Assessing the Acceptance of the Innovative Lighting System Trainer Using the Technology Acceptance Model: Evidence from Technical Education Students

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ABSTRACT

The integration of educational technology plays a pivotal role in enhancing technical instruction and learner engagement. This study evaluated the behavioral intention to use and accept the *Innovative Lighting System Trainer (ILST)* at North Eastern Mindanao State University, Cantilan Campus, employing the **Technology Acceptance Model (TAM)** as the theoretical framework. The study aimed to determine the levels of perceived usefulness, perceived ease of use, attitude toward use, and behavioral control, and to examine the relationships among these constructs. A descriptive–correlational research design was utilized, involving student respondents from technical and engineering programs during the Academic Year 2024–2025. Weighted means and Pearson correlation coefficients were computed to assess the acceptability of the ILST and the interrelationships among TAM constructs. Findings revealed that all TAM constructs were rated as *Very Highly Acceptable* (grand mean = 4.37). Perceived usefulness obtained the highest mean rating, while perceived ease of use was rated slightly lower but remained *Highly Acceptable*. Correlation analysis showed strong positive and statistically significant relationships among perceived usefulness, attitude toward use, and behavioral control, confirming the validity of TAM in this context. The study concludes that user acceptance of the ILST is primarily influenced by its perceived usefulness and positive attitude formation. Integrating the ILST into technical training programs is strongly recommended to promote active, technology-enhanced learning and improve skill-based competency.

Keywords: Educational technology, Innovative Lighting System Trainer (ILST), Perceived usefulness, Technical and vocational education, Technology Acceptance Model (TAM)

INTRODUCTION

The integration of innovative instructional technologies has become an essential element of modern education, particularly in the fields of science, technology, engineering, and industrial training. As global industries rapidly evolve, higher education institutions are compelled to adopt technology-enhanced learning systems that not only improve knowledge acquisition but also strengthen hands-on competencies essential for workplace readiness. In technical and vocational education, tools that simulate real-world electrical and industrial environments enable students to practice complex operations safely, effectively bridging the gap between theory and practical application (Scherer et al., 2019; Lin et al., 2021; Juera, 2022).

In this context, the Innovative Lighting System Trainer (ILST) has been developed as a technology-based instructional tool to support experiential learning in electrical technology programs. The ILST provides a simulated platform where learners can explore, assemble, and analyse lighting systems in a controlled environment. Its design aligns with the pedagogical shift toward outcome-based education, which emphasises competency, performance, and skill mastery through experiential engagement. Understanding how learners and instructors accept and adopt such innovations is vital for maximising their educational potential (e.g., Nguyen & Tran 2023; Zhao et al., 2023).

Research on technology integration in education has shown that successful adoption depends on users' perceptions of a technology's usefulness and ease of use (Davis, 1989; Venkatesh & Davis, 2000). The Technology Acceptance Model (TAM) remains one of the most robust frameworks for examining these determinants of technology adoption in educational contexts. Studies have applied TAM across diverse learning environments, including e-learning platforms, virtual laboratories, and simulation tools, revealing that user acceptance significantly predicts sustained use and educational impact (Teo, 2019; Ifinedo, 2017; Fussell & Truong 2021; Musa et al. 2023).

In technical and vocational education, technology-mediated learning environments have proven effective in improving student motivation, engagement, and practical proficiency (Crawford et al., 2022; Application & effect of VR in vocational education 2024). Tools such as programmable logic controllers, automation trainers, and simulation kits have been shown to promote skill transfer and confidence in laboratory-based learning (Abidin & Idris, 2021; Cheng & Yeh, 2019). However, most of these studies have focused on digital or software-based platforms, with limited exploration of hardware-based instructional technologies such as lighting system trainers (Sui et al., 2022; Hands-on & Virtual Labs in Electronics 2023).

Moreover, while TAM has been extensively validated across various educational settings, contextual factors such as institutional support, cultural environment, and localised technological innovations remain underexplored in the literature (Sánchez-Prieto et al., 2019; Wong et al., 2020; Longitudinal perspectives on tech acceptance 2024). This highlights the need for empirical investigation into user acceptance of locally developed instructional tools within technical education programmes.

Despite the proliferation of technology in education, little is known about how students and instructors perceive and accept hardware-based instructional technologies designed for hands-on learning. Most previous research has concentrated on software applications and online platforms, leaving a gap in understanding the acceptance of physical instructional devices like the ILST. Additionally, there is limited empirical evidence from Philippine higher education institutions assessing how TAM constructs, perceived usefulness, perceived ease of use, attitude toward use, and behavioural intention, influence the adoption of such innovations in technical-vocational training.

Addressing this gap is crucial, as user acceptance determines not only the effectiveness but also the sustainability of integrating new teaching technologies into the curriculum. Without empirical data on ILST acceptance, institutions risk under-utilising valuable educational innovations that could enhance technical competency and teaching efficiency (Charting the Future of Maritime Education 2024; Utilising Virtual Worlds for Training Professionals 2025).

This study aims to assess the acceptance of the Innovative Lighting System Trainer (ILST) among students and instructors of the Bachelor of Industrial Technology major in Electrical Technology at North Eastern Mindanao State University – Cantilan Campus. Guided by the Technology Acceptance Model (TAM), the study seeks to determine how perceived usefulness, perceived ease of use, and attitude toward the ILST influence users' behavioural intention to adopt the tool in instructional and learning contexts.

Specifically, the study intends to:

1. Describe the respondents' perceptions of the ILST in terms of perceived usefulness, perceived ease of use, attitude toward use, and behavioral intention;

2. Determine the relationships among the TAM constructs as they apply to the ILST; and

The study's findings are expected to provide empirical evidence supporting technology integration in technical-vocational programs, offering insights for curriculum developers, educators, and policymakers seeking to enhance practical training through innovative instructional systems.

LITERATURE REVIEW

Technological innovations have transformed the pedagogical landscape of technical and vocational education, enabling students to acquire practical skills through simulated and interactive learning environments. The integration of technology-driven instructional tools, such as the Innovative Lighting System Trainer (ILST), plays a vital role in improving students' hands-on competencies, engagement, and conceptual understanding. This review synthesizes relevant studies on technology acceptance, educational technology integration, and hands-on training tools, organized around the key constructs of the Technology Acceptance Model (TAM) — perceived usefulness, perceived ease of use, attitude toward use, and behavioral intention.

Technology Acceptance in Education

The Technology Acceptance Model (TAM) proposed by Fred Davis (1989) remains a foundational framework for examining user adoption of technological innovations. It posits that an individual's intention to use technology is primarily determined by perceived usefulness (PU) and perceived ease of use (PEOU). In the context of education, TAM has been widely applied to explore adoption behaviours among teachers and students across e-learning, simulation, and laboratory technologies. Recent studies highlight that users are more likely to embrace educational technologies when these tools are relevant, efficient, and supportive of learning outcomes (Lin et al., 2023; Antonietti et al., 2022). In technical education, the success of an instructional device like ILST depends on users' recognition of its capacity to enhance skill acquisition and simplify complex training tasks (Cattaneo & Rauseo, 2025).

Perceived Usefulness and Educational Impact

Perceived usefulness refers to the degree to which a person believes that using a system will enhance their performance. In engineering and technical education, tools that simulate real-world equipment such as lighting trainers, PLC simulators, and automation kits allow learners to practice safely and repeatedly. Research shows that such tools significantly improve concept mastery and procedural confidence (Edumadze et al., 2022; Anwar et al., 2023). Furthermore, the perceived usefulness of technology-based trainers often increases when the tools are aligned with curricular goals, reduce laboratory costs, and bridge theory–practice gaps (Pertiwi et al., 2023). These findings support the integration of ILST as a valuable medium for strengthening practical learning.

Perceived Ease of Use and User Experience

Ease of use reflects the extent to which users find a technology simple and effortless to operate. In the educational context, intuitive and user-friendly designs are essential to ensure efficient learning experiences (Chen et al., 2025). Studies reveal that training support, interface design, and prior exposure to similar technologies strongly influence ease of use perceptions (Lin et al., 2023). For the ILST, minimizing complexity and ensuring accessible operation are crucial for fostering user confidence and sustained utilisation among students and instructors in electrical training.

Attitude Toward Use and Behavioral Intention

Positive attitudes toward technology significantly enhance behavioural intention to adopt it. Users who perceive educational technologies as beneficial and easy to use tend to exhibit greater motivation and long-term adoption (Siliņa-Jasjukeviča et al., 2025; Cattaneo et al., 2025). Within technical education, favourable attitudes toward instructional innovations correlate with improved engagement, self-efficacy, and satisfaction (Msimango et al., 2024). Instructors' willingness to incorporate the ILST in laboratory teaching also influences students' behavioural intention, highlighting the importance of institutional support and professional development (Giac et al., 2025).

Educational Technology in Hands-On Learning

Hands-on training tools are integral to competency-based technical education. Research underscores their role in providing authentic, safe, and controlled environments where learners can experiment with electrical systems without real-world risks (Zhang et al., 2025; Msimango et al., 2024). The adoption of smart trainers like ILST

aligns with the constructivist learning paradigm, enabling students to apply theoretical concepts through practice. Studies confirm that such interactive tools improve retention, motivation, and practical skill proficiency (Exploring Hands-On Activities in Cambodia, 2024).

Critical Analysis

While previous studies confirm TAM's effectiveness in explaining technology acceptance, most have focused on digital learning systems (e.g., LMS platforms, MOOCs, virtual labs) rather than hardware-based instructional trainers. This indicates a research gap in tangible, hands-on technologies used in technical education. Moreover, contextual factors such as institutional readiness, curriculum alignment, and instructor competency are often underexplored in TAM-based educational models (Antonietti et al., 2022). There is also limited evidence from Philippine or Southeast Asian contexts addressing the acceptance of localised instructional innovations like the ILST.

Theoretical Framework

This study is anchored on TAM. The model posits that two primary constructs, Perceived Usefulness (PU) and Perceived Ease of Use (PEOU), directly influence an individual's Attitude Toward Use, which in turn determines Behavioural Intention to Use. Applied to the ILST, TAM provides a robust framework to analyse how students and instructors evaluate its functional efficiency and usability, ultimately shaping their intention to adopt it in training.

METHODOLOGY

Design

This study employed a descriptive research design to examine the acceptance of the Innovative Lighting System Trainer (ILST) among electrical technology students. The design was selected for its suitability in providing an accurate representation of current perceptions and acceptance levels without manipulating variables. This approach allowed the researchers to systematically describe how users perceive and intend to adopt the ILST as an instructional innovation.

Locale

The study was conducted at North Eastern Mindanao State University – Cantilan Campus, located in Pag-antayan, Cantilan, Surigao del Sur, Philippines. The university offers programs in industrial and technical education, providing an ideal environment for evaluating the ILST's applicability. The setting was chosen because it integrates both theoretical and practical components of electrical technology education, enabling direct assessment of the trainer's educational value.

Respondents

The study involved a total of 150 respondents, comprising students from the Bachelor of Industrial Technology major in Electrical Technology program at North Eastern Mindanao State University – Cantilan Campus. Participants were selected using purposive sampling, targeting individuals with direct exposure to or experience with electrical training tools. Inclusion criteria required respondents to be currently enrolled or actively teaching in the Electrical Technology program. Participation was voluntary, and anonymity was strictly maintained throughout the research process.

Instrument

Data were collected using a structured questionnaire developed based on the Technology Acceptance Model (TAM) proposed by Davis (1989). The instrument was designed to assess user acceptance and behavioral intention toward the Innovative Lighting System Trainer (ILST), a technology-based instructional tool for enhancing hands-on learning in electrical education. The questionnaire consisted of the core constructs of TAM, including *Perceived Usefulness, Perceived Ease of Use, Attitude Toward Use,* and *Behavioral Intention*.

To ensure content validity and contextual relevance, the questionnaire was adapted and modified from several previously validated instruments used in studies on technology acceptance in education and applied technology contexts. Expert validation was conducted by three faculty specialists in educational technology. Pilot testing with a small group of electrical technology students yielded a Cronbach's alpha of 0.89, indicating high internal consistency and reliability.

Data Gathering Procedure

Prior to data collection, ethical clearance was obtained from the university's research ethics committee. Permission to conduct the study was formally requested from the program chair of the Electrical Technology department. After approval, questionnaires were distributed to qualified respondents through classroom visits and scheduled sessions. Participants were briefed on the study's objectives, procedures, and confidentiality protocols. Informed consent was obtained prior to participation. Completed questionnaires were collected, encoded, and organized for statistical analysis. All data were stored securely and used exclusively for research purposes.

Data Analysis

The data were analyzed using descriptive statistical techniques, including means and standard deviations, to describe respondents' levels of acceptance across TAM constructs. Inferential analyses, such as correlation analysis, were employed to examine relationships among perceived usefulness, ease of use, attitude, and behavioral intention toward ILST utilization. These analytical methods were chosen for their appropriateness in quantifying perception-based data and identifying key factors influencing acceptance levels.

Ethical Considerations

The study adhered to established ethical research standards. All participants provided informed consent prior to data collection and were assured of the confidentiality and anonymity of their responses. Participation was entirely voluntary, and respondents were informed that they could withdraw from the study at any time without penalty. No personally identifiable information was collected. Data were securely stored in password-protected files and used solely for academic and research purposes.

RESULTS

Acceptability of the Innovative Lighting System Trainer (ILST)

Table 1 presents the respondents' perception of the acceptability of the Innovative Lighting System Trainer (ILST) based on the four Technology Acceptance Model (TAM) constructs: perceived usefulness, perceived ease of use, attitude toward use, and behavioral control.

Respondents rated the ILST as "Very Highly Acceptable" overall (Grand Weighted Mean = 4.37), indicating strong agreement with the positive statements across all constructs. The construct perceived usefulness obtained the highest mean score (4.53, SD = 0.39), suggesting that students recognized the ILST's capacity to enhance learning efficiency, safety, and technical competence. The statement *"Using the ILST will enhance my learning and technical skills"* received the highest mean within this dimension (4.77, SD = 0.59).

Attitude toward use ranked second (Mean = 4.47, SD = 0.44), reflecting favorable affective responses toward adopting the ILST in training. The highest-rated item in this category was *"I believe that using the ILST is a good idea"* (Mean = 4.76, SD = 0.46).

Behavioral control followed with a mean of 4.30 (SD = 0.39), implying that respondents generally perceived sufficient control and confidence in using the ILST, supported by the availability of resources and technical support.

Finally, perceived ease of use recorded the lowest—but still "Highly Acceptable"—mean score (4.21, SD = 0.58), indicating that while respondents found the ILST manageable, a small proportion perceived some operational challenges or learning curve during initial use

Table 1. Acceptability of the Innovative Lighting System Trainer Based on TAM Constructs

Statements	**Weighed Mean**	**Standard Deviation**	**Interpretation**
PERCEIVED USEFULNESS			
Using the Innovative Lighting System Trainer (ILST) will enhance my learning and technical skills.	4.77	0.5924	Very Highly Acceptable
The ILST will improve the quality of my training and skill development.	4.36	0.6783	Very Highly Acceptable
I believe the ILST will help me complete tasks more efficiently.	4.54	0.6306	Very Highly Acceptable
The ILST will reduce learning difficulties and allow me to train for longer periods comfortably.	4.33	0.6919	Very Highly Acceptable
I believe that using the ILST will increase my confidence in electrical installations.	4.53	0.6722	Very Highly Acceptable
The ILST will allow me to train more effectively with fewer interruptions due to errors or uncertainties.	4.38	0.6311	Very Highly Acceptable
The design of the ILST will significantly improve my learning experience.	4.59	0.6151	Very Highly Acceptable
I believe that the ILST will be valuable for both basic training and advanced learning.	4.57	0.6176	Very Highly Acceptable
The ILST will contribute to a safer learning environment by reducing the risk of electrical accidents.	4.67	0.585	Very Highly Acceptable
Average Weighted Mean	4.53	0.3864	Very Highly Acceptable
PERCEIVED EASE OF USE			
Learning to operate the ILST will be easy for me.	4.13	0.7015	Highly Acceptable
I find the ILST easy to use.	4.19	0.7631	Highly Acceptable
I believe I can become skillful in using the ILST quickly.	4.33	0.7641	Very Highly Acceptable
It would be easy for me to get the ILST to function as needed.	4.33	0.7188	Very Highly Acceptable
The features of the ILST are straightforward and easy to understand.	4.24	0.8166	Very Highly Acceptable

I believe that using the ILST would not require a lot of effort.	4.17	0.8414	Highly Acceptable
The instructions and guidelines for using the ILST are clear and easy to follow.	4.15	0.8171	Highly Acceptable
I believe I could troubleshoot and solve problems that arise while using the ILST.	4.1	0.8089	Highly Acceptable
I will be able to use the ILST without needing much assistance.	4.25	0.8105	Very Highly Acceptable
Average Weighted Mean	4.21	0.5766	Highly Acceptable
ATTITUDE TOWARD USE			
I believe that using the ILST is a good idea.	4.76	0.4588	Very Highly Acceptable
Using the ILST would make my training more engaging and interactive.	4.54	0.5979	Very Highly Acceptable
I like the idea of using the ILST to enhance my technical skills.	4.47	0.6622	Very Highly Acceptable
I have a positive attitude toward incorporating the ILST into my learning process.	4.46	0.6306	Very Highly Acceptable
The ILST will positively influence my learning experience.	4.28	0.7519	Very Highly Acceptable
I would feel comfortable using the ILST regularly.	4.41	0.7151	Very Highly Acceptable
Using the ILST will make my training more interesting and engaging.	4.51	0.6927	Very Highly Acceptable
Overall, I am enthusiastic about using the ILST.	4.37	0.7456	Very Highly Acceptable
Average Weighted Mean	4.47	0.4442	Very Highly Acceptable
BEHAVIORAL CONTROL			
I have full control over whether I will use the ILST.	4.39	0.6323	Very Highly Acceptable
I feel confident in my ability to use the ILST effectively.	4.43	0.5947	Very Highly Acceptable
I have access to the resources (e.g., training, support) needed to use the ILST.	4.3	0.6731	Very Highly Acceptable
I have the necessary knowledge and skills to operate the ILST.	4.14	0.5911	Highly Acceptable

The availability of the ILST is within my control.	4.27	0.6203	Very Highly Acceptable
I can easily access technical support if I encounter any issues with the ILST.	4.19	0.8305	Highly Acceptable
External factors, such as classroom setup or availability of equipment, will not prevent me from using the ILST.	4.23	0.6036	Highly Acceptable
I have the flexibility to decide when and how to use the ILST.	4.35	0.6129	Very Highly Acceptable
I feel capable of overcoming any challenges related to using the ILST.	4.41	0.6151	Very Highly Acceptable
Using the ILST is entirely within my personal control.	4.35	0.6568	Very Highly Acceptable
Average Weighted Mean	4.3	0.3943	Very Highly Acceptable
Grand Weighted Mean Interpretation	4.37		Very Highly Acceptable
Legend: 4.24 – 5.04 – Strongly Agree; 3.43 – 4.23 – Agree; 2.62 – 3.42 – Neutral; 1.81 – 2.61 – Disagree; 1.00 – 1.80 – Strongly Disagree			

Correlation Among TAM Constructs

Table 2 displays the Pearson correlation coefficients among the TAM constructs. The results show varying degrees of association between the variables.

A strong positive and statistically significant correlation was found between *Perceived Usefulness* and *Attitude Toward Use* ($r = 0.7608$, $p < 0.001$), indicating that students who perceived the ILST as useful also held favorable attitudes toward its adoption. Similarly, *Perceived Usefulness* was strongly and significantly correlated with *Behavioral Control* ($r = 0.6243$, $p < 0.001$).

A moderate correlation between *Perceived Usefulness* and *Perceived Ease of Use* ($r = 0.4055$, $p = 2.629$, not significant) suggests that perceived ease does not necessarily determine usefulness in this context. Meanwhile, *Perceived Ease of Use* correlated weakly but significantly with *Attitude Toward Use* ($r = 0.2352$, $p = 0.0038$), indicating a smaller yet meaningful influence.

All other relationships among constructs (e.g., *Ease of Use* and *Behavioral Control*, *Attitude Toward Use* and *Behavioral Control*) demonstrated strong, positive, and significant correlations, confirming the interdependence of the constructs within the TAM framework.

Table 2. Correlation Matrix Among TAM Constructs

Relationship	**Pearson r**	**p-value**	**Interpretation**
Perceived Usefulness vs. Perceived Ease of Use	0.4055	2.629	Moderate correlation, not statistically significant
Perceived Usefulness vs. Attitude Toward Use	0.7608	0	Strong positive correlation, statistically significant

Perceived Usefulness vs. Perceived Behavioral Control	0.6243	0	Strong positive correlation, statistically significant
Perceived Ease of Use vs. Attitude Toward Use	0.2352	0.0038	Weak positive correlation, statistically significant
Perceived Ease of Use vs. Perceived Behavioral Control	0.6742	0	Strong positive correlation, statistically significant
Attitude Toward Use vs. Perceived Behavioral Control	0.6258	0	Strong positive correlation, statistically significant

DISCUSSION

The findings demonstrate robust acceptance of the Innovative Lighting System Trainer among students at North Eastern Mindanao State University. The results affirm the core postulates of the Technology Acceptance Model (TAM) originally proposed by Fred Davis (1989), emphasising that perceived usefulness and attitude toward use are primary determinants of technology adoption.

The very high perceived usefulness (M = 4.53) underscores that students recognise the ILST as an effective tool for enhancing technical proficiency, aligning with recent evidence that usefulness significantly predicts behavioural intention (for example, in modelling metaverse adoption: Al-Barghothi et al., 2023). Similarly, the strong correlation between perceived usefulness and attitude toward use (r = 0.7608) supports prior findings that favourable beliefs about a technology's utility translate into positive affective responses (Yao & Liu, 2025).

While perceived ease of use received slightly lower ratings, it still met the "Highly Acceptable" threshold. This mirrors recent observations that ease of use may be less influential when the benefits of the technology are clearly perceived (Birhanemeskel, 2025). The moderate, non-significant correlation between usefulness and ease of use (r = 0.4055) further implies that students value ILST's functionality more than its simplicity—an observation consistent with utilitarian technology adoption settings (Hasan et al., 2023).

The strong positive associations between behavioural control (i.e., users' sense of autonomy and confidence) and other constructs highlight users' confidence and autonomy in operating the ILST, echoing extensions of TAM that integrate constructs from the Theory of Planned Behavior (Ajzen, 1991; Stöckl & Struck, 2025). When users feel capable and supported, their likelihood of consistent usage increases.

These results suggest that training interventions and structured orientation programmes focusing on the ILST's functional benefits and operational mastery could sustain and enhance acceptance. Emphasising perceived usefulness through applied exercises and demonstrations may reinforce positive attitudes and behavioural intentions. At the same time, ensuring that ease of use remains sufficient (through user-friendly design and support) will help maintain momentum for adoption.

The study's scope is limited to one university campus, restricting the generalisability of the findings. Future research may explore comparative analyses across institutions or integrate qualitative methods (e.g., interviews or focus groups) to capture deeper motivational insights. Longitudinal studies could also assess how sustained exposure influences behavioural intention and skill retention (Fatokun, 2025).

In summary, the study validates the relevance of the TAM constructs in evaluating educational technology adoption within technical training contexts. The ILST was widely perceived as useful, easy to use, and under the users' control, leading to positive attitudes and intentions toward utilisation. These insights contribute to evidence-based strategies for technology integration in engineering and vocational education.

CONCLUSIONS AND RECOMMENDATION

This study concludes that the Innovative Lighting System Trainer (ILST) demonstrates strong user acceptance, validated through consistently high ratings across all Technology Acceptance Model (TAM) constructs. Perceived usefulness emerged as the most dominant predictor of behavioral intention, indicating that learners' willingness to adopt the ILST is driven primarily by its capacity to enhance learning efficiency, confidence, and safety in technical practice. Significant correlations among perceived usefulness, attitude toward use, and behavioral control confirm the applicability of TAM within technology-driven instructional settings. These findings provide empirical support for the integration of interactive, simulation-based learning systems in engineering education to improve engagement and practical competence.

It is recommended that the ILST be formally implemented as a core instructional tool within technical training curricula, supported by structured faculty development and maintenance programs. Institutional policies should promote continuous evaluation of system usability, learner outcomes, and instructional integration to ensure sustained adoption. Future studies are encouraged to examine longitudinal effects, cross-campus applications, and qualitative learner experiences to deepen understanding of technology acceptance in educational innovation. Overall, the study affirms the ILST's pedagogical value and contributes evidence toward advancing the effective use of educational technologies in higher education.

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