International Journal of Sustainability and Advanced Integrated Research
Volume 2, Issue 2 (April-June 2026) | ISSN: 3107-7854
DOI: https://doi.org/10.65339/ijsair.V2.I2.348

Technology Integration and Academic Performance as Mediated by Learners' Engagement and Study Habits: Bases for Action Plan

Marjun B. Estillore[1], Dr. Melissa L. Loquere[2]
[1]*Teacher I, Buaya Elementary School, Lapu-Lapu City, Cebu, Philippines*
[2]*Instructor III, Bohol Island State University, Poblacion Norte, Clarin, Bohol, Philippines*

Publication history: Received: April 19, 2026; Revised: April 25, 2026; Accepted: May 2, 2026
Email of Corresponding Author: marjun.estillore@deped.gov.ph

Abstract

This study examined technology integration in public elementary education and its relationship with learners' engagement, study habits, and academic performance among Grade 4–6 learners in District 2 of Lapu-Lapu City, Cebu. Anchored on Contiguity Theory, Stimulus–Organism–Response Theory, Maslow's Hierarchy of Needs, and related technology adoption and engagement perspectives, the study investigated whether learners' engagement and study habits mediated the relationship between technology integration and academic performance. A quantitative, non-experimental mediation design was used. Data were gathered through adapted and validated questionnaires and academic performance records from 349 learner respondents and 96 teacher respondents from Bankal Elementary School, Punta Engaño Elementary School, and Soong Elementary School. Weighted mean, standard deviation, frequency, percentage, and Path Analysis through GLM Mediation Analysis were used to analyze the data. Findings showed that teachers had a high level of technology integration (M = 3.81, SD = 0.41), learners were highly engaged (M = 3.77, SD = 0.48), study habits were highly evident (M = 3.77, SD = 0.54), and learners' academic performance was very satisfactory (M = 86.73, SD = 3.40). However, learners' engagement and study habits did not significantly mediate the relationship between technology integration and academic performance. The direct and total effects of technology integration on academic performance were also not significant. The study concluded that technology use alone does not automatically improve academic performance; rather, effective learning outcomes require structured study habits, guided instruction, learner support, and sustained teacher facilitation. The study supports SDG 4 on Quality Education, SDG 9 on Industry, Innovation and Infrastructure, SDG 10 on Reduced Inequalities, and SDG 17 on Partnerships for the Goals. Its sustainability impact lies in promoting educational, technological, institutional, and policy sustainability through evidence-based technology integration and learner-centered academic support.

Keywords: Academic Performance; Learners' Engagement; Mediation Analysis; Public Elementary Education; Study Habits; Technology Integration; Technology-Supported Learning

1. Introduction

This study examined technology integration in public elementary education and its relationship with learners' engagement, study habits, and academic performance among Grade 4–6 learners in District 2 of Lapu-Lapu City, Cebu. It was anchored on the view that technology can support teaching and learning when used purposefully, but may also cause distraction, weak study routines, and reduced academic performance when implemented without adequate teacher guidance. The study focused on technology integration as the independent variable, academic performance as the dependent variable, and learners' engagement and study habits as mediating variables. Its findings were intended to serve as the basis for an action plan that would strengthen teacher support, learner engagement, productive study habits, and academic outcomes in public elementary schools.

Teachers have been challenged to integrate technology into classroom instruction while maintaining their essential role as facilitators of learning. Although digital platforms and multimedia tools can enhance participation and self-regulated learning, their unstructured use may also lead to distraction and poor study routines. Dargo and Dimas (2021) reported that learners' academic performance declined when technology-mediated learning was implemented without adequate guidance, emphasizing the importance of active teacher engagement. In District 2 of Lapu-Lapu City, a survey showed that 11 out of 15 teachers reported a low level of technology integration, as many focused mainly on delivering digital lessons, preparing modules, and recording assessment results, which limited personalized learner support. Upper-elementary learners require structured guidance because ineffective technology integration may negatively affect engagement, study habits, and academic performance. Pre-service training prepared teachers for traditional instructional roles but did not fully equip them for hybrid or technology-mediated learning environments. Without appropriate intervention, reliance on modular and digital strategies may compromise learners' engagement, study routines, and educational outcomes. Thus, this

study investigated the correlation between technology integration, learners' engagement, study habits, and academic performance as the basis for an evidence-based action plan.

The literature emphasizes that technology integration can enhance learning when supported by teacher guidance, appropriate instructional design, learner motivation, and digital readiness. Mishra et al. (2021) demonstrated that online learning sustained instructional continuity, but learners' discipline and time-management skills remained important determinants of academic success. Similarly, Aguilar (2021) reported that reliance on digital platforms reshaped students' study habits and required greater persistence and self-regulation. Johnson et al. (2021) found that gamified learning environments improved motivation and engagement, while Li et al. (2021) observed that adaptive learning systems strengthened planning and organizational skills. Wu and Kang (2021) further noted that technology-supported activities enhanced behavioral engagement when aligned with intrinsic motivation. However, several studies also identified barriers to effective technology use. Dargo and Dimas (2021) pointed to connectivity issues and limited technical support as major challenges in public schools. Guiamalon et al. (2021) highlighted learners' difficulties with independent learning, time management, and stress under modular learning conditions. Abante et al. (2021) also noted that unequal access to devices and connectivity limited learners' ability to benefit fully from technology. These findings suggest that access to technology alone does not guarantee improved learning outcomes unless learners receive sufficient support and structured guidance. Technology has also been shown to improve learner engagement through interactive and collaborative activities. Wang and Baker (2018) found that interactive content and collaborative online activities significantly increased student engagement. The OECD (2021) emphasized that effective technology integration, supported by teacher guidance, timely feedback, and meaningful communication, contributed to sustained learner engagement, better study habits, and improved academic performance. According to Ebele & Olofu (2017), successful learners usually achieve academic success by developing and applying effective study habits, suggesting that study routines strongly influence academic achievement. Digital literacy is another important theme in the literature. Nagle (2018) and Yu (2022) emphasized the need to assess learners' digital literacy because early development of digital skills strengthens study habits and academic performance. Nygren et al. (2019) and Forde and O'Brien (2022) stressed that the elementary years are crucial for developing digital competencies that support lifelong study behaviors. Technology integration has also extended beyond core academic subjects, as shown by Parris et al. (2022) and Jiang and Ning (2022) in physical education contexts, while García-Morales et al. (2021) recognized digital transformation as a strategic priority for schools. Historically, classrooms relied on direct instruction, where teachers served as the main source of knowledge and learners were passive recipients (Cuban, 1986). Digital technology shifted this structure by enabling interactive and participatory learning. Interactive whiteboards, educational applications, and online collaboration platforms support real-time feedback and collaborative learning, helping sustain learner interest and motivation (Johnson, 2019; Lu et al., 2021). Adaptive learning systems address individual learning styles and learning gaps (Smith & Jones, 2020), while multimedia resources make abstract concepts more concrete and understandable (Brown, 2021). Assistive technologies also promote inclusivity by supporting learners with disabilities (Meyer, Rose, & Gordon, 2014).

The study is situated within Philippine legal and educational mandates that promote quality, accessible, learner-centered, and research-based education. Section 1, Article XIV of the 1987 Philippine Constitution guarantees every learner's right to quality and accessible education. Republic Act No. 10533, or the Enhanced Basic Education Act of 2013, emphasizes learner-centered and research-based instruction. Republic Act No. 11448 strengthened the Open Distance Learning system and supported the use of digital tools and platforms to expand learning opportunities. The importance of these legal provisions became more evident during the COVID-19 pandemic, when education systems were compelled to continue instruction despite disruptions. President Rodrigo Duterte, in his 2020 State of the Nation Address, highlighted the urgency of educational continuity, while Secretary Leonor Magtolis Briones implemented DepEd Order No. 012, s. 2020, or the Learning Continuity Plan, which institutionalized modular, online, and blended learning modalities. These policies provided the basis for technology integration as a mechanism for sustaining instruction, improving study habits, and supporting academic performance. At the local level, the study focused on Grade 4–6 learners in District 2 of Lapu-Lapu City, where schools serve learners from both urban and coastal communities. This context is important because many Philippine public elementary learners face limitations in connectivity, device access, and digital readiness. Globally, the shift toward digitalized learning environments reflects broader educational transformation, where technology is increasingly used to promote participation, inclusivity, collaboration, and 21st-century skills.

This study was grounded in several theories that explain how technology integration may influence learner behavior and academic outcomes. Guthrie's Contiguity Theory (1968) suggests that learning is strengthened through repeated pairing of stimulus and response. In technology-integrated classrooms, repeated engagement with digital activities may reinforce study routines and support habitual learning behaviors. Mehrabian and Russell's Stimulus–Organism–Response (S-O-R) Theory explains how technological tools as stimuli influence learners' internal states, such as motivation and cognition, which then produce observable responses such as engagement and improved study habits. Maslow's Hierarchy of Needs also supports the study by suggesting that access to technology can help meet learners' basic, social, and esteem needs. When these needs are supported, learners are more likely to show motivation, self-regulation, and engagement. Additional

conceptual perspectives include the Student Engagement Model, Constructivist Theory, Diffusion of Innovations Theory, and the Technology Acceptance Model (TAM), which collectively explain how technology may enhance engagement, adoption, and learning outcomes. Guided and balanced technology use may support self-regulated learning and study habits despite possible distractions (Baron, 2021; Selwyn & Aagaard, 2020). Demographic factors such as gender and age may also affect digital behavior and technology adoption (El-Emadi et al., 2019; Shah et al., 2018), while novice learners may experience greater stress during adaptation (Harmsen et al., 2017). Learners' engagement is understood as behavioral, emotional, and cognitive involvement in learning (Fredricks et al., 2019; Kuh, 2020; Veermans et al., 2019). In this study, engagement and study habits served as mediating variables between technology integration and academic performance. Academic performance refers to learners' demonstrated achievement through grades or evaluations (Browne and Keeley, 2018), while digitalized learning environments refer to learning contexts that integrate technology to support instruction and learner outcomes (Keengwe et al., 2020). Teacher-related factors also shape technology integration. Chaturvedi and Purushothaman (2019) found that older teachers coped better with job stress, while Kazmi and Chaudhry (2015) reported no significant gender differences in coping, except that female teacher tended to seek more emotional support. Harmsen et al. (2017) also noted that beginning teachers were more vulnerable to professional pressures, especially during technology-based learning implementation.

Although technology integration, engagement, study habits, and academic performance have been studied individually, limited research has explored their interaction within Philippine public elementary schools. Many studies have focused on older learners who generally have better digital access and stronger digital readiness, leaving upper-elementary learners underrepresented. This gap is important because learners in Grades 4–6 often need greater instructional structure, parental support, and teacher guidance, especially in contexts affected by limited connectivity, device constraints, and uneven technology readiness. The study was therefore conducted to determine whether learners' engagement and study habits mediate the relationship between technology integration and academic performance. By examining these relationships in District 2 of Lapu-Lapu City, the study sought to generate evidence that could guide educators, administrators, and policymakers in designing interventions that make technology integration more structured, learner-centered, inclusive, and academically meaningful.

This study is aligned primarily with SDG 4 – Quality Education because it focuses on improving teaching and learning through effective technology integration, stronger learner engagement, productive study habits, and improved academic performance. The study supports the goal of ensuring inclusive and equitable quality education by examining how technology can be used meaningfully in public elementary schools, particularly among upper-elementary learners who may face limitations in digital access and readiness. The study is also connected to SDG 9 – Industry, Innovation and Infrastructure because it addresses the role of digital tools, technology-supported instruction, and educational innovation in strengthening learning environments. Since the study recognizes the need for teacher preparation, digital resources, and structured technology use, it contributes to innovation and digital sustainability in basic education. It also supports SDG 10 – Reduced Inequalities to the extent that it highlights access-related challenges such as limited devices, connectivity issues, and digital readiness among learners in public school settings. By proposing an action plan based on the findings, the study may help reduce learning gaps caused by unequal access to technology-supported instruction. SDG 17 – Partnerships for the Goals is also relevant because the improvement of technology integration requires cooperation among teachers, school administrators, parents, DepEd, and other stakeholders.

This study contributes to educational sustainability by promoting evidence-based strategies for improving technology-enhanced instruction, learner engagement, study habits, and academic performance. It recognizes that sustainable learning outcomes depend not only on the availability of digital tools but also on teacher competence, learner discipline, structured guidance, and institutional support. The study also contributes to technological sustainability by emphasizing purposeful and balanced technology integration rather than unstructured digital use. It highlights the need for teachers to use technology as a support mechanism for instruction, engagement, feedback, and independent learning. In terms of socio-economic and community sustainability, the study addresses the realities of public elementary learners who may experience limited digital access, connectivity problems, and uneven learning support. Strengthening technology integration in this context may help schools provide more equitable learning opportunities. Finally, the study supports institutional and policy sustainability by generating data that may guide school administrators and DepEd in curriculum planning, teacher professional development, resource allocation, and school-based intervention planning. Its proposed action plan can serve as a practical mechanism for improving digital learning practices while sustaining learners' academic growth, study discipline, and engagement in public elementary education.

2. Material and methods

2.1 Research Design

The study employed a quantitative, non-experimental mediation design using a structured questionnaire as the primary data-gathering instrument. The quantitative approach was used to measure the level of technology integration among

teachers and the levels of learners' engagement, study habits, and academic performance. Since the study was non-experimental, the researcher did not manipulate any variables but examined them as they naturally occurred in the learning environment. The mediation design was appropriate because it determined whether learners' engagement and study habits served as mediating variables in the relationship between technology integration as the independent variable and academic performance as the dependent variable. This design allowed the researcher to analyze the direct and indirect effects of technology integration on learners' academic performance through the identified mediators.

2.2 Locale of the Study

The study was conducted in District 2 of Lapu-Lapu City, Cebu, which consists of public elementary schools serving learners from both urban and coastal communities. The schools included were Bankal Elementary School, Punta Engaño Elementary School, and Soong Elementary School. These schools represented varied educational contexts, from urban areas near Mactan Island's industrial zone to coastal communities, making the district a suitable setting for examining how technology integration affected learners' engagement, study habits, and academic performance.

2.3 Respondents of the Study

The respondents consisted of Grade 4, Grade 5, and Grade 6 learners from the three selected elementary schools in District 2 of Lapu-Lapu City. The study also included Grade 4–6 teachers from the same schools to represent instructional practices and classroom technology use. A total of 349 learner respondents participated in the study, composed of 166 learners from Bankal Elementary School, 61 from Punta Engaño Elementary School, and 122 from Soong Elementary School. The teacher respondents included 45 teachers from Bankal Elementary School, 21 teachers from Punta Engaño Elementary School, and 30 teachers from Soong Elementary School, for a total of 96 teacher respondents. Their participation provided data on technology integration, learner engagement, study habits, and academic performance.

2.4 Sample and Sampling Procedure

The study identified a total learner population of 3,737 Grade 4–6 learners across the three selected schools, consisting of 1,780 learners from Bankal Elementary School, 1,308 from Soong Elementary School, and 649 from Punta Engaño Elementary School. From this population, 349 learners were selected as respondents. The manuscript described the use of a stratified random sampling technique to ensure proper representation from each school. It also stated that the total population method was used by including all learners present during the data-gathering period. These procedures were intended to promote representation, minimize sampling bias, and strengthen the reliability of the findings.

2.5 Research Instrument

The researcher used adapted and validated questionnaires as the primary instruments for data collection, with permission obtained from the original authors before their use. The instrument consisted of several parts measuring technology integration, learners' engagement, study habits, and academic performance. The section on technology integration was adapted from Hosseini and Kamal (2012) in the study Developing an Instrument to Measure Perceived Technology Integration Knowledge of Teachers. It contained 10 items measuring the frequency of technology use, effectiveness of digital tools, teacher strategies, and learners' comfort with technology, with a reliability index of Cronbach's alpha = 0.87.

2.6 Data Gathering Procedure

The researcher first prepared a formal request letter addressed to the Campus Director of Bohol Island State University Clarin Campus to seek approval to conduct the study. After approval was granted, permission letters were also secured from the Schools Division Superintendent and District Supervisor for endorsement. The researcher then coordinated with the principals and school heads of the selected schools to request assistance in administering the study among Grade 4, Grade 5, and Grade 6 learners in District 2 of Lapu-Lapu City, Cebu. After all permissions were obtained, the survey questionnaires were printed, organized, and personally distributed to the respondents to ensure clarity and uniformity in data collection. The respondents were informed about the purpose of the study, assured of confidentiality, and encouraged to answer honestly and accurately. They were given sufficient time to complete the questionnaires, which were retrieved immediately after completion to ensure a high response rate and minimize data loss. After retrieval, the researcher, with the assistance of a statistician, checked, tallied, encoded, and organized the responses for analysis.

2.7 Data Analysis Techniques

The study used weighted mean and standard deviation to determine the teachers' level of technology integration, learners' engagement, and learners' study habits. The weighted mean was interpreted using a four-point scale, where 3.25–4.00 indicated Very High, 2.50–3.24 indicated High, 1.75–2.49 indicated Moderate, and 1.00–1.74 indicated Low. Learners' academic performance was described using frequency and percentage based on the grading scale of 90–100 as Outstanding, 85–89 as Very Satisfactory, 80–84 as Satisfactory, 75–79 as Fairly Satisfactory, and below 75 as Did Not Meet Expectations. To determine whether learners' engagement and study habits mediated the relationship between technology integration and academic performance, the study used Path Analysis through GLM Mediation Analysis.

3. Results and Discussion

3.1 Level of Technology Integration, Engagement, Study Habits, and Academic Performance

3.1.1 Teachers' Level of Technology Integration

The results showed that the teachers' level of technology integration obtained an overall mean of 3.81 with a standard deviation of 0.41, interpreted as Highly Integrated. Among the indicators, the highest-rated statement was that teachers encountered discourteous attitudes from students, with a mean of 3.91 and a standard deviation of 0.29. The lowest-rated statement was that teachers did not receive answer sheets on time, with a mean of 3.69 and a standard deviation of 0.57, although it was still interpreted as Strongly Agree. These findings indicate that teachers experienced technology integration-related challenges to a great extent, particularly in relation to learner behavior, teacher preparedness, and support systems. The result suggests that effective technology integration depends not only on digital tools but also on classroom management, learner discipline, teacher competence, and institutional support. The continued presence of logistical challenges, such as delayed submission of learning outputs, supports the findings of Dargo and Dimas (2021), who identified limited access, transportation difficulties, and insufficient support systems as barriers affecting technology-mediated learning.

3.1.2 Learners' Level of Engagement

The learners' engagement obtained an overall mean of 3.77 with a standard deviation of 0.48, interpreted as Highly Engaged. The highest-rated indicator was that learners sometimes felt overburdened by their studies, with a mean of 3.87 and a standard deviation of 0.33. The lowest-rated indicator was that learners created their own illustrations and mnemonics to help understand important ideas, with a mean of 3.63 and a standard deviation of 0.63, although this was still interpreted as Strongly Agree. The findings show that learners were generally active, interested, and involved in technology-integrated learning, but their engagement was accompanied by academic pressure. This suggests that high engagement does not automatically remove stress, especially in learning contexts where learners are expected to manage multiple academic tasks independently. These findings are supported by Bond et al. (2023), who reported high student engagement in flexible and distance learning contexts alongside increased academic pressure. The results also align with Guiamalon et al. (2021), which emphasized that learners in modular learning environments may remain engaged while also experiencing stress, time-management difficulties, and independent learning challenges.

3.1.3 Learners' Level of Study Habits

The learners' study habits obtained an overall mean of 3.77 with a standard deviation of 0.54, interpreted as Highly Evident. The highest-rated indicator was that learners tried to relate their learning to real-life scenarios, with a mean of 3.91 and a standard deviation of 0.29. This was followed by the indicator showing that learners associated new learning with prior knowledge and experiences, with a mean of 3.86 and a standard deviation of 0.34. The lowest-rated indicator was that learners sought help from peers when needed, with a mean of 3.67 and a standard deviation of 0.54. The findings indicate that learners demonstrated strong study habits, particularly in connecting lessons to real-life situations and prior experiences. However, peer assistance was the least practiced study habit, suggesting that learners may rely more on personal strategies or teacher-provided materials than collaborative learning support. The findings are consistent with Guiamalon et al. (2021), which showed that learners may display strong study habits while still experiencing academic pressure. This implies that effective study habits are important but may not fully eliminate stress when learners face heavy workloads, time constraints, and performance expectations.

3.1.4 Learners' Academic Performance

The learners' academic performance showed an overall mean of 86.73 with a standard deviation of 3.40, interpreted as Very Satisfactory. Among the 349 learners, 173 or 49.57% were in the Very Satisfactory range, 106 or 30.37% were in the Outstanding range, and 70 or 20.06% were in the Satisfactory range. No learner fell under the Fairly Satisfactory or Did Not Meet Expectations categories. These findings indicate that the learners generally demonstrated strong academic performance, with all respondents obtaining grades of 80 and above. The dominance of the Very Satisfactory category suggests that most learners achieved a high level of mastery or proficiency. This finding is supported by Ebele and Olofu (2017), who emphasized that learners who develop effective study habits tend to achieve higher academic performance. The result suggests that the learners' positive study routines may have contributed to their favorable academic outcomes.

3.2 Mediation Analysis of Technology Integration, Learners' Engagement, Study Habits, and Academic Performance

3.2.1 Indirect Effect Through Learners' Engagement

The mediation analysis showed that the indirect effect of technology integration on academic performance through learners' engagement was not significant, with $\beta = 0.037$, SE = 0.400, and $p = 0.205$. This means that learners' engagement did not significantly mediate the relationship between technology integration and academic performance. Therefore, the null hypothesis was not rejected for this mediation path. This result suggests that although technology integration may influence learners' engagement, the effect was not strong enough to significantly improve academic performance through

engagement alone. The finding implies that engagement must be supported by other factors, such as guided instruction, learning discipline, and structured academic routines, to produce stronger academic outcomes. It also reinforces the idea that technology use should be intentionally facilitated by teachers rather than assumed to automatically improve performance.

3.2.2 Indirect Effect Through Study Habits

The indirect effect of technology integration on academic performance through study habits was also not significant, with $\beta = 0.050$, SE = 0.483, and $p = 0.157$. This indicates that study habits did not significantly mediate the relationship between technology integration and academic performance. Thus, the null hypothesis was also not rejected for this mediation path. This finding indicates that while study habits are important for learners' academic development, they did not statistically explain the relationship between technology integration and academic performance in this model. The result suggests that technology integration alone may not be enough to strengthen study habits in ways that directly affect grades. These findings are supported by Mishra et al. (2021), who emphasized that learners' discipline, self-regulation, and study habits remain key determinants of academic success even when technology and online learning platforms are used.

3.2.3 Direct and Total Effects of Technology Integration on Academic Performance

The direct effect of technology integration on academic performance was not significant, with $\beta = -0.034$, SE = 1.382, and $p = 0.730$. The total effect was also not significant, with $\beta = 0.052$, SE = 1.402, and $p = 0.610$. These results show that technology integration did not directly or overall significantly predict learners' academic performance when learners' engagement and study habits were considered in the analysis. The findings suggest that technology integration does not automatically lead to improved academic performance. Its effectiveness depends on how learners use technology, how teachers guide technology-supported instruction, and how learning routines are structured. Although technology can improve access to information and create interactive learning opportunities, its academic value depends on responsible use, sustained engagement, effective study habits, teacher feedback, and structured learning environments.

3.3 Proposed Action Plan Based on the Findings

3.3.1 Focus and Components of the Proposed Action Plan

Based on the findings, the proposed action plan focused on enhancing technology integration, learners' engagement, study habits, and academic performance for school year 2026–2027. The plan included orientation on effective technology integration, demonstration teaching using digital tools, structured technology-supported lessons, Learning Action Cell sessions, mentoring, coaching, validation of technology-integrated lesson plans, monitoring of learner engagement and study habits, and consolidation of reports for sustainability planning. The action plan responds to the finding that technology integration must be purposeful, structured, and learner-centered. It recognizes that teachers need continuous professional support to design technology-based activities that encourage engagement, discipline, and better study behaviors. The plan also emphasizes monitoring and feedback, suggesting that instructional improvement should be data-informed and aligned with learners' needs.

3.3.2 Risks, Mitigation Strategies, and Monitoring

The proposed plan identified possible risks such as limited teacher competence in technology integration, limited access to devices, unstable internet connectivity, low learner engagement, poor study habits, learner distraction, teacher resistance, and time constraints for professional learning activities. To address these concerns, the plan proposed continuous training, mentoring, Learning Action Cell sessions, use of offline-capable tools, low-tech strategies, interactive learner-centered activities, guided learning routines, peer support, and integration of sessions into existing school schedules. These mitigation strategies show that successful technology integration requires both digital and non-digital support mechanisms. The inclusion of classroom observation, lesson plan validation, engagement monitoring, study habit assessment, academic performance tracking, program evaluation, and action plan refinement indicates that the proposed intervention is intended to be continuous and evidence-based. This supports the broader finding that technology should not replace the role of teachers but should strengthen their capacity to facilitate meaningful, structured, and sustainable learning.

4. Conclusion & Recommendations

The study concluded that technology integration was highly practiced by teachers, while learners demonstrated a high level of engagement and strong study habits in technology-supported learning environments. The learners' academic performance was generally favorable, with most respondents obtaining very satisfactory results. These findings indicate that technology-supported instruction was present in the selected schools and that learners were generally responsive, motivated, and capable of maintaining positive learning routines. However, the mediation results showed that learners' engagement and study habits did not significantly mediate the relationship between technology integration and academic performance. Likewise, technology integration did not show a direct significant effect on academic performance. Among the variables examined, study habits emerged as the most important factor associated with learners' academic success. This implies that while technology may support instruction and engagement, its effectiveness depends largely on how learners

organize, manage, and sustain their learning practices. Therefore, the improvement of academic performance should not rely on technology use alone but should also emphasize disciplined study routines, structured learning support, teacher guidance, and consistent learner monitoring.

Based on the findings, the study recommends that schools sustain and enhance teachers' technology integration by providing continuous support, training, mentoring, and opportunities to improve instructional practices using digital tools. Teachers should be guided in using technology not merely for content delivery but also for creating interactive, learner-centered, and structured learning experiences that promote participation, focus, and independent learning. Since study habits were found to be highly important in relation to academic performance, learners should be given consistent guidance in developing effective routines such as time management, regular lesson review, task completion, and responsible use of digital resources. School administrators may also strengthen monitoring and support systems by encouraging Learning Action Cell sessions, classroom-based mentoring, and data-informed instructional planning. Technology integration and engagement strategies should be aligned with the development of positive study habits so that digital tools become instruments for improving learning behavior and academic achievement. Future researchers may further explore classroom-based interventions, additional learner-related variables, and broader school contexts to deepen understanding of how technology integration can more effectively contribute to academic performance.

The study was limited to Grade 4, Grade 5, and Grade 6 learners and teachers from selected public elementary schools in District 2 of Lapu-Lapu City, Cebu, during the school year 2025–2026. The study also used a quantitative, non-experimental mediation design, which means that the relationships among technology integration, learners' engagement, study habits, and academic performance were examined as they naturally occurred and did not establish causal effects. In addition, the data on technology integration, engagement, and study habits were gathered through structured questionnaires, which may depend on the respondents' perceptions and honesty in answering. Finally, the study focused only on technology integration, learners' engagement, study habits, and academic performance, so other possible factors such as parental support, internet access, availability of devices, teacher digital competence, home learning environment, and learner motivation were not fully examined within the mediation model.

Compliance with ethical standards

The study was conducted in accordance with institutional ethical standards, with the necessary approvals and permissions secured before data gathering. Participation was voluntary, informed consent was observed, and all information gathered was treated with confidentiality and used only for research purposes. The author declares no conflict of interest and acknowledges the contributions of all individuals and institutions involved. Copyright ownership and authorship responsibility were properly observed, including the appropriate use and acknowledgement of adapted research instruments.

REFERENCES

Abante, J. R., Almendral, B. C., Manansala, J. E., & Mañibo, J. (2021). A study on modular learning approach in the Philippines. *International Journal of Research Studies in Education, 10*(6), 1–15. https://doi.org/10.5861/ijrse.2021.602

Aguilar, S. J. (2021). Online learning and student engagement during the COVID-19 pandemic. *Educational Researcher, 50*(7), 502–506. https://doi.org/10.3102/0013189X211031551

Alghamdi, A. K., Alqefari, A., & Alzahrani, H. (2020). The effect of technology-enhanced learning on study habits in higher education. *Education and Information Technologies, 25*(6), 5131–5147.

Baron, N. S. (2021). *How we read now: Strategic choices for print, screen, and audio*. Oxford University Press.

Dargo, J., & Dimas, H. (2021). Digital divide in education: Connectivity and equity issues during COVID-19. *International Journal of Educational Policy Research and Review, 8*(2), 48–59. https://doi.org/10.15739/IJEPRR.21.008

El-Emadi, A. A., Mohamed, S., & Al-Kaabi, A. (2019). Gender differences in technology-enhanced learning. *Education and Information Technologies, 24*(5), 2853–2868. https://doi.org/10.1007/s10639-019-09921-2

Forde, C., & O'Brien, A. (2022). Opportunities and barriers to digitally enhanced learning in schools. *Technology, Pedagogy and Education, 31*(2), 217–230. https://doi.org/10.1080/1475939X.2022.2032208

Fuchs, K., Harel, S., & Barak, M. (2021). Digital tools and student engagement in online learning environments. *Computers & Education, 165*.

García-Morales, V. J., Garrido-Moreno, A., & Martín-Rojas, R. (2021). The impact of COVID-19 on higher education: Digital transformation and innovation. *Technological Forecasting and Social Change, 166*, 120565. https://doi.org/10.1016/j.techfore.2021.120565

Garzón-Artacho, E., Sola-Martínez, T., Romero-Rodríguez, J. M., & Gómez-García, G. (2021). Teachers' perceptions of digital competence at the lifelong learning stage. *Sustainability, 13*(7), 3658. https://doi.org/10.3390/su13073658

Guiamalon, T., Sali, M., & Balindong, N. (2021). Modular distance learning: Challenges of students in remote areas. *Journal of Education, Management and Development Studies, 1*(2), 1–10. https://doi.org/10.52631/jemds.v1i2.32

Harmsen, R., Helms-Lorenz, M., Maulana, R., & van Veen, K. (2018). The relationship between beginning teachers' stress causes, stress responses, teaching behaviour and attrition. *Teachers and Teaching: Theory and Practice, 24*(6), 626–643. https://doi.org/10.1080/13540602.2017.1414792

Jiang, X., & Ning, X. (2022). Innovative practices in digital physical education during COVID-19. *Journal of Teaching in Physical Education, 41*(4), 579–592. https://doi.org/10.1123/jtpe.2022-0068

Johnson, N., Veletsianos, G., & Seaman, J. (2021). U.S. faculty and administrators' experiences and approaches in the early weeks of the COVID-19 pandemic. *Online Learning, 25*(1), 6–21. https://doi.org/10.24059/olj.v25i1.2285

Koca, F., Kaya, H., & Yildirim, S. (2021). Teachers' evolving roles in digital learning environments. *Education and Information Technologies, 26*(4), 4271–4289. https://doi.org/10.1007/s10639-021-10453-4

Krishnamurthy, S. (2020). The future of business education: A commentary in the shadow of COVID-19. *Journal of Business Research, 117*, 1–5. https://doi.org/10.1016/j.jbusres.2020.05.034

Li, H., Wang, Y., & Xu, G. (2021). Adaptive learning systems and student engagement: Evidence from higher education. *Computers in Human Behavior, 122*, 106849. https://doi.org/10.1016/j.chb.2021.106849

Ma, W., Han, J., Yang, C., & Cheng, J. (2020). Study habits and technology adoption among higher education students. *International Journal of Emerging Technologies in Learning, 15*(18), 152–163. https://doi.org/10.3991/ijet.v15i18.16715

Miao, F., & Ma, W. (2023). Teachers as agents of digital transformation: Integrating technology into pedagogy. *Educational Technology Research and Development, 71*(2), 245–264. https://doi.org/10.1007/s11423-022-10183-5

Mishra, L., Gupta, T., & Shree, A. (2020). Online teaching-learning in higher education during lockdown period of COVID-19 pandemic. *International Journal of Educational Research Open, 1*, 100012. https://doi.org/10.1016/j.ijedro.2020.100012

Myasari, R., & Kemal, I. (2020). Teacher roles in technology-enhanced classrooms: A systematic review. *International Journal of Instruction, 13*(4), 807–824. https://doi.org/10.29333/iji.2020.13449a

Nagle, J. (2018). Critical digital literacy in education: Teaching and learning in the digital age. *Journal of Digital Learning in Teacher Education, 34*(3), 183–198. https://doi.org/10.1080/21532974.2018.1437854

Niederhauser, D. S., Lindstrom, D. L., & Strobel, J. (2020). Technology and engagement: Examining the role of digital tools in student learning. *Journal of Educational Computing Research, 58*(5), 1125–1145. https://doi.org/10.1177/0735633119881471

Nygren, H., Nissinen, K., & Saari, T. (2019). Promoting digital skills in formal and informal learning environments. *British Journal of Educational Technology, 50*(6), 3174–3191. https://doi.org/10.1111/bjet.12726

Parris, D., Ross, C., & Harrison, L. (2022). Digital technology applications in physical education during the COVID-19 pandemic. *Sport, Education and Society, 27*(6), 656–671. https://doi.org/10.1080/13573322.2022.2026345

Romero-Hall, E., & Jaramillo Cherrez, N. (2022). Faculty digital literacy in higher education during COVID-19. *Australasian Journal of Educational Technology, 38*(1), 68–83. https://doi.org/10.14742/ajet.7260

Salas-Pilco, S. Z., Yang, Y., & Zhang, Z. (2022). Student engagement in online learning in Latin America during COVID-19. *British Journal of Educational Technology, 53*(3), 593–619. https://doi.org/10.1111/bjet.13120

Selwyn, N., & Aagaard, J. (2020). Banning mobile phones from classrooms—An opportunity to advance understandings of technology addiction, distraction, and cyberbullying. *British Journal of Educational Technology, 51*(2), 715–725. https://doi.org/10.1111/bjet.12902

Shah, S., Alam, M., & Uddin, S. (2018). Age and digital learning adoption: Evidence from higher education. *Journal of Educational Technology Systems, 47*(1), 101–118. https://doi.org/10.1177/0047239518786722

Wu, T., & Kang, M. (2021). Teachers' digital practices in the new normal: Integration of ICT in teaching. *Australasian Journal of Educational Technology, 37*(5), 88–102. https://doi.org/10.14742/ajet.7021

Yu, Z. (2022). Digital literacy and student engagement in higher education. *Education and Information Technologies, 27*(1), 1–20. https://doi.org/10.1007/s10639-021-10745-1