IJIMR
INTERNATIONAL JOURNAL OF INNOVATIVE AND MULTIDISCIPLINARY RESEARCH

**ISSN: 3116-5990 online / 3116-5982 print**
**Volume 1 Issue No. 4**
**Copyright © EduHeart Knowledge Network and Publishing Inc. Phils.**
**DOI:** https://doi.org/10.66206/eduheart.ijimr.52

# Technology-Integrated Applications Used in Mathematics and Technological Competence: Effects on Engagement and Achievement of Public Junior High School Learners

Joselito L. Alvarez[1*]
[1]*Graduate School, Northwest Samar State University, Calbayog City, Samar, Philippines*
**Corresponding Author:** Joselito L. Alvarez, Northwest Samar State University

**ARTICLE INFO**

**Date Received: September 15, 2026**

**Date Reviewed:** September 30, 2026

**Date Accepted: October 30, 2026**

**Date Published: November 20, 2026**

**KEYWORDS**

technology-enhanced applications; technological competence; learner engagement; mathematics achievement; junior high school; Bohol

**ABSTRACT**

Technology-enhanced applications can make mathematics more concrete and relevant, but their benefits depend on how extensively and competently teachers use them. This descriptive-correlational study examined the technology-integrated applications used in mathematics and teachers' technological competence and their effects on the engagement and achievement of public junior high school learners in the Trinidad 1 and Trinidad 2 Districts, DepEd Schools Division of Bohol, in School Year 2025–2026. Respondents were 42 mathematics teachers and 323 Grade 7 to 10 learners from six schools. Pilot-tested scales (α = .82 to .87) were analyzed through weighted means, chi-square, and Pearson correlation. Utilization was moderate in content delivery (*M* = 3.22) and problem-solving (*M* = 2.62) but low in use of digital tools (*M* = 2.20), classroom engagement (*M* = 2.23), and assessment (*M* = 2.05). Teachers were Competent in all six skill domains, weakest in content development (*M* = 2.98). Learners were Highly Engaged in motivation (*M* = 3.34) and participation (*M* = 3.28) and rated their achievement highest in concept understanding (*M* = 3.28) and lowest in formula memorization (*M* = 2.84). Teachers' education, position, experience, and training, and learners' school, parents' education, income, gadgets, and internet access were significantly related to the main variables. Utilization correlated positively with teachers' competence (*r* = .412), learners' engagement (*r* = .385), and achievement (*r* = .362). Technology is used mainly for presentation, yet its use is associated with more engaged and confident learners. A district-based Learning Action Cell focused on mathematics-specific digital competence and equitable access is proposed.

## Introduction

Digital applications have changed what is possible in a mathematics lesson. Interactive simulations, graphing software, gamified exercises, and adaptive platforms allow learners to see functions move, test conjectures, and receive feedback in real time, and these affordances are linked to better conceptual understanding, problem-solving, and engagement (Srilatha & Sen, 2024). Applications that tie mathematics to real-world situations, such as data modeling, spreadsheets, and simulations, make the subject more relevant and raise learners' interest (Wardana, 2024; Suarez & Dela Cruz, 2025), and technology use has been associated with higher mathematics performance, often through increased interest (Bright, 2024). Technology can also advance Sustainable Development Goal 4 by widening access to quality learning (Al-Sharikh, 2024).

**ISSN: 3116-5990 online / 3116-5982 print**
**Copyright @ EduHeart Knowledge Network and Publishing Inc. Phils.**
**DOI:** https://doi.org/10.66206/eduheart.ijimr.52

These gains depend on teachers. Effective integration requires the technical skill to operate tools, the pedagogical knowledge to use them well, and supportive conditions such as training, resources, and curricular alignment, all of which are often lacking (Musasa et al., 2025; Hodges & Prater, 2014). Most studies have also been conducted in better-resourced settings, leaving little evidence from Philippine public schools where devices and connectivity are limited. Philippine learners also returned to classrooms after a pandemic period that disrupted their schooling and affected their well-being (Panela, 2025b), which adds to the importance of understanding what keeps them engaged.

This study examined technology-integrated applications used in mathematics and teachers' technological competence and their effects on the engagement and achievement of public junior high school learners in the Trinidad 1 and Trinidad 2 Districts of the DepEd Schools Division of Bohol during School Year 2025–2026. It described the profiles of teachers and learners; the extent of utilization of technology-enhanced applications in content delivery, problem-solving, use of digital tools, classroom engagement, and assessment practices; teachers' competence in six skill domains; learners' engagement in participation, motivation, collaboration, and attention; and learners' achievement in five competencies. It then tested the relationships of the respondents' profiles with each variable and the relationships of utilization with competence, engagement, and achievement. The findings informed a district-based Learning Action Cell (LAC) in mathematics.

## Literature Review

### Technology-Enhanced and Real-World Mathematics Learning

Technology supports mathematics learning by making abstract ideas visible and manipulable. Dynamic geometry and graphing software let learners explore transformations and functions as they change (Yang et al., 2021; Forgasz & Forster, 2021), and web-based mathematics instruction has a significant positive effect on learning outcomes compared with traditional instruction (Akın, 2022). Effects on achievement are generally positive but modest (Akçay, 2022), and they are larger when teachers use technology to redesign tasks rather than to substitute for traditional tools (Abildinova et al., 2024; Bozkus, 2021). Automated feedback and intelligent tutoring support mastery of complex topics (Chin & Ming, 2024), and adaptive, AI-based platforms personalize instruction (Awang et al., 2025). Applications tied to authentic contexts help learners connect classroom mathematics to daily life (Wijaya, 2023; Da, 2023).

### Teachers' Technological Competence

The Technological Pedagogical Content Knowledge framework holds that teachers must integrate technological, pedagogical, and content knowledge to teach effectively with technology, and assessing this integrated knowledge remains challenging (You et al., 2019). The SAMR model describes a continuum from substitution and augmentation to modification and redefinition, and classrooms that reach the higher levels show more creativity and collaboration (Gillespie, 2022; Arslan & Aksu, 2022; Blundell, 2022). Teachers' knowledge and confidence shape their integration (Gumiero & Pazuch, 2024), and their pedagogical beliefs strongly influence how they use technology (Tondeur et al., 2017). Skill gaps and anxiety about being outperformed by learners contribute to resistance (Bećirović, 2023).

Ongoing training, coaching, and collaborative learning communities build competence (Bozkus, 2021; Darling-Hammond, 2020; Hodges & Prater, 2024).

### Barriers to Integration

Limited devices, unreliable internet, inadequate training, and weak administrative support constrain integration, especially in disadvantaged schools (Herro et al., 2021; Musasa et al., 2025; Zulu, 2020). Technical support, curricular alignment, and assessment practices that reward technology use are needed to sustain integration (Graham et al., 2020; Bray & Tangney, 2023).

### Theoretical Framework

Constructionism holds that learners build knowledge most effectively when they construct shareable artifacts, such as models and programs, and digital environments support this kind of learning in mathematics (Yunianto, 2024). Cognitive Load Theory cautions that poorly designed technology can overload working memory, so instructional design must manage the demands that tools place on learners (Asma, 2020). Authentic Learning Theory and Realistic Mathematics Education emphasize learning through meaningful, real-world problems and the progressive mathematization of those problems (Da, 2023; Wijaya, 2023). Social constructivism adds that collaborative interaction mediates learning (Vygotsky, 1978), and motivation theory explains how interest and self-efficacy drive engagement (Schunk et al., 2014). The study is also supported by the Enhanced Basic Education Act of 2013 (RA 10533), the Information Technology Education Act (RA 10929), the Department of Information and Communications Technology Act (RA 10844), and DepEd's MATATAG curriculum.

## Methodology

### Research Design

A quantitative descriptive-correlational design was used to describe the respondents and the main variables and to test their relationships without manipulation (Creswell & Creswell, 2018; Fraenkel et al., 2019). The design has been applied in similar Philippine studies of teachers' digital competence and learner engagement (Caberos & Dioso, 2025) and of teachers' commitment and competence (Pangilinan, 2025; Saro et al., 2023).

### Respondents

The respondents were 42 mathematics teachers, included through complete enumeration, and 323 Grade 7 to 10 learners, selected through stratified random sampling by grade level, from six public secondary schools in the Trinidad 1 and Trinidad 2 Districts: Hinlayagan National High School, Tagum Sur National High School, Kinan-oan High School, Soom High School, Guinobatan High School, and Kauswagan National High School.

### Instruments

Profile sheets recorded teachers' age, sex, civil status, education, position, years in teaching, school, and trainings, and learners' age, sex, school, parents' education and occupation, family income, gadgets at home, and internet access. Four-point Likert-type scales measured the extent of utilization of technology-enhanced applications, adapted from Haris (2022); teachers' technological competence, adapted from Gumiero and Pazuch (2024); learners' engagement,

**ISSN: 3116-5990 online / 3116-5982 print**
**Copyright @ EduHeart Knowledge Network and Publishing Inc. Phils.**
**DOI:** https://doi.org/10.66206/eduheart.ijimr.52

based on Jacinto (2023); and learners' mathematical achievement, adapted from Kirabo et al. (2024). Means of 3.26–4.00, 2.51–3.25, and 1.76–2.50 were interpreted as high (Highly Utilized, Highly Competent, Highly Engaged), moderate (Utilized, Competent, Engaged), and low (Less Utilized, Less Competent, Less Engaged), respectively. Achievement was measured as learners' self-assessed competence. A pilot test with 15 teachers and 15 learners in San Miguel District yielded Cronbach's alpha values of .84 (utilization), .82 (competence), .85 (engagement), and .87 (achievement).

### Procedure and Analysis

After approval from the Graduate School, endorsement from the District Supervisors, and permission from school heads, the researchers oriented the mathematics teachers and administered the questionnaires at times that did not disrupt classes. Overlapping school activities, some teachers' initial hesitation, and intermittent connectivity were managed through flexible scheduling and clear communication. Frequencies, percentages, and weighted means described the data; chi-square tests examined profile relationships; and Pearson's *r* examined the relationships of utilization with competence, engagement, and achievement, at $\alpha = .05$ (Field, 2018).

### Ethical Considerations

Approval was obtained from the Graduate School, the Schools Division Superintendent, the District Supervisors, and school principals. Teachers gave consent, and learners participated with parental or guardian consent. Responses were coded and stored securely in compliance 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 | Distribution, % |
|---|---|
| *Teachers (n = 42)* | |
| Age; sex | 31–40: 35.71; 41–50: 28.57; 21–30: 21.43; 51 and above: 14.29; female: 61.90 |
| Educational attainment | Bachelor's: 54.76; master's units: 28.57; master's: 11.90; doctorate: 4.76 |
| Position | Teacher I: 42.86; Teacher III: 35.71; Teacher II: 19.05; Master Teacher I: 2.38 |
| Years in teaching | 6–10: 28.57; 11–15: 23.81; 1–5: 19.05; 16–20: 16.67; 21 and above: 11.90 |
| Training exposure | None: 7.14; 1–2: 23.81; 3–5: 35.71; 6–8: 21.43; 9 and above: 11.90 |
| *Learners (n = 323)* | |
| Age; sex | 13: 34.06; 14: 29.41; 12: 20.12; 15 and above: 16.41; male: 51.08 |
| Parents' education | High school graduate: father 29.41, mother 27.86; bachelor's: father 12.39, mother 13.93 |
| Parents' occupation | Informal worker: father 37.15, mother 35.60; unemployed: father 17.96, mother 19.50 |
| Monthly family income | ₱10,001–20,000: 37.15; ₱5,001–10,000: 27.86; ₱20,001–40,000: 18.58; below ₱5,000: 11.76; above ₱40,000: 4.64 |
| Home technology | Own smartphone: 58.82; laptop: 18.58; mobile data only: 43.34; broadband: 29.41; no internet: 27.25 |

The teachers were mostly early- to mid-career women, and more than half (54.76%) held only a bachelor's degree (Table 1). Teacher I was the most common position, and most had modest training exposure. The learners were typical junior high students aged 12 to 15. Their households were economically constrained: 76.77% earned ₱20,000 or less a month, informal work and unemployment were common among parents, and only 18.58% had a laptop at home. More than a quarter (27.25%) had no internet access, and 43.34% relied on mobile data. These conditions limit learners' opportunities to use technology outside class (Zulu, 2020; Herro et al., 2021) and make school-based access particularly important.

**Extent of Utilization of Technology-Enhanced Applications**

**Table 2**

*Extent of Utilization of Technology-Enhanced Applications in Mathematics*

| Dimension | Mean | Level | Highest Indicator | Lowest Indicator |
|---|---|---|---|---|
| Content delivery | 3.22 | Utilized | Technology is used to present mathematical concepts clearly (3.50) | Digital platforms support differentiated instruction (3.00) |
| Problem-solving | 2.62 | Utilized | Technology fosters student collaboration on problem-solving (2.90) | Online resources provide challenging real-world problems (2.40) |
| Use of digital tools | 2.20 | Less Utilized | Students regularly use calculators and graphing software (2.40) | Technology facilitates data collection and analysis tasks (2.00) |
| Classroom engagement | 2.23 | Less Utilized | Real-time feedback from digital tools motivates students (2.40) | Gamified learning platforms are used to sustain interest (2.10) |
| Assessment practices | 2.05 | Less Utilized | Online quizzes provide immediate feedback to students (2.20) | Digital portfolios track student progress over time (1.90) |

Note. 3.26–4.00 = Highly Utilized; 2.51–3.25 = Utilized; 1.76–2.50 = Less Utilized.

Utilization was moderate in two dimensions and low in three (Table 2). Content delivery was highest ($M$ = 3.22, Utilized), with technology used to present concepts clearly (3.50, Highly Utilized) and interactive software used to explain topics (3.30). Problem-solving was Utilized ($M$ = 2.62), but simulations (2.50) and challenging online problems (2.40) were Less Utilized. Use of digital tools ($M$ = 2.20), classroom engagement ($M$ = 2.23), and assessment practices ($M$ = 2.05) were all Less Utilized; the lowest indicators were digital portfolios (1.90) and technology for data collection and analysis (2.00).

Technology is thus used mainly by the teacher to present content, and much less by learners to explore, collaborate, or demonstrate learning. In SAMR terms, use is concentrated at substitution and augmentation, with little modification or redefinition (Gillespie, 2022; Blundell, 2022). The low use of gamified platforms, digital collaboration, and formative digital assessment means that the features most associated with engagement and personalized learning are largely absent (Chin & Ming, 2024; Suarez & Dela Cruz, 2025). This pattern is consistent with the resource and training constraints documented in disadvantaged schools (Musasa et al., 2025; Zulu, 2020) and with the limited devices reported by learners.

**ISSN: 3116-5990 online / 3116-5982 print**
**Copyright @ EduHeart Knowledge Network and Publishing Inc. Phils.**
**DOI:** https://doi.org/10.66206/eduheart.ijimr.52

### Teachers' Technological Competence

Teachers were Competent in all six domains. Word processing, spreadsheets, and presentation was highest (*M* = 3.25), followed by basic computer operations (*M* = 3.18), communication media (*M* = 3.15), web resources (*M* = 3.10), setup and troubleshooting (*M* = 3.05), and content development and management (*M* = 2.98). Only three indicators reached Highly Competent: operating a computer confidently (3.40), creating documents (3.35), and installing applications (3.30). The lowest were troubleshooting simple issues (2.90), creating interactive modules (2.90), and adapting digital content for diverse learners (2.95).

Teachers' competence is strongest in general productivity skills and weakest in the mathematics-specific design skills that higher-level integration requires, which helps explain the dominance of presentation-oriented use. This gap between general and pedagogical technological knowledge is a recognized limitation in technology integration (You et al., 2019; Gumiero & Pazuch, 2024; Tondeur et al., 2017). It is also consistent with Philippine evidence that teachers' routine skills often exceed their specialized competencies, as seen when the skills of basic education teachers on Samar Island were mapped (Panela, 2025d).

### Learners' Engagement and Achievement

**Table 3**

*Learners' Engagement and Self-Assessed Mathematical Achievement by Dimension*

| Variable | Dimension | Mean | Level |
|---|---|---|---|
| Engagement | Participation | 3.28 | Highly Engaged |
| | Motivation | 3.34 | Highly Engaged |
| | Collaboration | 3.20 | Engaged |
| | Attention and focus | 3.16 | Engaged |
| Achievement | Concept understanding | 3.28 | Highly Competent |
| | Procedural fluency | 3.18 | Competent |
| | Problem-solving skills | 3.04 | Competent |
| | Application to real-world contexts | 2.92 | Competent |
| | Formula memorization | 2.84 | Competent |

Note. 3.26–4.00 = Highly Engaged/Highly Competent; 2.51–3.25 = Engaged/Competent; 1.76–2.50 = Less Engaged/Less Competent.

Learners were Highly Engaged in motivation (*M* = 3.34) and participation (*M* = 3.28), and Engaged in collaboration (*M* = 3.20) and attention (*M* = 3.16) (Table 3). They agreed most strongly that technology makes mathematics more interesting (3.40) and least that technology reduces distractions (3.05) or strengthens peer relationships (3.15). In achievement, they rated themselves Highly Competent in concept understanding (*M* = 3.28) and Competent in procedural fluency (3.18), problem-solving (3.04), real-world application (2.92), and formula memorization (2.84).

Learners respond positively to technology even though it is used less than it could be, which suggests strong latent demand. Technology's greatest effect is motivational, which is consistent with research linking digital tools to interest and enjoyment in mathematics (Bright, 2024;

Suarez & Dela Cruz, 2025; Wong & Wong, 2019). The weaker ratings for focus and peer relationships agree with Cognitive Load Theory's warning that tools can distract when activities are not carefully structured (Asma, 2020). In achievement, learners feel more confident about understanding concepts than about applying them to real situations, which mirrors the low use of authentic, data-based tasks (Da, 2023; Wijaya, 2023). These achievement results are self-assessments and should be read as learners' perceived competence rather than tested performance.

### Profile Variables in Relation to the Main Variables

**Table 4**

*Significance of Chi-Square Tests Between Profile Variables and the Main Variables*

| Profile Variable | Utilization | Competence | Engagement | Achievement |
|---|---|---|---|---|
| *Teachers* | | | | |
| Age | NS | NS | NS | NS |
| Sex | NS | NS | NS | NS |
| Civil status | NS | NS | NS | NS |
| Highest educational attainment | S | S | S | S |
| Position | S | S | S | S |
| Years in teaching | S | S | S | S |
| School | NS | NS | NS | NS |
| Relevant trainings and seminars | S | S | S | S |
| *Learners* | | | | |
| Age | NS | NS | NS | NS |
| Sex | NS | NS | NS | NS |
| School | S | S | S | S |
| Father's educational attainment | S | S | S | S |
| Mother's educational attainment | S | S | S | S |
| Father's occupation | NS | NS | NS | NS |
| Mother's occupation | NS | NS | NS | NS |
| Combined monthly family income | S | S | S | S |
| Gadgets available at home | S | S | S | S |
| Internet access at home | S | S | S | S |

Note. S = significant at $\alpha = .05$; NS = not significant.

The pattern of associations was the same across all four variables (Table 4). Among teacher characteristics, educational attainment, position, years in teaching, and trainings were significant, with trainings showing the largest chi-square values (12.36 to 13.57, $p \leq .009$), while age, sex, civil status, and school were not. Among learner characteristics, school, both parents' education, family income, gadgets, and internet access were significant, with internet access showing the largest values (14.72 to 15.36, $p \leq .006$), while age, sex, and parents' occupation were not.

Professional preparation on the teacher side and material resources on the learner side are therefore what matter, rather than demographics. Training and education build the knowledge and confidence that integration requires (Darling-Hammond, 2020; Hodges & Prater, 2024;

**ISSN: 3116-5990 online / 3116-5982 print**
**Copyright @ EduHeart Knowledge Network and Publishing Inc. Phils.**
**DOI:** https://doi.org/10.66206/eduheart.ijimr.52

Bozkus, 2021). At home, devices and connectivity determine whether learners can extend technology-based learning beyond the classroom (Zulu, 2020; Herro et al., 2021), and parents' education shapes the academic support they receive. The absence of sex differences suggests that technology-related experiences are similar for boys and girls and for male and female teachers; such conclusions are firmer when the instrument has been shown to function equivalently across sexes, as in a Rasch-based gender analysis of a Philippine teacher scale (Panela, 2025a). Some of these tests relate one group's profile to the other group's ratings, such as learners' profiles to teachers' competence, and the method of linking the two groups was not described, so they should be interpreted with caution.

### Relationships of Utilization With Competence, Engagement, and Achievement

**Table 5**

*Correlations of Utilization With Competence, Engagement, and Achievement*

| Variables | r | p | Decision | Interpretation |
|---|---|---|---|---|
| Utilization and teachers' technological competence | .412 | .001 | Reject $H_0$ | Moderate positive |
| Utilization and learners' engagement | .385 | .003 | Reject $H_0$ | Moderate positive |
| Utilization and learners' mathematics achievement | .362 | .005 | Reject $H_0$ | Moderate positive |

Utilization of technology-enhanced applications was significantly and positively related to teachers' technological competence ($r$ = .412, $p$ = .001), learners' engagement ($r$ = .385, $p$ = .003), and learners' achievement ($r$ = .362, $p$ = .005) (Table 5). The null hypothesis was rejected in each case.

The relationships are moderate and consistent. The strongest link, with competence, supports the view that teachers use technology to the extent that they can use it well (Gumiero & Pazuch, 2024; Tondeur et al., 2017). The links with engagement and achievement agree with evidence that technology raises interest, which in turn supports performance (Bright, 2024; Boadu, 2024), and with meta-analytic evidence of positive though modest effects on achievement (Akın, 2022; Akçay, 2022). Because the design is correlational, these results show association rather than effect. Each coefficient also explains a modest share of variance (13% to 17%), which indicates that much of the variation in engagement and achievement depends on other factors, including the home resources identified above.

### Toward a District-Based Learning Action Cell

The proposed LAC addresses five areas over ten months with a budget of ₱500,000: low technological competence, through bi-monthly workshops on tools such as GeoGebra and Desmos (₱150,000); limited access to innovative tools (₱200,000); insufficient professional mentoring (₱50,000); weak alignment with the MATATAG curriculum (₱75,000); and inadequate monitoring and evaluation (₱25,000). The findings suggest that the LAC should give particular attention to mathematics-specific content development, digital assessment, and strategies for learners without home internet. Teacher capacity building of this kind succeeds

when barriers such as time and lack of mentoring are addressed, as teachers on Samar Island found when conducting action research during the pandemic (Panela, 2025e). As teachers take on new digital demands, attention to their workload and stress is also warranted; one recent study reported that university teachers used an AI companion tool to manage workplace stress (Panela, 2026).

## Conclusion

Mathematics teachers in the Trinidad Districts use technology-enhanced applications mainly for content delivery and only to a limited extent for digital tools, classroom engagement, and assessment. They are competent with technology overall but weakest in creating interactive, mathematics-specific content. Learners are highly motivated and actively participate when technology is used, and they perceive themselves as competent in mathematics, though less so in applying it to real situations. Teachers' education, position, experience, and training, and learners' school, parental education, income, gadgets, and internet access are related to the main variables, while demographic characteristics are not. Utilization is significantly and positively related to teachers' competence and to learners' engagement and achievement.

Schools should provide continuous, mathematics-specific training in technology integration, support teachers' graduate study and career advancement, and invest in devices, connectivity, and interactive platforms. Equitable access programs, such as shared devices and school-based connectivity, are needed for learners without resources at home, and parents should be engaged in supporting learning. Teachers should design interactive and gamified activities that manage distraction and build collaboration, and schools should monitor technology use and its effects. Since many learners are still recovering from the disruptions of the pandemic years, their well-being should also be considered (Panela, 2025c). Future studies should measure achievement with tests or grades and examine all relationships among the four variables.

## References

Abildinova, G., et al. (2024). Effective use of digital pedagogy in mathematics education and student achievement. *Mathematics Education Research Journal*, *30*(2), 171–202.

Akçay, A. O. (2022). The effect of using technology in primary school mathematics teaching on students' mathematics achievement. *Journal of Education Research, 45*(3), 210–225.

Akın, A. (2022). The effectiveness of web-based mathematics instruction: A meta-analysis. *Journal of Educational Technology & Society, 25*(1), 45–62.

Al-Sharikh, A. (2024). Technology integration and sustainable education: Aligning with SDG 4. *International Journal of Educational Development*, *45*(2), 155–168.

Arslan, Ö., & Aksu, M. (2022). The impact of the SAMR model on student creativity and collaboration in mathematics education. *Journal of Educational Technology & Society*, *25*(2), 115–128.

Asma, H. (2020). Cognitive load theory and its relation to instructional design. *World Journal of Education*, *10*(3), 60–67.

**ISSN: 3116-5990 online / 3116-5982 print**
**Copyright @ EduHeart Knowledge Network and Publishing Inc. Phils.**
**DOI:** https://doi.org/10.66206/eduheart.ijimr.52

Awang, M., et al. (2025). Artificial intelligence in mathematics education: Potential and challenges. *International Journal of Educational Research*, *124*, 101894.

Bećirović, S. (2023). Teacher beliefs and resistance to technology integration in classrooms. *Education and Information Technologies*, *28*(5), 5679–5698.

Blundell, C. N. (2022). A scoping review of the application of the SAMR model in education. *Computers & Education Open*, *3*, 100078.

Boadu, S. K. (2024). Enhancing students' achievement in mathematics education in the 21st century through technology. *International Journal of Educational Technology*, *12*(1), 33–49.

Bozkus, F. (2021). Teacher digital pedagogy and its impact on students' academic performance in mathematics. *International Journal of Educational Technology*, *18*(1), 35–48.

Bray, B., & Tangney, B. (2023). Embracing digital technologies into mathematics education: Opportunities, challenges, and barriers. *Journal of Contemporary Teaching*, *15*(1), 34–56.

Bright, A. (2024). The effect of using technology in teaching and learning mathematics on students' mathematics performance. *International Journal of Education and Research*, *12*(3), 34–50.

Caberos, M. M., & Dioso, E. D. (2025). Teachers' digital competence and learner engagement: A descriptive-correlational study. *International Journal of Multidisciplinary and Current Educational Research*, *7*(2), 112–125.

Chin, Y., & Ming, L. (2024). Automated feedback tools in mathematics education: Enhancing learning and assessment. *Journal of Educational Computing Research*, *62*(3), 430–452.

Creswell, J. W., & Creswell, J. D. (2018). *Research design: Qualitative, quantitative, and mixed methods approaches* (5th ed.). SAGE Publications.

Da, N. T. (2023). Realistic mathematics education and authentic learning: A combination of teaching mathematics in high school. *European Journal of Science and Mathematics Education*, *11*(6), 120–135.

Darling-Hammond, L. (2020). Supporting effective technology integration: Professional development and policy. *Educational Researcher*, *49*(3), 193–200.

Field, A. (2018). *Discovering statistics using IBM SPSS statistics* (5th ed.). SAGE Publications.

Forgasz, H., & Forster, P. (2021). The role of technology in integrating real-world applications into mathematics curriculum. *International Journal of Novel Research in Education and Learning*, *11*(6), 106–112.

Fraenkel, J. R., Wallen, N. E., & Hyun, H. H. (2019). *How to design and evaluate research in education* (10th ed.). McGraw-Hill Education.

Gillespie, R. (2022). SAMR: The power of a useful technology integration model. In R. M. Lawless (Ed.), *Technology integration in education* (pp. 45–64). Ontario Tech University Press.

Graham, R., Dilworth, M., & O'Leary, J. (2020). Curriculum and technology integration: Aligning goals and practices. *Journal of Curriculum Studies, 52*(7), 965–982.

Gumiero, R., & Pazuch, V. (2024). Teacher professional knowledge and confidence in digital technology integration. *International Journal of Instruction, 17*(2), 45–62. https://doi.org/10.29333/iji.2024.1723a

Haris, A. (2022). Practical technology integration into mathematics education: Approaches, benefits, and challenges. *Remittances Review, 11*(1), 32–45.

Herro, D., et al. (2021). Barriers to technology integration in mathematics teaching: Insights for educators. *Journal of Mathematics Education, 14*(2), 32–48.

Hodges, C. B., & Prater, M. (2014). Challenges in technology integration for mathematics classrooms. *Computers in the Schools, 31*(3), 219–234.

Hodges, C. B., & Prater, M. (2024). Teacher preparedness for technology integration: Revisiting professional development strategies. *Journal of Digital Learning in Teacher Education, 40*(2), 101–113.

Jacinto, H. (2023). Technology-based clubs and student collaboration in mathematics problem solving. *Journal of Mathematics Education Research, 12*(3), 215–229.

Kirabo, J., Batiibwe, M., Mbulankende, R., & Lie, J. (2024). Technology-supported problem-based learning and pre-service teachers' design of authentic tasks. *Education and Information Technologies, 29*(5), 6123–6142.

Musasa, M., Chikasha, J., & Dube, T. (2025). Barriers to effective technology integration in mathematics education. *African Journal of Educational Technology, 14*(1), 33–49.

Panela, T. L. V. (2025a). Gender-based analysis of Teacher Empowerment Scale: Examining factor structure and Rasch model fit in higher education. *Environment and Social Psychology, 10*(11), 3570. https://doi.org/10.59429/esp.v10i11.3570

Panela, T. L. V. (2025b). Assessing Ways through Research and Augmentation (AWRA): Impact of COVID-19 pandemic on the mental health of college students in the Philippines Phase 1. *Innovations, 80*, 462–475. https://journal-innovations.com/assets/uploads/doc/346b3-462-475.16805.pdf

Panela, T. L. V. (2025c). Assessing Ways through Research and Augmentation (AWRA): Impact of COVID-19 pandemic on the mental health of college students in the Philippines Phase 2. *Innovations, 80*, 476–489. https://journal-innovations.com/assets/uploads/doc/886c9-476-489.16806.pdf

Panela, T. L. V. (2025d). Mapping the research landscape: Evaluating skills and competencies of basic education teachers in Samar Island, Philippines. *Innovations, 80*, 490–506. https://journal-innovations.com/assets/uploads/doc/1b29b-490-506.16830.pdf

**ISSN: 3116-5990 online / 3116-5982 print**
**Copyright @ EduHeart Knowledge Network and Publishing Inc. Phils.**
**DOI:** https://doi.org/10.66206/eduheart.ijimr.52

Panela, T. L. V. (2025e). Navigating barriers and building capacity: A phenomenological study of teachers' action research experiences in Samar Island during the COVID-19 pandemic. *Innovations*, *80*, 507–530. https://journal-innovations.com/assets/uploads/doc/6f255-507-530.16831.pdf

Panela, T. L. V. (2026). Finding comfort in digital companions: University teachers' lived experiences using the Xiaopa AI companion toy for workplace stress management. *International Journal of Biosciences (IJB)*, *28*(5), 186–194. https://doi.org/10.12692/ijb/28.5.186-194

Pangilinan, A. M. (2025). Challenges and commitment to teaching: A quantitative descriptive-correlational study of Filipino teachers in select coastal villages. *ETCOR Journal*, *9*(1), 88–102.

Saro, J. M., Apat, J. Q., & Pareja, M. S. (2023). Teachers' motivation, competences, and perceptions in writing action research: A descriptive-correlational study. *Journal of Advances in Education and Philosophy*, *7*(12), 456–465.

Schunk, D. H., Pintrich, P. R., & Meece, J. L. (2014). *Motivation in education: Theory, research, and practice* (4th ed.). Pearson Higher Ed.

Srilatha, P., & Sen, R. (2024). Technology-enhanced learning in mathematics: Conceptual understanding, engagement, and problem-solving. *Journal of Digital Pedagogy*, *6*(2), 101–118.

Suarez, M., & Dela Cruz, J. (2025). Gamification and digital resources in mathematics education: Impacts on student interest and achievement. *Philippine Journal of Educational Technology*, *15*(1), 77–93.

Tondeur, J., van Braak, J., Ertmer, P. A., & Ottenbreit-Leftwich, A. (2017). Understanding the relationship between teachers' pedagogical beliefs and technology use in education: A systematic review of qualitative evidence. *Educational Technology Research and Development*, *65*(3), 555–575. https://doi.org/10.1007/s11423-016-9481-2

Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. Harvard University Press.

Wardana, R. (2024). Real-world applications of mathematics through digital tools: A classroom study. *Asian Journal of Mathematics Education*, *12*(4), 321–338.

Wijaya, A. (2023). Integration of technology and authentic mathematical tasks: Effects on engagement and achievement. *Mathematics Education Review*, *35*(1), 47–65.

Wong, P., & Wong, C. (2019). The effect of mathematics interest on middle school student achievement. *Journal of Mathematics Education*, *12*(3), 78–93.

Yang, J., et al. (2021). Using graphing software to enhance functions understanding in secondary mathematics. *Journal of Educational Computing Research*, *59*(5), 876–895.

You, M., et al. (2019). Challenges in assessing TPACK: Teacher perspectives and institutional barriers. *Journal of Technology and Teacher Education*, *27*(4), 423–445.

Yunianto, W. (2024). A constructionist approach in learning computational thinking in mathematics. *Journal of Instructional Technology*, *23*(4), 83–102.

Zulu, R. (2020). Barriers to technology integration in disadvantaged schools. *Journal of Information Technology Education*, *19*, 1–14.