, 2023; Uya, 2023), and a 15-item scale of affective, behavioral, and cognitive engagement (Fredricks et al., 2020). The constructs were rated as perceived by the respondent groups. A pilot test with 15 teachers and 15 Grade 9 learners from Area I, who were excluded from the final sample, yielded Cronbach's alpha values of .89 for integration, .92 for competence, .90 for effectiveness, .88 for engagement, and .93 for the overall instrument, indicating good to excellent reliability (Taber, 2018).

Procedure

After approval from the Graduate School and the Schools Division Superintendent of Leyte, the researchers coordinated with school heads and oriented administrators and teachers on the purpose and scope of the study. Questionnaires were administered in person or through a secure online platform, depending on each school's accessibility. Scheduling conflicts, limited internet connectivity in some schools, and delayed learner responses were addressed through flexible timeframes, close coordination with school heads, and follow-up visits.

Data Analysis

Frequencies and percentages described the profiles, and weighted means described the constructs. Composite scores were checked for normality using skewness and kurtosis; all values fell within ±2 (skewness −.098 to .213; kurtosis −.324 to .309), supporting parametric analysis (George & Mallery, 2019). Chi-square tests examined relationships between profile variables and the constructs, and Pearson's *r* examined relationships among the constructs, at $\alpha = .05$.

Ethical Considerations

Permission was secured from the Schools Division Superintendent, and informed consent was obtained from all teachers and learners. Participation was voluntary, identifiers were replaced

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with codes, and data were stored on password-protected devices accessible only to the research team, in accordance with the Data Privacy Act of 2012.

Results and Discussion

Profile of the Respondents

Table 1

Summary Profile of the Teacher and Learner Respondents

Variable	Most Frequent Categories, %
Teachers (n = 114)	
Age	31–40: 36.8; 41–50: 26.3; 21–30: 23.7; 51 and above: 13.1
Sex; civil status	Female: 59.6; male: 40.4; married: 68.4; single: 28.9
Educational attainment	BS with MA units: 42.1; MA: 34.2; BS: 15.8; with doctoral units or degree: 7.9
Position	Teacher II: 39.5; Teacher I: 30.7; Teacher III: 24.6; Master Teacher: 5.3
Years in teaching	11–15: 28.1; 6–10: 25.4; 1–5: 21.9; 16 and above: 24.5
Trainings attended	1–3: 36.0; 4–6: 34.2; 7–10: 19.3; more than 10: 10.5
Learners (n = 381)	
Age; sex	14: 40.9; 15: 31.0; 13: 24.1; 16 and above: 3.9; female: 51.7; male: 48.3
Parents' education	High school graduate: father 26.8, mother 26.8; college graduate: father 21.0, mother 6.6
Parents' occupation	Father: agriculture, forestry, fishery 24.9; mother: unemployed or informal work 32.0
Monthly family income	₱10,000–19,999: 33.3; below ₱10,000: 24.9; ₱20,000–29,999: 22.6; ₱30,000 and above: 19.2

The teachers were mostly mid-career, with more than a third aged 31 to 40, and most were women (59.6%) and married (68.4%) (Table 1). The workforce was strongly oriented toward graduate study, as 42.1% had master's units and 34.2% had completed a master's degree. Most held Teacher I to III positions (94.8%), and only 5.3% were Master Teachers. Experience was spread fairly evenly, and 70.2% had attended between one and six relevant trainings. A mid-career, graduate-oriented group is well placed for professional learning that moves practice toward transformation (Harris & Davis, 2023; Gomez & Albrecht, 2021), although the range of ages and training exposure suggests that support will need to be differentiated (Capistrano & Tamayo, 2025).

The learners were typical Grade 9 students aged 13 to 15, almost evenly divided by sex. Their households were modest: 58.2% of families earned less than ₱20,000 a month, the most common parental education was high school completion, fathers most often worked in agriculture, forestry, and fishery, and nearly a third of mothers (32.0%) were unemployed or in informal work. Learners in early adolescence respond strongly to interactive and relevant learning (Davis & Chang, 2022), while limited household resources can restrict their access to the home technology that supports engagement (Fernandez, 2024; Smith & Johnson, 2024).

Extent of Technology Integration

Table 2

Extent of Technology Integration in Mathematics Instruction by SAMR Level

SAMR Level	Mean	Level	Highest Indicator	Lowest Indicator
Substitution	3.64	Very High	Uses digital PDFs or slides for notes (3.91)	Gives online quizzes in the same format as paper quizzes (3.25)
Augmentation	3.47	High	Uses graphing calculators for visualization (3.82)	Uses spreadsheets to generate graphs (3.10)
Modification	2.73	Moderate	Uses dynamic geometry software (GeoGebra) (2.95)	Has learners create screencasts explaining their process (2.40)
Redefinition	1.85	Very Low	Runs community data projects with proposed solutions (2.05)	Conducts global data-sharing investigations (1.65)

Note. 3.50–4.00 = Very High; 3.00–3.49 = High; 2.50–2.99 = Moderate; 2.00–2.49 = Low; 1.00–1.99 = Very Low.

Integration declined steadily from the lower to the higher SAMR levels (Table 2). Substitution was Very High (M = 3.64), led by digital notes and slides (3.91) and projectors in place of chalkboards (3.85). Augmentation was High (M = 3.47), with graphing calculators (3.82) and equation editors (3.68) in wide use. Modification fell to Moderate (M = 2.73), with GeoGebra (2.95) the most used and learner-created screencasts (2.40) the least, and Redefinition was Very Low (M = 1.85), with every indicator at or near the bottom of the scale.

The gradient shows that teachers are comfortable using technology to replace or enhance familiar tasks but rarely use it to redesign learning. Substitution and augmentation make instruction more efficient and visual, yet they leave the structure of the lesson unchanged; the analytical, collaborative, and authentic tasks associated with deeper engagement belong to the higher levels (Hamilton et al., 2020; Drijvers, 2023). This plateau mirrors research reporting that teachers frequently stop at functional uses of technology unless they receive sustained, collaborative support (Cortez et al., 2024; Harris & Davis, 2023), and it is consistent with the contextual barriers documented in other developing systems (Musasa et al., 2024).

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Table 3

Teachers' Technological Competence and Teaching Effectiveness by Domain

Domain	Mean	Level	Highest Indicator	Lowest Indicator
Technological competence				
Basic computer operations	3.72	Very High	Starts up, shuts down, and restarts systems (3.92)	Installs, launches, and uninstalls software (3.45)
Setup, maintenance, and troubleshooting	3.40	High	Accesses technical support resources (3.68)	Troubleshoots common problems (3.10)
Word processing, spreadsheets, and presentation	3.51	Very High	Creates professional documents (3.88)	Uses advanced formatting features (3.15)
Web resources use and management	3.50	Very High	Uses search engines effectively (3.82)	Bookmarks and organizes web resources (3.25)
Communication media skills	3.53	Very High	Uses professional email (3.85)	Engages in professional networks (3.15)
Content development and management	3.18	High	Creates or modifies digital materials (3.35)	Develops multimedia content (3.05)
Teaching effectiveness				
Teaching-related behavior	3.44	High	Presents lessons clearly and in an organized way (3.72)	Provides timely, constructive feedback (3.18)
Subject matter expertise	3.49	High	Presents current, accurate information (3.72)	Connects content to real-world applications (3.05)
Relational expertise	3.54	Very High	Shows respect for all students (3.82)	Encourages participation and values input (3.25)
Personality	3.49	High	Is consistent and reliable in conduct and grading (3.72)	Adapts and handles unexpected situations calmly (3.15)

Note. 3.50–4.00 = Very High; 3.00–3.49 = High; 2.50–2.99 = Moderate; 2.00–2.49 = Low; 1.00–1.99 = Very Low.

Competence was Very High in four domains: basic operations (M = 3.72), communication media (3.53), productivity software (3.51), and web resources (3.50). It was High but lower in setup and troubleshooting (3.40) and lowest in content development and management (3.18), where developing multimedia content (3.05) and organizing digital repositories (3.12) were the weakest skills (Table 3). Teachers are therefore fluent users of existing tools but less prepared to create their own digital materials or solve technical problems independently. This "competence–use gap" is consistent with Philippine findings that advanced competencies lag behind basic ones (Chandra & Ali, 2024) and helps explain the plateau at the lower SAMR levels, since modification and redefinition require teachers to build tasks rather than display content (Setiyani et al., 2020; Gomez & Albrecht, 2021). A recent mapping of the skills and competencies of basic education teachers on Samar Island likewise found strengths in routine tasks alongside gaps in more specialized ones, underscoring the value of profiling competencies before designing training (Panela, 2025d).

Teaching effectiveness was High to Very High. Relational expertise was strongest (M = 3.54), led by respect for all students (3.82), followed by subject matter expertise and personality (3.49

each) and teaching-related behavior (3.44). The weakest indicators within each dimension, namely timely feedback (3.18), real-world connections (3.05), encouraging participation (3.25), and adaptability (3.15), are precisely the practices that technology can strengthen through digital formative assessment, authentic data, and interactive platforms (Zhang et al., 2024; Mendez & Lopez, 2023). The strong relational base is an asset, because supportive relationships make it safer for learners to take risks with unfamiliar tasks and tools (Uya, 2023).

Learner Engagement

Engagement weakened from the affective to the cognitive dimension. Affective engagement was High (M = 3.13), led by a positive attitude toward teachers (3.45), but a sense of belonging among peers (2.85) was only Moderate. Behavioral engagement was Moderate (M = 2.85): learners followed rules (3.35) but showed less consistent effort (2.75) and persistence with challenging tasks (2.55). Cognitive engagement was the weakest (M = 2.51), with self-regulation (2.25), going beyond requirements (2.35), and using effective strategies (2.45) at the Low level. The learners like their teachers and comply with classroom expectations, but they do not yet invest the strategic, self-directed effort that deep mathematical understanding requires. This profile is consistent with the view that affective and behavioral engagement can coexist with shallow cognitive processing (Fredricks et al., 2020) and that cognitive engagement grows when learners work on exploratory, technology-supported tasks that demand reasoning (Aldahmash & Alshahrani, 2022; Rahimi & Rezvani, 2023). It also echoes the documented strain on Filipino students' learning dispositions during and after the pandemic years (Panela, 2025b).

Profile Variables Associated With the Study Variables

Table 4

Chi-Square Tests Between Teachers' Profile and Technology Integration and Competence

Teacher Profile Variable	Integration χ^2 (p)	Competence χ^2 (p)
Age	15.24 (.018)*	11.38 (.044)*
Sex	2.85 (.241)	2.15 (.341)
Civil status	6.03 (.197)	5.67 (.225)
Highest educational attainment	25.17 (< .001)*	28.93 (< .001)*
Position	19.45 (.002)*	24.16 (< .001)*
Years in teaching	13.88 (.031)*	10.95 (.027)*
School	31.29 (< .001)*	22.47 (< .001)*
Number of trainings attended	42.56 (< .001)*	51.32 (< .001)*

Note. *Significant at α = .05.

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Table 5

Chi-Square Tests Between Learners' Profile and Perceived Effectiveness and Engagement

Learner Profile Variable	Effectiveness χ^2 (p)	Engagement χ^2 (p)
Age	7.95 (.242)	6.05 (.418)
Sex	9.87 (.043)*	3.78 (.286)
School	26.38 (< .001)*	23.94 (< .001)*
Father's educational attainment	13.25 (.039)*	16.37 (.012)*
Mother's educational attainment	15.68 (.016)*	18.62 (.005)*
Father's occupation	11.92 (.036)*	14.85 (.021)*
Mother's occupation	9.45 (.049)*	11.29 (.046)*
Combined monthly family income	17.54 (.002)*	31.47 (< .001)*

Note. *Significant at $\alpha = .05$.

Among teachers, the number of trainings attended had the strongest association with both integration ($\chi^2 = 42.56$) and competence ($\chi^2 = 51.32$), followed by school, educational attainment, and position (all $p \leq .002$); age and years in teaching were also significant, while sex and civil status were not (Table 4). Among learners, school and family income were most strongly associated with engagement ($\chi^2 = 23.94$ and 31.47, $p < .001$), and both parents' education and occupation were significant; age and sex were not (Table 5). Perceived teaching effectiveness was associated with school ($\chi^2 = 26.38$), income ($\chi^2 = 17.54$), parents' education and occupation, and learner sex ($\chi^2 = 9.87$, $p = .043$).

Two findings stand out. First, training and school context, rather than personal characteristics, track teachers' integration and competence. This supports the view that professional learning and organizational conditions jointly determine whether teachers use technology well (Cortez et al., 2024; Lim & Tondeur, 2020), and that postgraduate study builds the adaptive expertise needed to apply new tools (Gomez & Albrecht, 2021). The absence of sex differences agrees with evidence that institutional support matters more than gender in technology adoption (Harris & Davis, 2023); if teacher self-reports by sex are compared in future work, testing the measurement equivalence of the scales by gender, as done with a teacher empowerment scale in Philippine higher education, would make such comparisons more defensible (Panela, 2025a). Second, learners' engagement and their views of teaching follow their schools and family circumstances. Family education and livelihood shape the expectations and dispositions learners bring to class (Reyes & Santos, 2023; Smith & Johnson, 2024), and the significant sex association for perceived effectiveness is consistent with evidence that teachers' feedback patterns can differ for boys and girls in mathematics (Tan & Chen, 2021). Schools can partly offset these influences through strong relationships, relevant content, and supportive climates (Reyes & Santos, 2023).

Relationships Among Integration, Competence, Effectiveness, and Engagement

Table 6

Pearson Correlations Among the Major Variables

Variables	r	p	r^2	Strength
Technology integration and technological competence	.72	< .001	.52	Strong
Technology integration and teaching effectiveness	.58	< .001	.34	Moderate
Technology integration and learner engagement	.51	< .001	.26	Moderate
Technological competence and teaching effectiveness	.45	< .001	.20	Moderate
Teaching effectiveness and learner engagement	.63	< .001	.40	Moderately strong

Note. All coefficients significant; H_0 rejected. The correlation between competence and engagement was not reported in the source manuscript.

All reported relationships were positive and significant at $p < .001$ (Table 6). Technology integration was most strongly related to technological competence ($r = .72$). Among the predictors of engagement, teaching effectiveness had the strongest relationship ($r = .63$, about 40% shared variance), followed by technology integration ($r = .51$, about 26%). Integration was also related to effectiveness ($r = .58$), and competence to effectiveness ($r = .45$). The fifth null hypothesis was therefore rejected.

The pattern suggests a chain from competence to integration, from integration to effective teaching, and from effective teaching to engagement. Competence enables teachers to use technology at all, as TPACK predicts (Koehler et al., 2021; Li & Wang, 2024). Yet effectiveness, not technology use, is the variable most closely associated with engagement. Technology appears to act as an amplifier of good teaching rather than a substitute for it, which agrees with evidence that engagement depends on how teachers mediate digital tools (Rahimi & Rezvani, 2023) and on the quality of explanation, feedback, and relationships (Zhang et al., 2024; Mendez & Lopez, 2023). These results identify effectiveness and integration as the most promising predictors of engagement, but they are bivariate correlations. The study did not report a regression or mediation model, so the unique contribution of each predictor, holding the others constant, remains to be tested, and the relationship between competence and engagement was not reported.

Implications for a District-Based Learning Action Cell

The findings define the focus of the proposed LAC. Because training and school context track integration and competence, the LAC should operate as a cross-school network under a division memorandum, consistent with DepEd's LAC policy (Department of Education, 2022b). Because practice stalls at substitution and augmentation and content development is the weakest competence, its sessions should move teachers toward modification and redefinition through task redesign, multimedia creation, digital assessment, and data tools (Hamilton et al., 2020; Cortez et al., 2024). Because effectiveness is most closely tied to engagement, every technology session should be framed around a teaching goal, such as using digital formative assessment to give timely feedback or authentic data to connect mathematics to real life (Biggs

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& Tang, 2020). Mentoring pairs that draw on Master Teachers and graduate-trained teachers can sustain these changes (Harris & Davis, 2023). Teachers' experience with action research during the pandemic shows that such collaborative capacity building succeeds when time, technical support, and administrative backing are deliberately provided (Panela, 2025e). The manuscript's program spans eight months with a proposed budget of ₱2,000,000 across institutionalization, technology integration, competence building, pedagogical effectiveness, mentoring, cognitive engagement, equity, and monitoring.

Conclusion

Mathematics teachers in Area 2 of the Schools Division of Leyte use technology extensively for substitution and augmentation but rarely for modification and redefinition. They are highly competent in routine digital skills but weaker in troubleshooting and content development, and they are perceived as highly effective, especially in their relationships with learners. Grade 9 learners are affectively engaged but only moderately engaged in behavior and least engaged cognitively. Training, school, educational attainment, and position are associated with teachers' integration and competence, while school and family socioeconomic factors are associated with learners' engagement and perceptions of teaching. Integration, competence, effectiveness, and engagement are positively interrelated, and teaching effectiveness and technology integration are the strongest correlates of engagement.

The division should institutionalize a district-based LAC in mathematics that shifts professional development from functional technology use toward modification and redefinition, builds advanced competencies in digital content development and troubleshooting, and anchors every technological skill in effective pedagogy. The LAC should embed mentoring and peer coaching, prioritize learners' cognitive engagement through inquiry-based digital tasks, ensure equitable access to resources across schools, respond to learners' socioeconomic backgrounds, and include a monitoring framework centered on cognitive engagement. Because the LAC will add to teachers' workloads, the division should also attend to teachers' well-being; recent work on teachers' use of AI companion tools for workplace stress suggests that digital supports can help with this as well (Panela, 2026). The longer-term effects of disrupted schooling on learners' dispositions also merit continued monitoring (Panela, 2025c). Future research should test the predictors jointly through multiple regression or path analysis.

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