Gamification as a Pedagogical Approach to Strengthen Academic Performance and IMT Literacy in Empowerment Technologies for Senior High School TVL Learners

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DOI: https://doi.org/10.47772/IJRISS.2026.10100145

Received: 13 January 2026; Accepted: 19 January 2026; Published: 27 January 2026

ABSTRACT

In the context of 21st-century learning, Information, Media, and Technology (IMT) literacy is critical for equipping students with the skills required for academic and workplace success. This quasi-experimental study investigated the effectiveness of a quest-based gamification strategy in improving the academic performance, hands-on ICT skills, and IMT literacy of Senior High School (SHS) students in the Technical-Vocational-Livelihood (TVL) strand. Two intact Grade 11 classes from a rural public high school in the Northern Mindanao, Philippines participated in the eight-week intervention: one receiving conventional instruction (control) and the other undergoing gamified lessons (experimental). Pre- and post-test measures were conducted using validated instruments on IMT skills, a teacher-made academic test, and a performance-based rubric. Descriptive statistics revealed higher mean scores across all constructs for the experimental group. Paired-samples t-tests showed statistically significant improvements within the experimental group, while independent-samples t-tests indicated significant differences favoring the experimental group in all post-test outcomes. These results suggest that the integration of gamification elements—such as narrative quests, performance rewards, and collaborative challenges—fostered greater student engagement and mastery of content. Anchored in the theory of gamified learning and aligned with the P21 Framework for 21st-century skills, this study affirms that gamification can be an effective pedagogical strategy to close skill gaps in digital literacy and enhance authentic learning outcomes. Recommendations include incorporating gamification in ICT curricula, conducting INSET training for teachers, and expanding future studies to include qualitative data and learners from other strands.

Keywords: Engagement, Gamification, Pedagogy, Student Motivation, Teaching Innovation

INTRODUCTION

In today's rapidly evolving digital landscape, the ability to effectively engage with technology is no longer optional—it is essential. Information and Communications Technology (ICT) competencies are integral to succeeding in academic, social, and economic arenas in the 21st century (Partnership for 21st Century Skills, 2009; ICT in Education, 2023). As the global economy becomes increasingly digital, students must be equipped not only with content knowledge but also with the capacity to search, evaluate, use, and create information responsibly using digital tools (Brodowicz, 2025). These abilities are explicitly recognized in the Partnership for 21st Century Learning (P21) framework, which identifies Information Literacy, Media Literacy, and Technology Literacy (IMT) as foundational competencies that support lifelong learning and future readiness (Partnership for 21st Century Skills, 2009; Casner-Lotto & Barrington, 2006).

The IMT skills outlined in the P21 framework emphasize a holistic understanding of digital engagement. Information literacy enables students to discern credible information in an age of misinformation; media literacy fosters critical consumption and responsible participation in digital culture; and technology literacy equips learners to use tools and platforms for problem-solving, collaboration, and content creation. Collectively, these literacies empower students to thrive in knowledge-driven societies, where adaptability and digital fluency are core expectations across disciplines and careers (Otrel-Cass, Khoo, & Cowie, 2012; Quraishi, Ulusi, Muhid, Hakimi, & Olusi, 2024).

Despite this recognized importance, global assessments consistently reveal that students fall short in acquiring these essential IMT competencies. Studies reported that a significant percentage of students, even teachers, worldwide demonstrate only basic levels of digital proficiency (Youssef, Dahmani, & Ragni, 2022; Damayanti, Wijaya, & Rasuki, 2025). In the Philippines, the performance is even more concerning. Studies of Mangarin and Climaco (2024) and Estillore and Namoco (2024) reveal that a majority of Filipino learners—especially those in rural and under-resourced schools—lack access to digital tools and perform poorly in technology-related tasks. These limitations are reflected in their academic underachievement, particularly in subjects designed to build ICT skills, such as Empowerment Technologies.

Empowerment Technologies is a core subject in the SHS curriculum mandated across all academic strands in the Philippine K–12 Basic Education program. Its objective is to develop students' basic digital competencies, including online research, content creation, digital ethics, and hands-on use of productivity tools. However, studies have shown that students struggle to perform in this subject due to a range of barriers—including limited ICT exposure, outdated instructional strategies, and inadequate school infrastructure (Sambaan & Namoco, 2022; Villaseñor, 2024). These academic challenges are compounded by teachers' limited training in digital pedagogy, resulting in instruction that remains largely passive and teacher-centered (Martin-Diaz et al., 2020; Estillore & Namoco, 2024; Tongol & Namoco, 2025).

To address these challenges, gamification has emerged as a promising pedagogical approach. Gamification involves the integration of game-based elements—such as quests, rewards, and challenges—into non-game contexts like education, with the goal of increasing motivation, engagement, and learning outcomes (Deterding et al., 2011). Numerous studies have confirmed that gamified learning environments enhance students' academic performance and technological engagement by promoting active participation, feedback loops, and intrinsic motivation (Zainuddin et al., 2020; Beattie, 2022). In this study, a gamified teaching approach termed the Quest Gamification Teaching Strategy was designed and implemented to explore its effects on students' academic performance, hands-on ICT proficiency, and perceived IMT skills.

This study is significant for several stakeholders. For students, it offers a pathway to improve not only their academic standing but also their real-world ICT capabilities. For teachers, it provides an evidence-based instructional model that aligns with digital learning needs and the characteristics of Generation Z learners. For curriculum developers and educational policymakers, the study underscores the urgency of integrating engaging, learner-centered strategies into ICT-related subjects to meet national and global competency benchmarks.

The rationale of this study stems from the persistent underperformance of students in ICT subjects and the underutilization of learner-centered digital pedagogies in Philippine secondary education. By integrating gamification—specifically the Quest Gamification Teaching Strategy—into the Empowerment Technologies subject, this study responds to the call for innovative teaching strategies that can bridge the gap between students' digital realities and academic requirements.

Research Objectives

The goal of this study was to investigate the effectiveness of the Quest Gamification Teaching Strategy in enhancing SHS TVL strand students' academic performance, hands-on ICT skills, and perceived IMT literacy in Empowerment Technologies. Specifically, it aimed to: (1) determine the significant difference in students' performance before and after the intervention within each group; and (2) compare the post-test performance between the control and experimental groups in the mentioned constructs.

REVIEW OF RELATED LITERATURE

Information and Communications Technology (ICT) in the empowerment Technologies Subject for Senior High School Curriculum: Bridging Gaps through Gamification

Information and Communications Technology (ICT) has become an indispensable component of modern education, widely recognized for its transformative potential in enhancing teaching and learning processes. It supports the development of 21st-century competencies such as communication, collaboration, problem-solving,

and critical thinking (Schrum et al., 2015). More than just a set of tools or devices, ICT now embodies a broad knowledge and skills domain that requires well-structured, policy-driven integration to meet the complex needs of today's learners (Mlitwa, 2020; Tan et al., 2017). In line with global trends, the Philippine education system has institutionalized ICT through various reforms, including the K–12 curriculum, to ensure that all learners—regardless of socioeconomic background—can access digital learning and lifelong opportunities.

Within this national framework, the Empowerment Technologies subject plays a central role in building digital literacy among Grade 11 students across all academic and technical-vocational strands. Mandated by the Department of Education (DepEd, 2016), this subject develops foundational skills in information, media, and technology literacy, while promoting ethical digital citizenship, multimedia creation, and online collaboration (Gecobe, Gregorio, & Rogel, 2022). Ideally, it prepares students for higher education, entrepreneurship, or employment in the digital age. However, several studies have noted persistent implementation challenges, particularly in rural schools where ICT infrastructure is lacking, and where teachers are not adequately trained to deliver the evolving content of the course (Que, 2021; Dulay & Manuel, 2021).

Despite the availability of curriculum content, there remains a substantial gap in ICT competencies among many SHS learners, particularly in underserved regions. Factors such as poor internet connectivity, outdated or insufficient digital tools, and the absence of pedagogically contextualized strategies continue to hamper the development of ICT-related skills (Kilaton et al., 2023; Tan & Namoco, 2024). These deficiencies are particularly critical in areas like media evaluation, digital content creation, and information ethics—core competencies within the Empowerment Technologies curriculum. As a result, learners often demonstrate low academic performance and limited practical application of digital skills, calling for alternative, student-centered strategies to make ICT instruction more relevant and accessible in low-resource educational settings (Tongol & Namoco, 2025).

Although previous studies have explored the benefits of ICT integration in classroom instruction, there is limited empirical research that evaluates the impact of gamification on improving Information, Media, and Technology (IMT) literacy skills, especially within the Empowerment Technologies subject in Philippine public schools. While gamification has shown promise in enhancing engagement and academic performance in general education (Smiderle et al., 2020; Cosmiano & Namoco, 2024; Duero & Namoco, 2024), few studies have specifically examined its effect on IMT literacy development. This gap is particularly pronounced in the TVL tracks, where practical digital competencies are essential but often underdeveloped. Thus, this study seeks to address that gap by investigating how a quest-based gamified instructional strategy can enhance IMT literacy and academic performance among TVL SHS learners in a rural context.

Gamification and IMT Literacy Skills Development: Global and Local Perspectives

Global and local research consistently affirms that gamification is a powerful pedagogical strategy for improving students' academic outcomes, engagement, and motivation. International studies such as those by Smiderle et al. (2020) demonstrated that gamified instruction enhances students' perseverance and academic performance by incorporating game mechanics that mimic the feedback loops and goal-setting structures of digital games. Similarly, Lomibao et al. (2024) provided evidence that gamification increases learners' motivation by making educational tasks more interactive and rewarding. These findings support the claim that gamification is not merely a trend but a viable and research-backed approach to classroom instruction, especially in the context of 21st-century education.

In the Philippine setting, a growing body of evidence supports the effectiveness of gamified learning in improving academic performance and helping students navigate learning challenges with greater resilience. Samortin (2023) reported that Filipino SHS students exposed to gamified instruction in ICT-related subjects demonstrated notable improvements in task completion, participation, and confidence. Similarly, Diaz and Estoque-Loñez (2024) found that gamification promotes persistence and engagement in complex cognitive tasks, particularly when digital tools and platforms are integrated into the learning process. These studies emphasize the value of gamification not only in elevating academic results but also in fostering the competencies necessary for digital fluency.

When used to enhance Information, Media, and Technology (IMT) literacy skills, gamification becomes a transformative tool for developing higher-order thinking and real-world application. As Kapp (2012) and Deterding et al. (2011) explain, incorporating game elements such as quests, challenges, and performance-based rewards fosters deep engagement and active learning. Gamification reconfigures traditional learning environments into dynamic, student-centered spaces that cultivate critical thinking, creativity, collaboration, and information evaluation—core competencies of IMT literacy. This is particularly crucial for Generation Z learners who thrive in interactive, tech-driven settings (Cosmiano & Namoco, 2024; Javier & Fajardo, 2017). By creating opportunities for learners to engage in authentic digital tasks, gamification strengthens IMT literacy skills that serve as a foundation for advanced ICT competencies.

Aligning Gamification with Generation Z's Digital Learning Needs

Generation Z learners—born into a world of ubiquitous digital media—have developed distinct learning preferences shaped by constant exposure to technology. They are drawn to interactive, authentic, and globally connected experiences that reflect their daily digital environments (Tan et al., 2017). However, their fluency with social platforms and entertainment apps does not automatically translate into advanced academic or professional ICT proficiency. This phenomenon, known as the "digital native paradox," reveals a gap between technological familiarity and the ability to critically evaluate information, manage digital tools for productivity, and create knowledge through ICT (Reid et al., 2023; Milutinović, 2022). As such, traditional lecture-based instruction may fall short in addressing their developmental needs. Educators must instead adopt structured, student-centered interventions that cultivate higher-order digital competencies—such as critical thinking, digital collaboration, and ethical online behavior—essential for thriving in the 21st-century information society (Holzer et al., 2022; Torres & Ortega-dela Cruz, 2024).

In this context, gamification emerges as a pedagogical strategy that resonates well with Generation Z's motivational profile. By embedding game-like features such as real-time feedback, experience points, collaborative missions, and rewards into instructional content, gamified learning transforms academic tasks into engaging, purpose-driven experiences (Beattie, 2022; Holt, 2024). These elements not only sustain attention—crucial for learners with shortened focus spans—but also provide relevance and enjoyment, which are essential for long-term learning. Research supports that Gen Z learners thrive in gamified environments that mirror their digital habits while encouraging deeper academic engagement and ICT literacy development (Why You Need Gamification, 2024). Consequently, gamification offers a responsive, evidence-based approach to bridging the gap between Gen Z's digital lifestyle and the rigorous demands of academic ICT learning.

Hypotheses Development

Gamification, as a pedagogical strategy, has demonstrated considerable potential in fostering learner engagement and enhancing skill acquisition, particularly among Generation Z students who are deeply immersed in digital environments (Deterding et al., 2011; Kapp, 2012; Cosmiano & Namoco, 2024). By embedding game elements such as quests, challenges, feedback systems, and rewards into instructional content, gamified learning creates interactive and meaningful experiences that align with the way digital natives process information. In the context of Empowerment Technologies, this immersive approach is hypothesized to significantly improve Information, Media, and Technology (IMT) literacy skills—defined as the ability to critically access, evaluate, and apply digital information and media tools (Schrum et al., 2015; Javier & Fajardo, 2017). When students engage in gamified tasks that simulate real-world ICT applications, they develop and internalize IMT competencies more effectively, particularly in low-resource learning environments where traditional instruction often fails to connect with students' digital realities (Samortin, 2023; Diaz & Estoque-Loñez, 2024). Hence, it is posited that gamified instruction will lead to statistically significant improvements in students' perceived IMT literacy skills.

Furthermore, the development of IMT literacy through gamification is expected to have a positive cascading effect on students' cognitive performance in Empowerment Technologies, as measured by summative assessments. Cognitive learning outcomes—such as understanding theoretical ICT concepts, applying digital tools to solve problems, and synthesizing multimedia content—are aligned with the academic goals of the subject (DepEd, 2016; Gecobe et al., 2022, Cosmiano & Namoco, 2024; Duero & Namoco, 2024). Studies have shown that gamification promotes deeper cognitive engagement by offering authentic learning contexts, timely

feedback, and structured progression systems that mirror the motivational architecture of digital games (Smiderle et al., 2020; Mendoza, 2024). These elements support not only knowledge retention but also critical thinking and problem-solving skills essential in ICT-based tasks. Therefore, it is hypothesized that students exposed to quest-based gamified instruction will exhibit significantly higher academic performance in Empowerment Technologies compared to those receiving conventional instruction.

METHODOLOGY

This study utilized a quasi-experimental, pretest-posttest non-equivalent group design to determine the effects of a gamified instructional strategy on students' academic performance, hands-on ICT skills, and perceived Information, Media, and Technology (IMT) literacy. Two intact Grade 11 TVL classes from Maputi Senior High School, Naawan District, Misamis Oriental, Philippines, were purposively selected and randomly assigned as control and experimental groups. The experimental group received instruction through a quest-based gamification strategy, while the control group was taught using conventional methods. Pretests and posttests were conducted over an eight-week period to assess the impact of the intervention.

The respondents of the study were evenly divided between the control group and the experimental group, with 30 participants in each group, accounting for 50% of the total sample per group. In terms of age, the majority of the respondents were between 15 to 16 years old, comprising 66.7% of the total, which is characteristic of Grade 11 students in the SHS level. A smaller proportion were aged 17 to 19, while a minimal number were older students aged 23 and 24, possibly due to late school entry or return to schooling. Regarding sex, male students dominated the sample, representing 61.7%, while female students accounted for 38.3%.

The study site was a rural SHS offering technical-vocational strands, with limited access to advanced ICT resources. Such a context underscored the importance of exploring innovative, low-resource teaching strategies. The participants were Grade 11 students enrolled in Empowerment Technologies—a core subject across strands. Baseline data such as age, gender, and ICT background were collected to control for confounding variables.

Three research instruments were utilized in this study: (1) a researcher-developed IMT Skills Questionnaire anchored on the Information, Media, and Technology (IMT) competencies outlined in the P21 Framework. The instrument was validated by content experts and pilot-tested for reliability with 35 Grade 11 students who were not part of the control nor experimental groups; (2) a 40-item academic performance test aligned with the DepEd's Empowerment Technologies curriculum, validated by subject matter experts based on the official curriculum guide and a researcher-constructed Table of Specifications (TOS), with internal consistency assessed using the Kuder-Richardson Formula 20 (KR-20); and (3) a hands-on performance rubric designed to assess students' proficiency in multimedia production and the use of productivity tools, developed in collaboration with experienced ICT educators.

The intervention was rooted in gamification theory (Deterding et al., 2011) and applied a quest-based instructional model that combined narratives, structured challenges, collaborative missions, and reward systems. The design emphasized performance-based learning through authentic tasks such as "boss quests," peer evaluations, and a tiered progression system that promoted engagement and mastery of digital competencies aligned with Empowerment Technologies learning outcomes. These features were tailored to enhance student motivation, foster active participation, and bridge gaps in IMT (Information, Media, and Technology) literacy.

To ensure fidelity of implementation—crucial in quasi-experimental designs (Creswell & Creswell, 2018)—the researcher trained a designated Empowerment Technologies co-teacher in the mechanics and instructional flow of the gamified framework. Daily monitoring and classroom observations were conducted to verify that all quests, collaborative activities, and feedback protocols were delivered as designed. This ensured that the intervention was consistently executed and maintained internal validity while reflecting authentic classroom conditions.

The intervention spanned eight weeks during the second grading period. The experimental group received the gamified instruction, while the control group was taught using conventional methods. In week one, both groups underwent pretests measuring IMT skills, academic achievement, and hands-on ICT performance; the same

instruments were administered in week nine as posttests. Descriptive statistics (mean and standard deviation) were used to summarize results. Paired samples t-tests compared pre- and post-test performance within groups, while independent samples t-tests evaluated differences between groups. All parametric assumptions were verified prior to analysis.

Ethical protocols were rigorously followed, including informed consent from parents, approval from school administrators, and compliance with the Data Privacy Act of 2012 and DepEd Order No. 25, s. 2018. Participants' anonymity and data confidentiality were upheld throughout the study. Finally, appropriate ethical approval from the members of the thesis panel to conduct the study was sought, and the researchers were given permission to conduct the study.

RESULTS AND DISCUSSION

Reliability of the Research Instrument

The reliability of the research instrument was established through the computation of Cronbach's alpha. As shown in Table 1, the subscales for Information Literacy all exceeded the commonly accepted threshold of 0.70, indicating that the items within each construct consistently measured the intended skills (Hair, Black, Babbin, & Anderson, 2019). These results affirm the reliability of the instrument for assessing students' IMT literacy in the context of this study.

Table 1. Reliability Assessment of the IMT Research Instrument

Constructs	Cronbach Alpha	No. of Items
Information Literacy	0.782	13
Media Literacy	0.756	13
Technology Literacy	0.822	14

Statistical Assumptions for T-Test Assessment

Before conducting the T-test, key statistical assumptions were first evaluated to ensure the accuracy and integrity of the dataset. The dataset was examined for any missing values prior to conducting statistical analyses, as handling incomplete data is essential to ensure the accuracy and reliability of research findings. Each of the 60 respondents provided complete data, thereby ensuring the integrity of the dataset and eliminating the need for imputation or data cleaning procedures related to missingness. The boxplot analysis was used to evaluate for

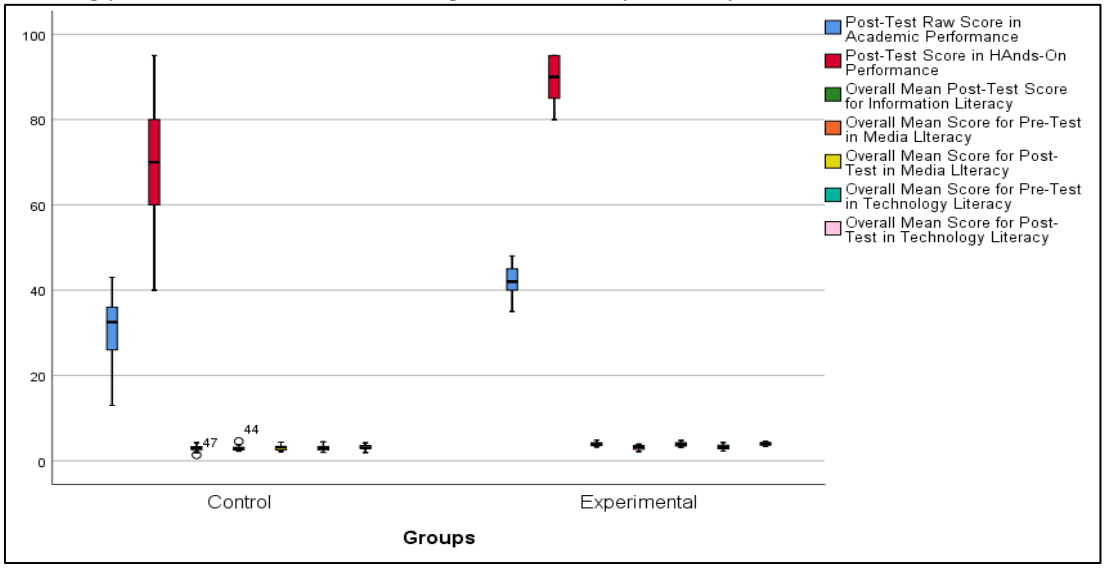

Figure 1. Outliers Assessment Using Boxplot

outliers in the data. As presented in Figure 1, the experimental group exhibited no visible outliers across all measured constructs—indicating consistent performance following the implementation of the Quest Gamification strategy. Meanwhile, the control group displayed several mild outliers, particularly in the literacy-related variables such as IMT Literacy. Despite the presence of these outliers, the distributions for academic and hands-on performance remain relatively symmetrical and within acceptable ranges, suggesting the dataset maintains overall integrity. Therefore, the results support the assumption of normality and justify the use of parametric tests for further statistical analysis.

Assessing normality is essential before conducting t-tests. As shown in Table 2, the skewness and kurtosis values for all constructs fall within the acceptable range of –1 to +1, indicating that the data are approximately normally distributed. For instance, the pre-test academic performance (skewness = –0.517; kurtosis = –0.762) and post-test academic performance (skewness = –1.137; kurtosis = 0.834) demonstrate slight negative skewness but remain within thresholds commonly considered acceptable for normality assessment. Similarly, hands-on performance scores and IMT literacy constructs show skewness and kurtosis values well within acceptable bounds, confirming that no severe departures from normality are present. These results indicate that the dataset meets the normality assumption required for conducting paired samples t-tests and independent samples t-tests.

Table 2. Skewness and Kurtosis Assessment of the Constructs

Constructs	Skewness		Kurtosis	
	Statistic	Std. Error	Statistic	Std. Error
Pre-Test Score in Academic Performance	-0.517	0.309	-0.762	0.608
Post-Test Score in Academic Performance	-1.137	0.309	0.834	0.608
Pre-Test Score in Hands-on Performance	-0.251	0.309	-0.294	0.608
Post-Test Score in Hands-On Performance	-0.956	0.309	0.427	0.608
Pre-Test in Media Literacy	0.447	0.309	-0.250	0.608
Post-Test in Media Literacy	-0.237	0.309	-0.641	0.608
Pre-Test in Technology Literacy	0.319	0.309	-0.643	0.608
Post-Test in Technology Literacy	-0.507	0.309	-0.254	0.608

The assumption of homogeneity of variances was tested using Levene's Test. As shown in Table 3, the Levene's Test for Equality of Variances yielded non-significant results for three variables: Information Literacy ($F = 1.38$, $p = .25$), and Technology Literacy ($F = 3.14$, $p = .08$). Since the p-values are greater than 0.05, we fail to reject the null hypothesis of equal variances. This indicates that the assumption of homogeneity of variances is met for these variables, and thus the row labeled "Equal variances assumed" should be used for the corresponding t-tests. Alternately, for the following variables, the Levene's Test was significant, indicating a violation of the homogeneity of variance assumption: Media Literacy ($F = 4.39$, $p = .04$), Academic Performance ($F = 16.69$, $p < .001$), Hands-On Performance ($F = 13.80$, $p < .001$). For these variables, the row labeled "Equal variances not assumed" was used in interpreting the t-test results to correct for this violation, following the recommendation by Field (2018).

Table 3. Results of Homogeneity of Variance Assessment Using Independent Samples Test

	Levene's	t-test for Equality of Means					
	Test			Sig	Mean	Std. Error	95% CI

		F	Sig.	t	df	(2-tailed)	Difference	Difference	LL	UL
Post-Test Score for Information Literacy	Equal variances assumed	1.38	0.25	-6.96	58.00	0.00	-0.90	0.13	-1.16	-0.64
	Equal variances not assumed			-6.96	51.41	0.00	-0.90	0.13	-1.16	-0.64
Post-Test in Media Literacy	Equal variances assumed	4.39	0.04	-6.13	58.00	0.00	-0.78	0.13	-1.03	-0.52
	Equal variances not assumed			-6.13	50.86	0.00	-0.78	0.13	-1.03	-0.52
Post-Test in Technology Literacy	Equal variances assumed	3.14	0.08	-7.85	58.00	0.00	-0.90	0.11	-1.13	-0.67
	Equal variances not assumed			-7.85	49.70	0.00	-0.90	0.11	-1.13	-0.67
Post-Test in Academic Performance	Equal variances assumed	16.69	0.00	-7.27	58.00	0.00	-11.60	1.60	-14.80	-8.40
	Equal variances not assumed			-7.27	37.58	0.00	-11.60	1.60	-14.83	-8.37
Post-Test in Hands-On Performance	Equal variances assumed	13.80	0.00	-7.90	58.00	0.00	-19.00	2.41	-23.82	-14.19
	Equal variances not assumed			-7.90	36.52	0.00	-19.00	2.41	-23.88	-14.12

Problem 1: Differences in Pre-Test and Post-Test Mean Scores in IMT Skills, Academic Performance, and Hands-On ICT Performance Within Each Group

To assess the within-group effectiveness of the instructional intervention paired samples t-tests was conducted for each construct: academic performance, hands-on ICT performance, and perceived IMT literacy skills. These

tests were performed separately for both the control and experimental groups, and the results are summarized in Table 4.

In the control group, the changes in mean scores across all were not statistically significant ($p > .05$). This suggests that the conventional instructional approach used in the control group did not result in meaningful improvement in students' competencies across the examined indicators. Specifically, academic performance showed no significant gain ($M = -0.90$, $SD = 7.78$, $p = .531$), and similarly, the scores in hands-on performance ($M = 0.04$, $SD = 0.61$, $p = .708$), information literacy ($M = -0.03$, $SD = 0.66$, $p = .812$), media literacy ($M = -3.83$, $SD = 8.48$, $p = .019$), and technology literacy ($M = 0.02$, $SD = 0.68$, $p = .885$) showed no consistent patterns of improvement.

Conversely, the experimental group, which was exposed to the Quest Gamification teaching strategy over an eight-week intervention, showed statistically significant improvements in all measured constructs. Post-test scores were significantly higher than pre-test scores in academic performance ($M = -12.13$, $SD = 6.48$, $p < .001$), hands-on performance ($M = -0.69$, $SD = 0.31$, $p < .001$), and all three IMT literacy skills: information literacy ($M = -0.82$, $SD = 0.41$, $p < .001$), media literacy ($M = -14.50$, $SD = 5.78$, $p < .001$), and technology literacy ($M = -0.71$, $SD = 0.34$, $p < .001$). These findings support the theoretical underpinnings of constructivist learning theory, particularly its emphasis on active, experiential, and student-centered learning environments (Vygotsky, 1978; Piaget, 1972).

These findings strongly suggest that the intervention employed—a structured, digitally integrated pedagogy—had a substantial impact on enhancing both cognitive and technical proficiencies of the students. Rooted in the constructivist learning theory, the intervention likely provided opportunities for active learning, collaboration, and real-world application of skills, all of which contribute to deeper learning (Vygotsky, 1978; Bruner, 1996). The use of performance-based tasks, ICT-integrated activities, and media engagement likely strengthened the students' ability to critically navigate and create content across platforms. This is supported by contemporary literature which highlights that digitally enhanced and student-centered instructional designs contribute to improved academic achievement and skill development (Schrum, et al., 2015; Cosmiano & Namoco, 2024).

In particular, the hands-on ICT video development tasks and literacy-oriented scaffolding embedded within the intervention may have provided students with experiential learning opportunities—engaging them cognitively, socially, and emotionally. These features are aligned with the 21st-century skills framework and DepEd's directive for contextualized, skills-based learning in the SHS TVL track. Thus, the observed statistical gains underscore the effectiveness of the intervention in bridging theoretical knowledge with practical application, affirming its pedagogical value and alignment with both national curriculum goals and global educational standards.

Table 4. Paired Samples Test Table for Academic Performance, Hands-On Performance and IMT Literacy Skills for Both Groups

Control Group		Paired Differences					t	df	Sig. (2-tailed)
		Mean	SD	Std. Error Mean	95% CI				
					LL	UL			
Pair 1	Pre-Test in Academic Performance	-0.90	7.78	1.42	-3.80	2.00	-0.63	29	0.531
	Post-Test in Academic Performance	-3.83	8.48	1.55	-7.00	-0.67	-2.48	29	0.019
Pair 2	Pre-Test in Hands-on Performance	0.04	0.61	0.11	-0.18	0.27	0.38	29	0.708

	Post-Test in Hands-On Performance	0.02	0.68	0.12	-0.23	0.27	0.15	29	0.885
Pair 3	Pre-Test for Information Literacy	-0.03	0.66	0.12	-0.27	0.22	-0.24	29	0.812
	Post-Test for Information Literacy	-0.90	7.78	1.42	-3.80	2.00	-0.63	29	0.531
Pair 4	Pre-Test in Media Literacy	-3.83	8.48	1.55	-7.00	-0.67	-2.48	29	0.019
	Post-Test in Media Literacy	0.04	0.61	0.11	-0.18	0.27	0.38	29	0.708
Pair 5	Pre-Test in Technology Literacy	0.02	0.68	0.12	-0.23	0.27	0.15	29	0.885
	Pre-Test in Technology Literacy	-0.03	0.66	0.12	-0.27	0.22	-0.24	29	0.812
Experimental Group									
Pair 1	Pre-Test in Academic Performance	-12.13	6.48	1.18	-14.55	-9.71	-10.26	29	0.000
	Post-Test in Academic Performance	-14.50	5.78	1.05	-16.66	-12.34	-13.75	29	0.000
Pair 2	Pre-Test in Hands-on Performance	-0.69	0.31	0.06	-0.81	-0.58	-12.24	29	0.000
	Post-Test in Hands-On Performance	-0.71	0.34	0.06	-0.84	-0.58	-11.43	29	0.000
Table 4 continued									
Pair 3	Pre-Test for Information Literacy	-0.82	0.41	0.08	-0.97	-0.66	-10.82	29	0.000
	Post-Test for Information Literacy	-12.13	6.48	1.18	-14.55	-9.71	-10.26	29	0.000
Pair 4	Pre-Test in Media Literacy	-14.50	5.78	1.05	-16.66	-12.34	-13.75	29	0.000
	Post-Test in Media Literacy	-0.69	0.31	0.06	-0.81	-0.58	-12.24	29	0.000
Pair 5	Pre-Test in Technology Literacy	-0.71	0.34	0.06	-0.84	-0.58	-11.43	29	0.000
	Pre-Test in Technology Literacy	-0.82	0.41	0.08	-0.97	-0.66	-10.82	29	0.000

Problem 2: Differences in Post-Test Mean Scores Between the Control and Experimental Groups in IMT Skills, Academic Performance, and Hands-On ICT Performance After the Implementation of the Quest Gamification Strategy

The independent samples t-test was conducted to determine whether significant differences existed in the post-test mean scores between the control and experimental groups across five constructs. The results are summarized in Table 5.

Academic and Hands-On Performance

The results revealed statistically significant differences in academic performance between the control ($M = 30.93$, $SD = 8.15$) and experimental groups ($M = 42.53$, $SD = 3.17$), $t(58) = -7.27$, $p < .001$), with a mean difference of -11.60. Similarly, for hands-on ICT performance, the experimental group ($M = 89.33$, $SD = 4.50$) significantly outperformed the control group ($M = 70.33$, $SD = 12.38$), $t(58) = -7.90$, $p < .001$), with a mean difference of -19.00. These results affirm the effectiveness of the gamified intervention, which integrated active learning features such as role-playing quests, task rewards, and collaborative missions. Such strategies are aligned with Deci and Ryan's Self-Determination Theory, which posits that autonomy, competence, and relatedness increase intrinsic motivation (Ryan & Deci, 2000). The performance gains can also be explained by the principles of Constructivist Learning Theory, which emphasize learner-centered, contextualized experiences that the Quest Gamification model operationalized through real-world task simulations (McLeod, 2025).

Information, Media, and Technology Literacy Skills

Significant improvements were also observed in all three IMT skill constructs. For information literacy, the experimental group (M = higher) outscored the control group, $t(58) = -6.96$, $p < .001$, with a mean difference of -0.902. Media literacy similarly favored the experimental group, $t(58) = -6.13$, $p < .001$, and technology literacy showed a strong effect as well, $t(58) = -7.85$, $p < .001$. These findings resonate with the digital learning needs of Generation Z students, who thrive in fast-paced, visually engaging, and interactive environments (Beattie, 2022; Holt, 2024). The Quest Gamification model's embedded challenges, multimedia production tasks, and competitive feedback mechanisms likely contributed to deeper engagement and the enhancement of higher-order digital competencies (Lomibao, Roble, & Nob, 2024; Smiderle et al., 2020).

The significant differences in all assessed constructs suggest that the Quest Gamification strategy meaningfully enhanced both cognitive and performance outcomes among students. Its game-based elements—such as leveling up, receiving digital badges, and collaborative storytelling—support self-directed learning and make abstract ICT competencies more tangible and relevant to students' lives. This aligns with studies that emphasize the role of gamification in fostering sustained motivation, learner autonomy, and meaningful engagement (Torres & Ortega-dela Cruz, 2024; Duero & Namoco, 2024; Pagente et al, 2024). As such, the intervention did more than simply transmit knowledge; it transformed the learning environment into a dynamic space where students could explore, create, and reflect—hallmarks of 21st-century digital literacy education.

Table 5. Independent Samples T-Test Results

		Levene's Test for Equality of Variances		t-test for Equality of Means						
				t	df	Sig. (2-tailed)	Mean Diff	Std. Error Diff	95% CI	
		F	Sig.						LL	UL
Post-Test Score in Academic Performance	Equal variances assumed	16.69	0.000	-7.27	58.00	0.000	-11.60	1.596	-14.80	-8.40
	Equal variances not assumed			-7.27	37.58	0.000	-11.60	1.596	-14.83	-8.37

Post-Test Score in Hands-On Performance	Equal variances assumed	13.80	0.000	-7.90	58.00	0.000	-19.00	2.405	-23.81	-14.19
	Equal variances not assumed			-7.90	36.52	0.000	-19.00	2.405	-23.88	-14.12
Post-Test Score for Information Literacy	Equal variances assumed	1.38	0.245	-6.96	58.00	0.000	-0.902	0.130	-1.16	-0.643
	Equal variances not assumed			-6.96	51.41	0.000	-0.902	0.130	-1.16	-0.642
Post-Test in Media Literacy	Equal variances assumed	4.39	0.041	-6.13	58.00	0.000	-0.777	0.127	-1.03	-0.523
	Equal variances not assumed			-6.13	50.86	0.000	-0.777	0.127	-1.03	-0.523
Post-Test in Technology Literacy	Equal variances assumed	3.14	0.082	-7.85	58.00	0.000	-0.900	0.115	-1.13	-0.670
	Equal variances not assumed			-7.85	49.70	0.000	-0.900	0.115	-1.13	-0.670

CONCLUSION

The findings of this study confirmed the hypotheses that quest-based gamification significantly enhances both Information, Media, and Technology (IMT) literacy and academic performance among SHS TVL strand students enrolled in the Empowerment Technologies subject. Specifically, the results revealed that students who participated in the gamified intervention showed statistically significant improvements in academic performance, hands-on ICT competencies, and perceived IMT literacy skills. These gains were evidenced by the paired-samples t-tests within the experimental group and further supported by the independent-samples t-tests comparing the post-test results between the experimental and control groups. The consistent superiority of the experimental group in all assessed areas suggests that the gamified teaching strategy is effective in developing not only cognitive skills but also digital literacy capabilities, thereby supporting the central hypothesis of the study.

These findings validate earlier assertions in the literature that gamification supports personalized, learner-centered instruction and fosters deeper cognitive engagement (Deterding et al., 2011; Kapp, 2012). By incorporating elements such as quests, rewards, and progress mechanics, the intervention successfully motivated learners and facilitated mastery of Empowerment Technologies content. In line with Smiderle et al. (2020) and Mendoza (2024), the study demonstrated that game-based learning environments are capable of sustaining

learner interest and building perseverance, particularly among Generation Z students. Moreover, the improvement in students' IMT literacy aligns with the findings of Diaz and Estoque-Loñez (2024), Pagente et al. (2024) and Cosmiano and Namoco (2024), who emphasized that gamified strategies lead to increased confidence and competence in navigating digital tools and information. These outcomes affirm that when gamification is aligned with curricular goals and 21st-century frameworks such as P21, it can be a transformative tool for bridging gaps in both academic and digital literacies—especially in low-resource public schools, where traditional instructional models may fall short of fostering essential 21st-century skills.

RECOMMENDATIONS

Based on the findings and limitations of this study, the following recommendations are offered to relevant stakeholders. Teachers are encouraged to adopt gamification strategies, particularly those that integrate elements of quest-based learning and flipped classrooms, to enhance students' academic performance, hands-on ICT skills, and Information, Media, and Technology (IMT) literacy. As this study has shown, students in the experimental group who were taught using the Quest Gamification Strategy demonstrated significantly higher post-test scores across all constructs. Teachers are therefore advised to shift from traditional lecture-based instruction to more interactive and student-centered approaches that promote engagement, autonomy, and digital competence.

It is recommended, further, that gamification be recognized as a viable pedagogical tool not only in Empowerment Technologies but across other subject areas. The results of this study emphasize its effectiveness in improving both cognitive and technical skills among learners. Curriculum developers may explore integrating game-based learning into curriculum guides and teacher training modules to facilitate wider application in diverse learning contexts.

It is recommended for school leaders to invest in capacity-building activities such as In-Service Training (INSET) programs focused on the practical implementation of gamification and flipped learning in classroom settings. These programs should include workshops on digital content creation, the design of gamified lessons, and the use of learning management systems (LMS). Providing the necessary infrastructure and technical support will also be crucial to institutionalize these innovative practices in SHS education.

Given the limitations of this study, future research may adopt a mixed-methods or purely qualitative design to explore the lived experiences of students under the Quest Gamification approach. Understanding their perceptions, challenges, and engagement patterns can offer deeper insight into the intervention's effectiveness. Moreover, similar studies may be conducted in other academic tracks and disciplines (e.g., STEM, ABM, HUMSS) to determine whether the observed gains are replicable across learning constructs, thereby improving the generalizability of the results.

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