**ISA Journal of Multidisciplinary (ISAJM)**

Homepage: https://isapublisher.com/isajm/

Volume 3, Issue 2, March-April, 2026 ISSN: 3049-1851

# Tech Savvy ABM: Integrating Technology in Teaching and Learning Business Mathematics

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**Received:** 11.03.2026 | **Accepted:** 11.04.2026 | **Published:** 13.04.2026

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**DOI:** *10.5281/zenodo.19558595*

**Abstract** **Review Article**

Business Mathematics is a core subject that equips learners with essential financial literacy and budgeting skills. Yet, many Grade 11 students struggle to transition from traditional rote computation to high-level analytical reasoning. To address low engagement and performance gaps, this quasi-experimental study investigated the effectiveness of technology-based instruction (TBI) compared to traditional teaching methods among Grade 11 Senior High School Accountancy, Business, and Management (ABM) students at Cabulay High School (SY 2025-2026). The study compared the TBI strategy (experimental group) with traditional methods (control group) using pre-tests and post-tests among 48 participants. Results indicated that while both groups began with statistically equivalent baseline knowledge ($p = 0.128$), the experimental group achieved a significantly higher posttest mean score ($M = 83.82$) compared to the control group ($M = 74.03$). Effect size analysis revealed an extraordinarily large effect size for the TBI group (Cohen's $d = 1.905$), with a mean gain nearly twice that of the control group. In conclusion, technology-based instruction positively and significantly influences the development of mathematical proficiency and conceptual understanding in Business Mathematics. The study recommends integrating digital tools like financial calculators and mobile applications into regular classroom instruction to enhance academic performance and bridge learning gaps.

**Keywords:** Technology-Based Instruction (TBI), Business Mathematics, ABM Strand, Academic Performance, Quasi-Experimental Design.



## Introduction

The rapid digitalization of the global economy has redefined the pedagogical requirements of business education. In the Philippines, the Accountancy, Business, and Management (ABM) strand is designed to produce 21st-century learners equipped with financial literacy and analytical acumen (CIIT Philippines, 2023). Central to this curriculum are specialized subjects like Business Mathematics, which require high-level cognitive processing and data-driven decision-making. Recent research emphasizes that the success of these subjects depends on Technology-Based Instruction (TBI). Global trends suggest that specialized software and digital simulations serve as "cognitive partners," moving students beyond rote computation toward deep conceptual mastery (Bond et al., 2024;

Haleem et al., 2022). Within the ASEAN region, digital transformation is now a foundational requirement for "future-ready" students (ASEAN, 2025).

Despite these benefits, a significant gap exists between the intended curriculum and classroom reality. In the Philippines, Grade 11 ABM students continually struggle with specialized mathematical concepts due to limited foundational exposure and a reliance on traditional, lecture-based models (DepEd, 2023). While the Department of Education mandates technology integration, local schools like Cabulay High School face barriers, including inconsistent digital pedagogy and a "readiness gap" among educators (Mercado, 2021; Sanchez-Cruzado et al., 2021, Co, 2021). Although literature suggests TBI improves student interest, there is a lack of localized evidence examining how a teacher's digital fluency and specific instructional strategies directly influence academic performance in Business Mathematics.

This study, "Tech Savvy ABM: Integrating Technology in Teaching and Learning Business Mathematics," seeks to address this instructional divide by investigating the nexus between technology integration and student achievement at Cabulay High School. Ultimately, this research supports UN Sustainable Development Goal 4 (Quality Education) by offering insights into how digital transformation can close the comprehension gap and prepare students for the analytical rigors of the global business landscape.

## Methodology

This study employed a quasi-experimental, non-equivalent pretest-posttest control group design to evaluate the effectiveness of the technology-based instruction (TBI) on the business mathematics skills of 48 Grade 11 ABM students from two intact classes at Cabulay High School (SY 2025-2026). Purposive sampling was used to select these respondents. The experimental group received instruction integrating traditional methods and TBI, while the control group was taught traditionally.

Data was collected using a validated 30-item teacher-made multiple-choice test, aligned with Grade 11 ABM Business mathematics 4th quarter lessons competencies, administered as both a pre-test and post-test. A prior 50-item NSAT instrument was used for a homogeneity test, confirming the initial similarity in the groups' mathematics ability despite slightly different standard deviations.

The four-week intervention involved the experimental group experiencing the combination of the traditional method and TBI-integrated lessons. Post-tests were then administered to both groups. Data analysis involved frequency counts, means, standard deviations, independent samples t-tests, Levene’s test for variance equality, Cohen’s d for effect size, and the Shapiro-Wilk test for normality. These statistical tools aimed to determine the significant impact of the TBI on the students' business mathematics solving skills.

Ethical considerations, including informed consent and confidentiality, were observed throughout the research process.

## Results and Discussions

Table 1. Pretest Mean Percent Score in Business Mathematics of the Participant

| Group | N | Mean | SD | t | p-value | Decision |
|---|---|---|---|---|---|---|
| Experimental Group (Traditional and Technology-Based Instruction) | 24 | 68.96 | 5.38 | 1.548 | 0.128 | Fail to reject Ho |

| | | | |
|---|---|---|---|
| Control Group (Traditional Method) | 24 | 66.32 | 6.39 |

*p-value* ≤ 0.05 *is significant*

The mean percent score (MPS) in Business Mathematics of the participants before the intervention, shown in Table 1, reveals that the Experimental Group obtained a mean score of M = 68.96 SD = 5.38), while the Control Group recorded a lower mean score of M = 66.32 (SD = 6.39). After employing an independent-samples t-test, it was found that the observed difference between the two groups was statistically significant. The results indicated that the difference was not statistically significant, t = 1.548, p = 0.128, leading to the decision to fail to reject the null hypothesis. This indicates that the two groups performed comparably on the pretest. The results confirm that the participants in both groups started at a similar level of proficiency in Business Mathematics; thus, any observed differences in posttest performance can be attributed to the Technology-Based Instruction rather than any pre-existing differences.

Table 2. Posttest Mean Percent Score Business Mathematics of the Participant

| Group | N | Mean | SD | t | p-value | Decision |
|---|---|---|---|---|---|---|
| Experimental Group (Traditional and Technology-Based Instruction) | 24 | 83.82 | 5.12 | 5.603 | < .001 | Reject Ho |
| Control Group (Traditional Method) | 24 | 74.03 | 6.86 | | | |

*p-value* ≤ 0.05 *is significant*

The table presents that the experimental group, which was exposed to a combination of traditional and technology-based instruction, achieved a significantly higher posttest mean score (M = 83.82, SD = 5.12) compared to the control group, which was taught using the traditional method (M = 74.03, SD = 6.86). The independent-samples t-test result revealed a statistically significant difference in the posttest performances of the two groups, t = 5.603, p < .001, leading to the rejection of the null hypothesis, proving that digital integration leads to statistically superior learning gains in Business Mathematics. These results suggest that technology enhances conceptual clarity and engagement through better visualization (Al-Ansi et al., 2023). This aligns with international research (Bond, 2020; Zheng et al., 2021; Li & Wong, 2022) and local studies (Cahiles, 2025; Buan et al., 2025) highlighting how ICT tools bridge the gap between abstract theory and practice. In the end, the study finds that teaching with technology is an important step forward in education. By fostering visual-spatial reasoning (Guzman-Gonzalez & Vesga-Bravo, 2024) and providing immediate feedback, these tools effectively overcome traditional learning barriers within the Philippine educational landscape, such as limited access to resources and varying levels of student engagement.

Table 3. Comparison of the Mean Difference of the Posttest and Pretest Business Mathematics of the Participant

| Group | Posttest | Pretest | Mean Gain | SD | t | p-value | Cohen's d | Decision |
|---|---|---|---|---|---|---|---|---|
| Experimental Group (Traditional and Technology-Based Instruction) | 83.82 | 68.96 | 14.86 | 3.44 | 6.598 | < .001 | 1.905 | Reject Ho |
| Control Group (Traditional Method) | 74.03 | 66.32 | 7.71 | 4.05 | | | | |

p-value $\leq 0.05$ is significant

The comparison of the mean gain achievement of the two groups after the intervention presented in Table 3 reveals a statistically significant difference, t = 6.598, p < .001, showing that the experimental group gained a notable improvement of 14.86 (SD = 3.44) as compared to the control group's mean gain of 7.71 (SD = 4.05). This implies that participants who were exposed to a combination of traditional and technology-based instruction performed better than those who were taught with traditional lecture-based instruction. This confirms that the higher mean gain obtained by the experimental group can be attributed to the effectiveness of the technology-based instruction and not due to chance. This claim is further justified by the extremely high Cohen's d value of 1.905, indicating that the integration of technology with traditional instruction produced a significant improvement in learning outcomes, likely due to the increased engagement, interactive learning experience, and improved conceptual understanding.

Moreover, the findings suggest that digital tools accelerate learning by increasing engagement and reducing cognitive load. This aligns with Kaden (2020), who noted a "virtuous cycle" of progress, and Papadakis et al. (2021), who emphasized that adaptive tools allow for the immediate correction of mathematical misconceptions. Additionally, the results mirror the research of Moralista and Oducado (2020), highlighting the high receptivity of Filipino students to technology-mediated platforms. Additionally, Bascara (2024) affirmed that integrating business-related software within the Philippine senior high school curriculum effectively bridges the gap between theory and practice, leading to substantial performance gains.

Furthermore, the effect size far exceeds Hattie's (2023) 0.40 threshold for highly successful interventions. Ariyanti and Santoso (2020) suggest such gains occur when technology redefines how students visualize complex business problems. This data justifies the widespread adoption of digital tools to move beyond mere instructional substitution. Dizon et al. (2025) also noted similar success in Philippine STEM education using interactive simulations. Finally, Villena (2024) emphasizes that technology acts as an equalizer in senior high school, reducing learning anxiety. Ultimately, the study confirms TBI as an exceptionally robust model for the local educational landscape.

Based on the findings, the study concludes that Technology-Based Instruction (TBI) is a transformative and highly effective pedagogical strategy for improving Business Mathematics performance. The research established that while both groups began with comparable baseline proficiency, the experimental group achieved significantly superior learning gains. The results confirm that technology integration moves beyond mere substitution, redefining how students visualize complex financial operations. By providing immediate feedback and reducing cognitive load, TBI effectively bridges the gap between abstract mathematical theory and practical application.

Ultimately, this intervention serves as a robust equalizer in the Philippine senior high school context, fostering greater engagement and academic growth. These findings justify the widespread adoption of technology-mediated instruction to overcome traditional learning barriers and enhance the mastery of business-related concepts.

Integrating the findings of this study, it is highly recommended that Business Mathematics teachers actively integrate Technology-Based Instruction (TBI) into their pedagogy to move beyond traditional rote memorization. School administrators should prioritize the procurement of digital tools and interactive simulations that foster visual-spatial reasoning and provide immediate feedback to students. Furthermore, Department of Education (DepEd) officials should consider institutionalizing technology-mediated strategies within the Senior High School curriculum to standardize these high-impact learning gains across the region.

To ensure sustainability, continuous professional development programs and technical workshops should be conducted to equip educators with the skills needed to effectively utilize business-related software. Future researchers are encouraged to conduct longitudinal studies or expand this intervention to ABM subjects to validate its long-term efficacy. Ultimately, adopting TBI will serve as a powerful equalizer, reducing learning anxiety and ensuring that Filipino learners are better prepared for the practical demands of the modern financial landscape.

**Acknowledgment:**

The researcher would like to convey his gratitude and appreciation to the people who contributed unselfishly their knowledge, time, and effort that made this piece of work successful. Dr. Rosalyn L. Delizo, Dean of Graduate School, for providing continuous motivation, suggestions, and assistance; Dr. Nelson D. Guray, her adviser and statistician, for sharing his valuable time, patience in giving suggestions, integral knowledge, support, guidance, and encouragement, and brilliant suggestions to finish this study; Engr. Rey C. Naval, Dr. Eleanor Macapal and Dr. Cynthia Grace T. Valdez, Members of the Panel, for sharing their ideas and skills in order to make this piece of work more meaningful; Mr. Randy B. Mina, Principal III, Cabulay High School, for allowing him to float her questionnaire in your respective school; The Grade 11 ABM students of Cabulay High School, for the wisdom and time answering his questionnaire; To the 8 experts who render their time in validating the content of the questions for the pre-test and post-test of Business Mathematics; Her parents, siblings and friends, for their moral support, cheer and laughter which encouraged her throughout the duration of this study; Above all to the Lord Almighty who gave bountiful blessings, good health, infinite guidance, love and wisdom throughout the completion of this work.

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