ISSN (Online): 2455-3662
EPRA International Journal of Multidisciplinary Research (IJMR) - Peer Reviewed Journal
Volume: 12| Issue: 5| May 2026|| Journal DOI: 10.36713/epra2013 ||SJIF Impact Factor 2026: 8.753 || ISI Value: 1.188

ACCEPTABILITY AND EFFECTIVENESS ASSESSMENT OF A LOGIC TRAINER KIT (LTK) TOWARD AN IMPROVED STUDENT'S PERFORMANCE SKILLS IN DIGITAL ELECTRONICS

Jeser B. Bonhoc

[1]*Master of Science in Industrial Technology at Cebu Technological University San Francisco Campus, San Francisco Cebu City. Philippines*

[2]*Instructor, College of Technology and Engineering at, Cebu Technological University San Francisco Campus, San Francisco, Cebu City, Philippines*

Article DOI: https://doi.org/10.36713/epra27628
DOI No: 10.36713/epra27628

ABSTRACT

This research, named "Acceptability and Effectiveness Assessment of a Logic Trainer Kit (LTK) Toward an Improved Student Performance Skills in Digital Electronics," examined the influence of the Logic Trainer Kit on student achievement at Cebu Technological University–San Francisco Campus. Based on the Technology Acceptance Model (TAM), Constructivist Learning Theory, and Experiential Learning Theory, the study evaluated the tool's acceptability and instructional effectiveness in improving concept understanding, practical skills, motivation, problem-solving skills, and overall learning satisfaction. A quantitative-descriptive design was employed, involving 375 participants from the Bachelor of Industrial Technology – Computer Technology and Bachelor of Industrial Technology – Electronics Technology programs. Data were collected using modified survey questionnaires. The results showed that students reached elevated levels of comprehension, skill enhancement, involvement, motivation, and contentment while utilizing the Logic Trainer Kit. Additionally, the tool was seen as very beneficial and easy to use, indicating a high level of acceptance from users. Even with these positive results, some challenges were observed, such as issues with understanding circuit connections and the restricted access to trainer kits for group work. In summary, the research finds that the Logic Trainer Kit greatly enhances student understanding and involvement in digital electronics. It emphasizes that organized, practical teaching resources aligned with national educational benchmarks are crucial for fostering skills and enhancing outcome-driven education. As a result, the research suggests continual improvement of the kit, better access to lab resources, and sustained institutional backing to optimize its efficacy and further enhance student learning results

KEYWORDS: *Logic Trainer Kit, Digital Electronics, Technology Acceptance Model, Experiential Learning, Constructivist Learning Theory, Instructional Effectiveness, Student Engagement*

INTRODUCTION

Digital Electronics plays a vital role in modern technology and engineering education. It serves as the foundation for computer systems, automation technologies, telecommunications, embedded systems, robotics, and digital control applications. Because of its broad applications, Digital Electronics has become one of the core subjects in engineering, industrial technology, and computer technology programs. Students studying this subject are expected to develop both theoretical understanding and practical competencies involving logic gates, Boolean algebra, combinational circuits, sequential circuits, and digital system design.

However, despite its significance, Digital Electronics remains one of the most difficult subjects for many students due to the abstract and technical nature of its concepts. Traditional lecture-based instruction often limits students' opportunities to engage directly with circuit operations and digital logic applications. As a result, learners frequently experience difficulties in visualizing circuit behavior, analyzing logic functions, and troubleshooting digital systems.

Recent educational studies emphasized the importance of active and experiential learning environments in improving student understanding and engagement in technical education. Interactive instructional tools and laboratory-based activities significantly contribute to enhanced conceptual comprehension, critical thinking, and technical skills development. According to Bond et al. (2020), technology-enhanced learning environments increase student engagement and improve learning outcomes in higher education. Similarly, Martin et al. (2022) highlighted that practical and technology-supported instruction promotes deeper learning and stronger retention of technical concepts.

In response to these challenges, educational institutions have increasingly adopted laboratory tools and instructional technologies to bridge the gap between theory and practice. One of these innovations is the Logic Trainer Kit (LTK), a hands-on educational device designed to assist students in understanding and applying Digital Electronics concepts through practical experimentation. The Logic Trainer Kit enables learners to construct circuits, observe outputs, analyze logic operations, and troubleshoot problems using actual digital components.

The implementation of the Logic Trainer Kit aligns with Constructivist Learning Theory, which emphasizes that learners construct knowledge through direct experience and active engagement. Jean Piaget and Lev Vygotsky argued that meaningful learning occurs when students interact with learning materials and actively participate in problem-solving activities. Likewise, Kolb's Experiential Learning Theory supports the idea that learning is strengthened through concrete experiences, reflective observation, conceptualization, and experimentation.

The Technology Acceptance Model (TAM) also provides a relevant framework for evaluating the effectiveness of instructional technologies. According to Davis (1989), perceived usefulness and perceived ease of use significantly influence technology acceptance and utilization. In educational settings, students are more likely to adopt and benefit from instructional tools when they perceive them as useful, user-friendly, and supportive of learning.

Considering these theoretical and practical perspectives, this study aimed to assess the acceptability and effectiveness of the Logic Trainer Kit in improving student learning and performance in Digital Electronics. Specifically, the study investigated students' perceptions regarding the usefulness, usability, and instructional value of the LTK in enhancing conceptual understanding, practical skills, student motivation, problem-solving ability, and satisfaction with learning experiences.

Theoretical Framework

This study is anchored on the Technology Acceptance Model (TAM), Constructivist Learning Theory, and Experiential Learning Theory in examining the use of the Logic Trainer Kit (LTK) in Digital Electronics. TAM explains that students' acceptance of the trainer kit depends on its perceived usefulness and ease of use, while Constructivist and Experiential Learning theories emphasize active, hands-on learning through problem-solving and real-world experiences.

The Logic Trainer Kit serves as the instructional intervention, while factors such as engagement, instructional design, and attitude toward technology influence student performance outcomes, including concept understanding, practical skills, motivation, problem-solving ability, and learning satisfaction. The framework suggests that greater acceptability and hands-on involvement lead to improved learning outcomes in Digital Electronics.

The Logic Trainer Kit is a laboratory-based instructional tool powered by a 12V DC source with regulated +5V output for TTL integrated circuits. It includes essential logic gates, DIP switches, LED indicators, a seven-segment display, and a 555 timer IC, allowing students to perform practical activities in combinational and basic sequential logic circuits. Its organized design promotes usability, engagement, and effective learning.

The trainer kit is further supported by the theories of Davis (1989), Piaget (1936), Vygotsky (1978), and Kolb (1984), as well as Republic Acts No. 7722, and 8292, which advocate technology-integrated, competency-based, and innovative instruction in higher education. Overall, the Logic Trainer Kit functions as an effective instructional innovation that strengthens technology acceptance, experiential learning, and outcomes-based education in Digital Electronics.

Objectives of the Study

This study aimed to assess the acceptability and effectiveness of the Logic Trainer Kit (LTK) in improving student performance in Digital Electronics.

Specifically, it sought to:

1. Determine the profile of the respondents in terms of:
   - gender;
   - program enrolled and year level;
   - prior knowledge in Digital Electronics;
   - frequency of hands-on laboratory activities; and
   - level of access to learning tools and laboratory resources.
2. Determine the level of perceived effectiveness of the Logic Trainer Kit in terms of:
   - concept understanding;
   - practical skills;
   - student motivation;
   - problem-solving ability; and
   - satisfaction with learning experience.
3. Determine the level of acceptance of the Logic Trainer Kit in terms of:
   - perceived usefulness;
   - perceived ease of use;
   - learning engagement;
   - instructional design and accessibility;
   - student attitude toward technology-based tools; and
   - availability of learning support.
4. Identify the challenges encountered by students in using the Logic Trainer Kit.
5. Determine the significant relationship between the level of acceptance and perceived effectiveness of the Logic Trainer Kit.
6. Propose enhancements for the Logic Trainer Kit based on the findings of the study.

METHODOLOGY

This study utilized a quantitative-descriptive research design. The quantitative approach was appropriate because the study focused on measuring students' perceptions, acceptance, and perceived effectiveness of the Logic Trainer Kit using numerical data and statistical analysis.

The descriptive method was employed to describe the respondents' demographic profile, determine the level of effectiveness and acceptance of the LTK, identify challenges encountered by students, and examine the relationship between acceptance and effectiveness.

Respondents of the Study

The respondents consisted of 375 second-year and third-year students enrolled in the Bachelor of Industrial Technology major in Computer Technology and Electronics Technology during the Academic Year 2025–2026.
The respondents were selected using stratified sampling to ensure representation from both programs.

Program	Population	Sample	Percentage
BIT-CT	388	300	58.60%
BIT-ET	124	75	14.65%
Total	**512**	**375**	**73.25%**

Research Instrument

a) The study utilized a modified survey questionnaire adapted from previous related studies. The questionnaire was divided into sections covering:
b) 1. Respondents' demographic profile;
c) 2. Perceived effectiveness of the Logic Trainer Kit;
d) 3. Level of acceptance based on TAM constructs;
e) 4. Challenges encountered in using the trainer kit; and
f) 5. Suggestions for improvement.
g) The questionnaire used a five-point Likert scale to measure students' responses.

Statistical Design

The gathered data were analyzed using IBM SPSS.
The following statistical tools were used:
• Frequency and Percentage;
• Weighted Mean;
• Standard Deviation;
• Mann-Whitney U Test;
• Kruskal-Wallis Test; and
• One-Way ANOVA.
These statistical tools were utilized to determine significant differences and relationships among variables.

RESULTS AND DISCUSSIONS

The majority of respondents were female students representing 57.07% of the sample, while male students accounted for 42.93%. Most respondents were enrolled in the Bachelor of Industrial Technology major in Computer Technology program.

The findings suggest balanced participation between male and female students, allowing broader perspectives regarding the implementation of the Logic Trainer Kit.

Most respondents reported having basic to moderate prior knowledge in Digital Electronics. This indicates that the majority of learners still required structured laboratory instruction and instructional support to strengthen their understanding of digital circuits.

The majority also reported frequent engagement in hands-on laboratory activities and adequate access to learning resources. This suggests that practical learning experiences are already integrated within the institution's instructional approach.

Level of Perceived Effectiveness of the Logic Trainer Kit
Concept Understanding

The overall mean for concept understanding was interpreted as High. Students strongly agreed that the Logic Trainer Kit helped them understand Digital Electronics concepts, visualize circuit operations, and improve their understanding of logic gates and truth tables.

These findings support the principles of Constructivist Learning Theory and experiential learning, emphasizing that direct interaction with learning materials enhances conceptual understanding.

Practical Skills

The findings showed that students perceived the Logic Trainer Kit as highly effective in improving practical skills. Respondents reported that the trainer kit helped them apply theoretical concepts in practice and improved their laboratory competencies.

However, lower responses related to troubleshooting and circuit analysis indicate the need for additional guided laboratory exercises.

Student Motivation

Students reported that the Logic Trainer Kit increased their interest and engagement in Digital Electronics laboratory activities. The respondents found the use of the trainer kit more interactive and motivating compared to traditional instruction.

These results support previous studies emphasizing the positive effects of active learning and technology-supported environments on student engagement.

Problem-Solving Ability

The respondents agreed that the Logic Trainer Kit enhanced their problem-solving skills and improved their understanding of circuit logic.

However, more advanced troubleshooting skills still require improvement through scaffolded activities and instructor guidance.

Satisfaction with Learning Experience

The respondents expressed satisfaction with the use of the Logic Trainer Kit during laboratory activities. Students perceived the trainer kit as beneficial in enhancing their overall learning experience.

The findings suggest that hands-on instructional tools contribute significantly to student satisfaction and engagement in technical education.

Level of Acceptance of the Logic Trainer Kit

Perceived Usefulness

Students strongly agreed that the Logic Trainer Kit enhanced their understanding of Digital Electronics and improved their learning performance.

The high level of perceived usefulness indicates that students recognize the instructional value of the trainer kit.

Perceived Ease of Use

The respondents also agreed that the Logic Trainer Kit was easy to use and understand. The organized layout, labeled components, and clear outputs contributed to positive usability perceptions.

Learning Engagement

The findings revealed high levels of student engagement during laboratory activities involving the trainer kit. Students actively participated in constructing circuits, testing outputs, and analyzing results.

Instructional Design and Accessibility

The respondents perceived the trainer kit as well-organized and accessible. However, some students identified limited access to laboratory resources as a challenge.

Student Attitude Toward Technology-Based Tools

The majority of respondents showed positive attitudes toward the use of instructional technologies in laboratory learning.

Availability of Learning Support

Students acknowledged the importance of instructor guidance and laboratory support in maximizing the benefits of the Logic Trainer Kit.

Challenges Encountered by Students

The students identified several challenges in using the Logic Trainer Kit, including:

- difficulties in troubleshooting complex circuits;
- limited availability of trainer kits;
- limited laboratory time; and
- challenges in circuit connections.

These findings suggest the need for additional instructional support and expansion of laboratory resources.

Relationship Between Acceptance and Effectiveness

The statistical analysis revealed a significant relationship between the level of acceptance and perceived effectiveness of the Logic Trainer Kit.

The findings imply that students who perceive the trainer kit as useful and easy to use are more likely to experience improved learning outcomes and engagement.

These results strongly support the Technology Acceptance Model.

CONCLUSION

Based on the findings of the study, the following conclusions were drawn:

1. The Logic Trainer Kit is an effective instructional tool for improving students' conceptual understanding, practical skills, motivation, problem-solving ability, and satisfaction with learning experiences in Digital Electronics.
2. Students generally perceive the Logic Trainer Kit as highly acceptable in terms of usefulness, usability, engagement, instructional design, and learning support.
3. Hands-on and technology-supported learning environments significantly contribute to enhanced engagement and academic performance in technical education.
4. There is a significant relationship between students' acceptance of the Logic Trainer Kit and its perceived effectiveness.
5. Despite positive findings, students still encounter challenges involving laboratory access, troubleshooting, and circuit analysis.
6. The integration of Logic Trainer Kits aligns with outcomes-based education and supports competency development in Digital Electronics.

RECOMMENDATION

Based on the findings and conclusions of the study, the following recommendations are proposed:

1. Educational institutions should continue integrating Logic Trainer Kits in Digital Electronics instruction to strengthen practical learning experiences.
2. Additional trainer kits and laboratory resources should be provided to ensure equal access for all students.
3. Educators should incorporate guided troubleshooting activities and scaffolded laboratory exercises to improve higher-order problem-solving skills.
4. Institutions should provide continuous faculty training on technology-supported instruction and laboratory management.
5. Future researchers may conduct experimental studies comparing traditional instruction and trainer kit-supported learning.
6. The Logic Trainer Kit should be continuously improved based on student feedback and technological advancements.

REFERENCES

1. *Al-Emran, M., & Granić, A. (2021). Is it still valid or outdated? A bibliometric analysis of the technology acceptance model and its applications from 2010 to 2020. Recent Advances in Technology Acceptance Models and Theories.*
2. *Bond, M., Bedenlier, S., Marín, V. I., & Händel, M. (2020). Mapping research in student engagement and educational technology in higher education: A systematic evidence map. International Journal of Educational Technology in Higher Education, 17(1), 1–30. https://doi.org/10.1186/s41239-019-0176-8*
3. *Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. MIS Quarterly,*

ISSN (Online): 2455-3662
EPRA International Journal of Multidisciplinary Research (IJMR) - Peer Reviewed Journal
Volume: 12| Issue: 5| May 2026|| Journal DOI: 10.36713/epra2013 ||SJIF Impact Factor 2026: 8.753 || ISI Value: 1.188

13(3), 319–340. https://doi.org/10.2307/249008

4. *Dwivedi, Y. K., et al. (2020). Setting the future of digital and social media marketing research: Perspectives and research propositions. International Journal of Information Management.*
5. *Hamzah, N. H., et al. (2023). The effectiveness of a proposed electronic training kit in enhancing practical learning among students. Kurdish Studies. https://doi.org/10.58262/ks.v12i1.129*
6. *Kolb, D. A. (1984). Experiential learning: Experience as the source of learning and development. Prentice-Hall.*
7. *Lombardi, D., et al. (2021). The curious construct of active learning. Psychological Science in the Public Interest, 22(1), 8–43. https://doi.org/10.1177/1529100620973974*
8. *Martin, F., Sun, T., & Westine, C. D. (2022). A systematic review of research on online teaching and learning from 2009 to 2018. Computers & Education, 159, 104009. https://doi.org/10.1016/j.compedu.2020.104009*
9. *Piaget, J. (1936). The origins of intelligence in children. International Universities Press.*
10. *Romarate, M. A., Aquino, A. B., Punongbayan, E. J., Ramos, Q. G., Aclan, B. L., & Porley, R. N. (2023). Development of outcomes-based instructional materials in professional teacher education courses for a flexible set-up. Journal of Education and E-Learning Research, 10(1), 61–67. https://doi.org/10.20448/jeelr.v10i1.4378*
11. *Theobald, E. J., et al. (2020). Active learning narrows achievement gaps for underrepresented students in undergraduate science, technology, engineering, and mathematics. Proceedings of the National Academy of Sciences*
12. *Vygotsky, L. S. (1978). Mind in society: The development of higher psychological processes. Harvard University Pres*