

Evaluation of Interactive Learning Material Developed using HTML5 Content in Teaching Empowerment Technologies to Technical-Vocational SHS Students

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Article History:

Date Received: September 7, 2026

Date Revised: September 10, 2026

Date Accepted: September 17, 2026

Date Published: October 07, 2026

DOI: <https://doi.org/10.67903/ijroms0478>

Document ID: 2026IJROMS0478

Recommended Citation:

Tejam, J. K. T. (2026). Evaluation of interactive learning material developed using HTML5 content in teaching empowerment technologies to technical-vocational SHS students. *International Journal of Research on Multidisciplinary Studies*, 1(9), 1–6. <https://doi.org/10.67903/ijroms0478>

Abstract. E-learning integration demands tailored, high-quality interactive resources, yet many educators continue to rely on generic online materials rather than developing competency-specific tools for Technical-Vocational Livelihood (TVL) students. Consequently, this study evaluated the effectiveness of an Interactive Learning Material (ILM) developed using HTML5 content, specifically targeting the Empowerment Technologies learning competency (CS ICT11/12-ICTPT-Ia-b-1). To address the lack of customized interventions, the research employed a quasi-experimental design integrated with a descriptive survey method. The participants consisted of 153 Grade 11 and 12 students representing various academic strands—including TVL, Accountancy, Business and Management (ABM), Humanities and Social Sciences (HUMSS), and the General Academic Strand (GAS) at the City College of San Jose del Monte (CCSJDM). These students were selected using purposive-random sampling procedures. Data collection used a validated, researcher-developed survey questionnaire to measure perceived ILM quality, alongside standardized pre-tests and post-tests to find knowledge gain between a control group and a treatment group. The statistical treatments applied to the collected data included the mean, standard deviation, and independent samples t-tests. The findings revealed that students highly rated the HTML5 ILM across all quality criteria: attractiveness ($M=4.2$), clarity and comprehensiveness ($M=4.5$), applicability ($M=4.3$), interactivity ($M=4.6$), and assessment ($M=4.4$). Furthermore, a significant knowledge gain was observed. The treatment group, which used the HTML5-based material, achieved a higher post-test mean score (81.2) compared to the control group (75.8) that received traditional instruction. The independent samples t-test confirmed a statistically significant difference ($p < 0.05$) between the two groups. The study concludes that highly interactive HTML5-based ILMs are effective instructional tools that significantly enhance student knowledge acquisition and promote active engagement in Empowerment Technologies.

Keywords: Empowerment Technologies; HTML5; Interactive Learning Material; Knowledge Gain; TVL Students

Introduction

The transition to digital learning environments has fundamentally reshaped 21st-century education, prioritizing interactive and technology-mediated pedagogical strategies over traditional, static methods. In the Philippines, the Senior High School (SHS) curriculum integrates the subject "Empowerment Technologies" to equip students with critical Information and Communication Technology (ICT) competencies essential for their professional and academic futures. However, a significant gap exists in the practical implementation of this curriculum. Many educators, particularly in the Technical-Vocational Livelihood (TVL) track, rely heavily on generic, passive online resources rather than developing customized, competency-specific instructional tools.

HTML5 has appeared as a strong, open-source standard capable of delivering rich multimedia and interactive content seamlessly across platforms without the need for external plugins. Despite its technical potential, empirical research evaluating the specific impact of HTML5-based Interactive Learning Materials

(ILMs) on the exact learning competencies of Philippine TVL students is still scarce. Grounded in the Technology-Mediated Learning Theory (TMLT) which posits that active cognitive engagement with digital tools significantly enhances knowledge retention, this study evaluates an HTML5 ILM tailored specifically for the learning competency "CS ICT11/12-ICTPT-Ia-b-1". By investigating its effects on students' knowledge gain and perceived material quality, this research provides vital, evidence-based insights necessary to improve ICT instruction and bridge the gap between theoretical curriculum goals and practical digital execution.

Research Questions

This study evaluates the effectiveness of an HTML5-based Interactive Learning Material (ILM) in teaching TVL-Empowerment Technologies. Specifically, it looks to answer the following questions:

1. What is the socio-demographic profile of the senior high school respondents in terms of their grade level and specific academic strand?
2. How do the students evaluate the perceived quality of the developed HTML5-based ILM in terms of attractiveness, clarity and comprehensiveness, applicability, interactivity, and assessment?
3. Is there a statistically significant difference in knowledge gain between the control group receiving traditional instruction and the treatment group utilizing the highly interactive HTML5-based material?

Scope and Delimitation

This research is primarily focused on evaluating the academic effectiveness and perceived material quality of a customized, HTML5-based Interactive Learning Material (ILM) designed for the Empowerment Technologies subject. The study is delimited to 153 Grade 11 and Grade 12 senior high school students enrolled at the City College of San Jose del Monte (CCSJDM). To ensure a comprehensive evaluation, the participant includes representatives from the Technical-Vocational Livelihood (TVL), Accountancy, Business and Management (ABM), Humanities and Social Sciences (HUMSS), and General Academic Strand (GAS) tracks who are taking TVL-Empowerment Technologies. Furthermore, the instructional intervention and subsequent academic assessments are strictly bounded to one specific Empowerment Technologies learning competency "CS ICT11/12-ICTPT-Ia-b-1". Finally, the evaluation is confined to measuring absolute knowledge gain through standardized pre-tests and post-tests, alongside assessing the ILM's quality across five specific domains: attractiveness, clarity and comprehensiveness, applicability, interactivity, and assessment.

Literature Review

E-Learning and Technology-Mediated Instruction

The rapid integration of digital technologies in education demands a strong pedagogical framework. According to Technology-Mediated Learning Theory, instructional materials that promote active student participation yield significantly higher educational performance than passive learning models (Bower, 2019). This theoretical foundation underscores the critical shift from traditional, text-heavy modules to highly interactive digital environments.

The Role of HTML5 in Interactive Learning

HTML5 serves as a cornerstone for modern e-learning by enabling the creation of multimedia-rich, cross-platform interactive content without requiring third-party software. Recent academic discourse strongly supports its efficacy. Rahmi et al. (2024) proved that integrating HTML5-based interactive content such as H5P into learning management systems significantly improves students' practical skills, knowledge acquisition, and overall learning satisfaction in blended learning setups. Similarly, Mutawa et al. (2023) found that HTML5-driven interactive videos and embedded assessments create an immersive learning experience that sustains student motivation and enhances academic comprehension.

Empowerment Technologies

In the Philippine educational landscape, Empowerment Technologies is a vital subject designed to foster digital literacy, particularly for TVL students preparing for immediate workforce entry (Naelga & Sonsona, 2017; Valencia, 2019). Despite this clear curricular mandate, educators often struggle to design digital tools that effectively translate these competencies into practical applications. Current literature explores broad e-learning adoption rather than the localized development of competency-specific materials. Consequently, this empirical evaluation is necessary to bridge this research gap, using insights from recent HTML5 studies to set up evidence-based development guidelines for educators.

Despite the known benefits of interactive learning environments, current studies show a persistent challenge in practical application, instructors struggle to design digital learning tools tailored to specific, real-world competencies. The existing literature often explores broad e-learning implementations rather than localized, competency-specific material development. Consequently, an empirical evaluation is necessary to bridge this research gap. By evaluating an HTML5 learning module targeted specifically at the Empowerment Technologies curriculum, this study provides specific, evidence-based guidelines for developing highly interactive HTML5 learning content tailored for Technical-Vocational Livelihood (TVL) education.

Methodology

Research Design

This study employed a quasi-experimental research design integrated with a descriptive survey method. The quasi-experimental part utilized a pre-test/post-test control group setup to empirically measure the isolated effect of the HTML5-based ILM intervention on students' knowledge gain. Concurrently, the descriptive survey approach was utilized to quantify the students' perceptual evaluation of the Interactive Learning Material's quality post-intervention.

Research Locale

The study was conducted at the City College of San Jose del Monte (CCSJDM), a prominent educational institution in the City of San Jose del Monte, Province of Bulacan, Philippines. This locale was selected because it caters to a highly diverse demographic of senior high school students and actively offers the Academic and TVL track, making it an ideal setting to evaluate targeted, vocational ICT interventions.

Research Participants

The participants consisted of 153 Senior High School students currently enrolled in Grades 11 and 12 at CCSJDM. To ensure a comprehensive evaluation, the sample included representatives from various academic strands: Technical-Vocational Livelihood (TVL), Accountancy, Business and Management (ABM), Humanities and Social Sciences (HUMSS), and the General Academic Strand (GAS).

Research Instrument

Data collection was executed using a researcher-developed survey questionnaire designed to measure perceptions of the Interactive Learning Materials's quality across five domains, which are attractiveness, clarity and comprehensibility, applicability, interactivity, and assessment. Pre-tests and post-tests aligned with the "CS ICT11/12-ICTPT-Ia-b-1" competency were utilized to assess knowledge gain.

Data Gathering Procedure

Participants were assigned to either a control or treatment group. Both groups were administered a pre-test prior to instruction. The control group received standard traditional instruction, while the treatment group interacted solely with the HTML5-based ILM. Following the intervention duration, a post-test was administered to both groups. Finally, the treatment group completed the survey questionnaire to evaluate the Interactive Learning Material perceived quality.

Results and Discussions

Research Question 1: What is the socio-demographic profile of the senior high school respondents in terms of their grade level and specific academic strand?

Table 1. Number of Male and Female Senior High School Students by Academic Strand

Grade Level	Strand	Male	% (Male)	Female	% (Female)
1. Grade 11	Technical-Vocational Livelihood (TVL)	37	24.18	18	10.23
2. Grade 12	Accountancy, Business and Management (ABM)	23	15.03	66	37.50
3. Grade 12	Humanities and Social Sciences (HUMSS)	45	29.41	52	29.55
4. Grade 12	General Academic Strand (GAS)	22	14.38	23	13.06
5. Grade 12	Technical-Vocational Livelihood (TVL)	26	16.99	17	9.66
TOTAL		153	100%	176	100%

The socio-demographic characteristics reflect a representative cross-section of the senior high school population at CCSJDM. Out of 153 students, the majority were female (52.3%). The largest single strand

demographic came from Grade 12 ABM students (37.5% of the female sample and highly represented among males).

Research Question 2: How do the students evaluate the perceived quality of the developed HTML5-based ILM in terms of attractiveness, clarity and comprehensiveness, applicability, interactivity, and assessment?

Table 2. Mean Scores and Standard Deviations for the Evaluation of HTML5 Content Interactive Learning Material

	Aspect	Mean Score	Standard Deviation
1.	Attractiveness	4.2	0.8
2.	Clarity and Comprehensiveness	4.5	0.7
3.	Applicability	4.3	0.9
4.	Interactivity	4.6	0.6
5.	Assessment	4.4	0.8

Students viewed the HTML5-based ILM highly favorably. The highest-rated aspect was Interactivity ($M=4.6$, $SD=0.6$), suggesting that the material effectively provided students with opportunities for active participation, conforming to the premises of Technology-Mediated Learning Theory. Clarity and Comprehensiveness ($M=4.5$, $SD=0.7$) and Assessment ($M=4.4$, $SD=0.8$) also received excellent ratings, indicating the material was easily understood and effective in facilitating self-evaluation. These results strongly align with the theoretical underpinnings of Technology-Mediated Learning Theory, which argues that effective learning requires active cognitive engagement. Furthermore, these findings directly corroborate the research of Mutawa et al. (2023), who established that HTML5 features, such as embedded interactive assessments and clickable scenarios, dramatically boost student engagement and transform passive learners into active participants. The high rating in Applicability ($M=4.3$, $SD=0.9$) also indicates that the localized design of the ILM successfully bridged the gap between abstract ICT concepts and real-world TVL applications.

Research Question 3: Is there a statistically significant difference in knowledge gain between the control group receiving traditional instruction and the treatment group utilizing the highly interactive HTML5-based material?

Table 3. Mean Scores for the Pre-test and Post-test for Control and Treatment Groups

	Group	Pre-test Mean Score	Post-test Mean Score
1.	Control	72.5	75.8
2.	Treatment	72.5	81.2

The inferential statistics provided clear evidence of the intervention's academic efficacy. While both the control and treatment groups established an identical baseline with a pre-test mean score of 72.5, their post-test trajectories diverged significantly. The control group, which received traditional instruction, achieved a post-test mean of 75.8. In contrast, the treatment group utilizing the HTML5 ILM surged to a post-test mean of 81.2. While the control group achieved a post-test mean of 75.8, the treatment group achieved 81.2. The t-test results confirmed a statistically significant difference between the two groups ($p < 0.05$), indicating a substantially greater increase in knowledge gain for the treatment group. This finding strongly supports the hypothesis that HTML5 interactive learning materials positively impact students' knowledge acquisition when compared to conventional instruction. An independent samples t-test confirmed that this difference is statistically significant ($p < 0.05$), indicating a substantial increase in knowledge gain directly attributable to the interactive material. This empirical outcome powerfully supports the findings of Rahmi et al. (2024), validating that interactive HTML5 content not only engages students but tangibly improves practical skills and knowledge retention in digital learning frameworks. Ultimately, the data demonstrates that shifting away from generic resources toward customized, HTML5-driven ILMs significantly enhances the instructional delivery and academic outcomes of the Empowerment Technologies curriculum.

Ethical Considerations

Ethical clearance for this study was formally obtained from the research ethics committee and the Principal's Office of the City College of San Jose del Monte. The research strictly complied with Republic Act No. 10173 (Data Privacy Act of 2012). All participants and their legal guardians signed informed consent and assent forms, acknowledging voluntary participation without any form of pressure. To uphold absolute data privacy, no personally identifiable information was published. Student identities were replaced with alphanumeric codes in all datasets. Participants were explicitly informed of the study's procedures, assured of minimal risks, and retained the unconditional right to withdraw their data from the study at any time without

facing academic penalties. All research data is securely stored and scheduled for secure deletion upon the study's publication.

Conclusion

The study concludes that the interactive learning material developed using HTML5 content was highly effective in enhancing students' knowledge gain in the TVL-Empowerment Technologies curriculum. By comparing the control and treatment groups, the empirical findings demonstrate that interactive elements successfully foster deeper comprehension and active student involvement. Furthermore, high evaluations for the material's clarity, interactivity, and assessment underscore the critical need for visually appealing, culturally applicable, and competency-specific e-learning tools to replace generic online materials.

Recommendations

Based on the specific findings, the following actionable recommendations are provided for relevant stakeholders: For Teachers: Integrate HTML5-based ILMs into routine classroom instruction. Capitalize on the high interactivity ratings by utilizing embedded simulations, games, and built-in quizzes to actively engage students during lessons. For Instructional-Material Developers: Prioritize clarity, comprehensiveness, and real-world applicability during design phases. Ensure materials accommodate various learning styles by blending visual aesthetics with intuitive functionality. For Administrators and Curriculum Planners: Formally endorse and support the integration of HTML5-based ILMs as supplementary components of the TVL-Empowerment Technologies curricula. Provide necessary funding, institutional support, and technology-focused training for educators. For Future Researchers: Conduct longitudinal studies to track the long-term impact of HTML5 ILMs on motivation and knowledge retention beyond immediate post-tests. Future research should also explore individualized learning paths and assess scalability across diverse institutions.

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