Academic Performance and Students' Perceptions of Technology-Based Instruction in Technology and Livelihood Education 7

1 Lucy C. Teatro, 2 Marivic M. Cuizon, PhD,

Email: lucy.teatro@deped.gov.ph

Lumbocan National High School, Butuan City Division, Philippines
2Agusan Colleges Inc, Butuan City, Philippines

Abstract: This study determined the effectiveness of Technology-Based Instruction (TBI) on the academic performance of Grade 7 students in Technology and Livelihood Education (TLE 7) and examined students' perceptions of the use of technology-based instructional materials. Specifically, it sought to compare the posttest performance of students taught with and without TBI, identify significant differences between their pretest and posttest performances, and describe learners' perceptions of TBI in terms of motivation, engagement, understanding, and learning independence. The study employed a quasi-experimental research design using a two-group pretest–posttest approach. The respondents were 66 Grade 7 students from Lumbocan National High School in Butuan City, Philippines, during the School Year 2025–2026, divided into a control group taught through conventional instruction and an experimental group exposed to technology-based instructional materials. A validated researcher-made 30-item multiple-choice test was used as the pretest and posttest instrument, while descriptive and inferential statistics were applied for data analysis. Findings revealed that students exposed to TBI achieved significantly higher posttest performance than those taught without TBI, with most TBI learners attaining Very Satisfactory to Outstanding levels. The group taught without TBI showed no statistically significant improvement between pretest and posttest, indicating limited effectiveness of traditional instruction. In contrast, the TBI group demonstrated a significant improvement in academic performance, with posttest scores concentrated in the higher score ranges. Moreover, students expressed positive perceptions of TBI, reporting increased motivation, engagement, understanding, and independence in learning. Overall, the study confirms that Technology-Based Instruction is an effective approach for enhancing academic performance and learning experiences in TLE 7

Keywords: *Academic performance, Student perceptions, Technology-Based Instruction, Technology and Livelihood Education*

INTRODUCTION

The rapid technological transformation of the 21st century has significantly reshaped educational systems worldwide, redefining how teaching and learning are delivered. Advances such as artificial intelligence, learning analytics, and immersive technologies have enabled more personalized, interactive, and learner-centered instructional approaches. These innovations support the growing demand for skills-based education that prepares learners for real-world applications, enhances learner engagement, and promotes digital literacy essential for participation in contemporary digital societies (Bekteshi, 2025).

In the Philippine context, the integration of digital technology in education has become a central focus of the Department of Education (DepEd) in its efforts to modernize and improve educational quality in response to the demands of the digital age (Atilano-Tang & Cirilo, 2023). Programs such as the DepEd Computerization Program, institutionalized through DepEd Order No. 78, s. In 2010, aim to provide public schools with essential ICT infrastructure to promote digital literacy and student-centered learning. In addition, DepEd Order No. 42, s. 2015 encourages the integration of ICT tools in daily lesson preparation, while DepEd Order No. 16, s. 2022, the Digital Rise Program emphasized the use of ICT and emerging technologies to transform teaching and learning. These initiatives are further reinforced by DepEd Memorandum No. 62, s. 2021, which promotes innovation in digital learning and strengthens teachers' competence in implementing technology-based instruction.

Despite these national initiatives, challenges in effectively integrating technology persist at the school level. At Lumbocan National High School in Butuan City, particularly in Technology and Livelihood Education (TLE) 7, many students experience difficulty in mastering essential competencies. TLE is designed to equip learners with practical, technical, and entrepreneurial skills necessary for daily living and future employment; however, limited use of effective instructional materials has contributed to low academic performance, as reflected in students' Mean Percentage Scores. These learning gaps highlight the need for innovative instructional approaches that can enhance students' understanding and performance.

Technology-Based Instruction (TBI) offers a promising approach to addressing these challenges by promoting active learning, learner engagement, and independent learning through the use of interactive and multimedia-supported materials. Research has shown that technology-based instruction can improve students' academic performance and foster positive learning perceptions by providing clear explanations, guided practice, and opportunities for self-paced learning (Bekteshi, 2025).

In response to these concerns, this study examined the academic performance and students' perceptions of Technology-Based Instruction in Technology and Livelihood Education 7 at Lumbocan National High School. Specifically, it sought to determine the effectiveness of technology-based instructional materials in improving students' academic

performance and to explore learners' perceptions of technology integration in TLE instruction. The findings of this study aim to contribute to improved instructional practices and support the effective integration of technology in TLE classrooms.

Theoretical framework

This study was anchored on the Constructivist Learning Theory, primarily developed by Jean Piaget (1936) and further elaborated by Lev Vygotsky (1978). Constructivist Learning Theory posits that learners actively construct their own understanding and knowledge of the world through experiencing things and reflecting on those experiences. It emphasized that learning is an active, constructive process rather than a passive reception of information. Piaget focused on individual cognitive development, suggesting that learners build mental models of the world through processes of assimilation and accommodation. Vygotsky, on the other hand, highlighted the crucial role of social interaction and culture in cognitive development, introducing concepts such as the Zone of Proximal Development (ZPD) and scaffolding, where a more knowledgeable peer or teacher assists a student in achieving a task that was just beyond their current independent capabilities. Both perspectives underscore that student are not empty vessels, but rather active participants who integrate new information with existing knowledge to create meaning.

The Constructivist Learning Theory is related to this study on the efficacy of technology-based instruction in TLE for Grade 7 students, as it provides a robust framework for understanding how such instruction facilitates meaningful learning. From a constructivist perspective, content quality in technology-based TLE instruction was not merely about the accuracy of information, but about how effectively it enabled students to actively engage and build understanding through interactive, real-world relevant content presented in diverse multimedia formats, such as electrical circuit simulations or virtual workshops, which allow students to experiment and construct their understanding.

Similarly, instructional quality shifted from direct instruction to facilitation, with teachers guiding students to explore, collaborate, and solve TLE problems using technology by selecting appropriate digital tools, setting clear objectives, and providing timely scaffolding. The technical quality of the technology was crucial, as cumbersome or unreliable tools hinders interaction; thus, constructivism demands intuitive, robust, and supportive hardware and user-friendly software for seamless creation, experimentation, and collaboration in TLE. Consequently, other findings, such as enhanced student engagement, motivation, and the development of higher-order thinking skills, is anticipated, as active involvement in designing projects, troubleshooting digital tools, or collaborating virtually on TLE tasks fosters problem-solving, critical thinking, and creativity. This meant that the efficacy of technology-based instruction is measured not only by content recall, but by students' ability to apply knowledge, innovate, and adapt, which are hallmarks of constructivist learning.

Methodology

This study employed a quasi-experimental research design using a two-group pretest–posttest approach to examine the effectiveness of Technology-Based Instruction (TBI) in TLE 7. One group was taught using conventional instructional methods, while the other was exposed to technology-based instructional materials. Pretests and posttests were administered to both groups to measure changes in students' performance. The study was conducted at Lumbocan National High School in Butuan City, Philippines, during the School Year 2025–2026. The respondents consisted of 66 Grade 7 students enrolled in TLE, distributed into two sections.

Sampling technique and Sample

The respondents consisted of 66 Grade 7 students enrolled in TLE, distributed across two sections. These students served as the control and experimental groups. A complete enumeration (universal sampling) technique was employed, wherein all Grade 7 students enrolled in the school were included to minimize sampling bias. A researcher-made 30-item multiple-choice test, validated by experts and tested for reliability, served as both the pretest and posttest instrument. Data collection followed ethical procedures, including institutional approval and informed consent. After pretesting, the experimental group received TBI while the control group received traditional instruction. Posttests were administered after the intervention. Data were analyzed using frequency and percentage, weighted mean, and paired-samples t-test to determine performance levels and significant differences between goups.

Results and Discussions
Level of post-test performance of both groups of students in TLE 7

Table 1 presents the distribution of students' posttest performance in TLE 7, comparing the achievement levels of learners with TBI and without TBI after the instructional implementation. The Table focuses on how students performed across defined score ranges and descriptive levels, providing a clear picture of learning outcomes following the use of the intervention.

Table 1

Level of Posttest Performance of the students in TLE 7

Score Ranges	Group		Total	Descriptive Level
	Without TBI	With TBI		
26 – 30	1	17	18	Outstanding
20 – 25	9	12	21	Very Satisfactory
14 – 19	11	3	14	Satisfactory
8 – 13	11	0	11	Poor
0 – 7	2	0	2	Very Poor
Total	**34**	**32**	**66**	

The highest frequency is observed in the 26–30 score range (Outstanding) with a total of 18 students, where 17 students are from the group with TBI and only 1 student is from the group without TBI. This result indicates that most high-performing students belonged to the group exposed to the TBI, suggesting that the instructional intervention was highly effective in enhancing students' mastery of TLE 7 competencies. The concentration of posttest scores in the outstanding category among the TBI group reflects improved understanding, skill acquisition, and overall learning performance. TBI learners dominated Very Satisfactory to Outstanding levels, supporting AlGerafi et al. (2023) and Sabri et al. (2024), who documented superior outcomes from interactive, technology-enhanced instruction.

The lowest frequency is recorded in the 0–7 score range (Very Poor) with only 2 students, all of whom are from the group without TBI, while none from the group with TBI fell into this category. This finding implies that the absence of the instructional intervention may have contributed to persistently low performance among a few learners. The zero count for students with TBI in this lowest category suggests that the intervention helped prevent extremely poor learning outcomes. Lower posttest levels among non-TBI learners align with Abedi (2024), who found traditional, teacher-centered approaches insufficient for producing strong gains.

Overall, the table shows a total of 66 students, consisting of 34 without TBI and 32 with TBI, with posttest scores generally concentrated in the Very Satisfactory and Outstanding levels. This overall distribution indicates a positive shift in student performance after instruction, particularly among those exposed to TBI. The general picture suggests that the use of TBI contributed significantly to improved posttest performance in TLE 7, demonstrating its effectiveness as an instructional approach. The overall upward shift for TBI learners corroborates Hardianti et al. (2024), confirming that well-integrated technology improves achievement distributions.

Significant difference between the pretest and posttest performance of both groups of students in TLE 7

Table 2

Paired Samples t-test between the level of pretest and posttest performances of the students

Group	Test	Mean	SD	t-value	p-value	Decision on H_o	Interpretation/ Remarks
Without TBI	Posttest	15.65	5.198	.814	.427	Do not reject H_o	Not significant
	Pretest	14.53	6.311				
With TBI	Posttest	24.72	3.920	8.653**	.000	Reject H_o	Significant
	Pretest	14.25	6.016				

**significant @ p<.01*

Table 2 shows the result of the paired samples t-test between the pretest and posttest scores of the students. In the group taught without the TBI, the pretest resulted with a mean score of 14.53 and 15.65 in the posttest. It can be observed that the pretest scores are more diverse (SD=6.311) than in the posttest (SD=5.198). This indicates that the pretest scores are very scattered away from the mean in the pretest. In the posttest, some of these scores have improved and converged near the mean with a very few of them located in the farthest ends of the scale. The t-test revealed that there is no significant difference between the pretest and posttest mean scores of the students (t=.814; p=.427) which led to the non-rejection of the null hypothesis. The absence of a significant difference between the pretest and posttest scores of students taught without the Technology-Based Instructional (TBI) materials may be attributed to several classroom-related factors observed during the implementation. Students were primarily exposed to traditional teaching methods, such as lecture-based discussions and printed materials, which limited opportunities for active engagement, visualization, and hands-on interaction. As a result, many learners showed passive participation, relying heavily on teacher explanations rather than exploring concepts independently.

Moreover, students demonstrated varying levels of

interest and attention, particularly when lessons involved abstract or procedural concepts in TLE. Without multimedia support or interactive content, some learners struggled to sustain focus and to connect lessons with real-life applications. This may explain why, despite slight improvements in posttest scores, learning gains were not substantial enough to produce a statistically significant difference. Classroom observations also revealed that students had difficulty recalling procedures and safety practices after instruction, suggesting that knowledge retention was limited. The lack of immediate feedback and reinforcement activities further contributed to uneven learning progress among students. Consequently, while a few learners showed improvement, others remained at the same level, resulting in minimal overall change in performance. These findings imply that traditional instruction alone may be insufficient in addressing diverse learning needs, particularly in skill-oriented subjects such as Technology and Livelihood Education. This reinforces the need for innovative and technology-enhanced strategies to promote deeper understanding, engagement, and consistent learning outcomes.

In the second group who was taught with the TBI, the pretest mean score was 14. 25 and in the posttest, the mean score improved to 24.72. The pretest scores of the students in this group are also more diverse (SD=6.016), located away from the mean, indicating diverse level of mastery of the lesson. In the posttest, these scores have improved and moved away from the lower scales and were concentrated in the two upper locations of the scale (SD=3.920). The t-test revealed that there is a significant improvement on the performance of the students (t=8.653;p=.000) .This finding provides empirical evidence of the efficacy of the TBI in improving the mastery level of the students in TLE 7.

The significant improvement in the posttest performance of students taught with the Technology-Based Instructional (TBI) materials indicates that the intervention was effective in enhancing students' mastery of the lessons in TLE 7. The substantial increase in the mean score from the pretest to the posttest, along with the reduced variability of scores, suggests that students not only improved but also achieved more consistent learning outcomes. During the implementation, students were observed to be more engaged, attentive, and motivated when lessons were delivered using TBI. The use of visual and interactive content helped clarify procedures and concepts, enabling learners to better understand and retain the lessons. Students were also able to revisit learning materials and receive immediate feedback, which contributed to improved performance and

reduced learning gaps. These findings support existing studies which emphasize that technology-based and multimedia instruction enhances student engagement, comprehension, and retention, particularly in skill-oriented subjects such as Technology and Livelihood Education. Overall, the results provide empirical evidence that TBI is an effective instructional approach for improving students' learning outcomes in TLE 7.This finding is consistent with Abedi (2024), who reported that teacher-centered instructional approaches, even when minimally supported by technology, often fail to yield substantial improvement because they limit learner autonomy, interaction, and active engagement. Similarly, Chama (2023) emphasized that conventional instructional practices frequently result in passive learning and do not adequately address learners' diverse needs, leading to minimal progress over time. Moreover, Rodriguez and Habla (2023) noted that without meaningful and consistent integration of digital tools, improvements in student performance are often marginal and attributed more to repetition than to deep understanding. These studies support the present finding that the non-TBI group demonstrated only slight score increases that were not statistically significant, particularly in a skills-oriented subject such as Technology and Livelihood Education (TLE)

Conclusions

Based on the findings, the study concludes that Technology-Based Instruction (TBI) is an effective instructional approach in teaching TLE 7. Students exposed to TBI demonstrated significantly higher academic performance compared to those taught using traditional methods, as evidenced by their superior posttest scores and concentration in the Very Satisfactory to Outstanding performance levels. The absence of extremely low scores among TBI learners further indicates that technology-based instruction supports mastery of competencies and reduces poor learning outcomes.

Moreover, the lack of significant improvement in the non-TBI group suggests that traditional instructional approaches alone are insufficient to produce meaningful learning gains in TLE 7. In contrast, the significant improvement observed among TBI learners confirms the positive impact of integrating technology into instruction.

Additionally, students' favorable perceptions of the TBI materials manifested through increased motivation, engagement, understanding, and learning independence reinforce the instructional value of technology-based learning. Overall, the study affirms that well-designed Technology-Based Instruction enhances both academic

achievement and learning experiences in TLE 7.

Teachers may integrate Technology-Based Instruction (TBI) into TLE 7 lessons to enhance students' engagement, understanding, and mastery of competencies, while continuously developing their skills in using educational technologies. Students may actively participate in technology-based learning activities and utilize digital resources to improve independent learning and academic performance. School principals may support the effective implementation of TBI by providing adequate technological resources, infrastructure, and professional development opportunities for teachers. Future researchers may replicate the study in other subject areas, grade levels, or school settings and explore the long-term effects of Technology-Based Instruction on students' achievement, motivation, and higher-order thinking skills to further strengthen the evidence on its effectiveness.

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