DEVELOPMENT AND EVALUATION OF ACCEPTABILITY OF VEHICLE ELECTRICAL SECURITY SYSTEM TRAINER AS AN INSTRUCTIONAL TOOL IN TEACHING AUTOTRONICS

Joe Vane N. Antifuesto[1], Alenogines L. San Diego[2]
College of Science and Technology Education, University of Science and Technology of Southern Philippines,
C.M. Recto Ave., Lapasan, Cagayan de Oro City 9000
*Correspondence Tel.: +63 935 522 3206, *E-mail: [1]joevane.antifuesto@ustp.edu.ph

ABSTRACT *- Autotronics program was previously known to be the Automotive technology program. It is a new curriculum in USTP Cagayan de Oro city that adapts the outcome-based education (OBE) framework. As a new program, shortage of instructional material does happen. Preliminary survey was conducted on both USTP-Cagayan de Oro City Campus and Department of Education (DepEd), Cagayan de Oro city. These two institutions both have an automotive program. Results revealed that the vehicle electrical security system training material is unavailable. To address identify problem, the researcher develops a vehicle electrical security system trainer using ADDIE process. The study focuses on the development and level of acceptability in terms of Technical Values (Functionality, Aesthetics, and Safety). Thirty enrolled students in the Autotronics program, three USTPCDO instructors and two DepEd senior high school automotive instructors participated in the survey. Six academe and industrial expert evaluated the trainer. Overall, the results of data analysis revealed that the completed instructional trainer is highly acceptable. Discussion and recommendations for future studies are presented in the study.*

Keywords: BSAT, Design, Development, Acceptability, Autotronics, OBE, Vehicle Electrical Security System, ADDIE

INTRODUCTION

On the birth of Bachelor of Science in Autotronics program, where the program adapts the outcome-based education framework; it cannot be denied that shortage or unavailability of instructional materials does happen. It is to believed that well-designed school experience could transfer to help learner continue to learn once they left school [1]. Students who are engaged in learning displays productive achievement behaviors [2]. This is further validated by the comparison of Simulation-based Training and Lecture-based Education in Teaching Situation Awareness were simulation-based training outperforms lecture-based training in terms of learning overall situation awareness because it improves perception ability [3].

Autotronics program aims that the students acquire interest and excitement for the subject and/or procedure that is their conduit for acquiring new knowledge as they become more actively involved in learning process. The style of learning by doing is particularly enjoyable for students, and this procedure takes a hands-on approach to learning. Simulation and other constructivist teaching-learning methods are becoming increasingly popular [4]. Moreover, instructors in Autoronics program need to conduct interactive lessons especially on the course Vehicle Electrical Security System. Car alarm on the vehicle is designed to help car users to protect their cars from such incidents with the use of alarm and GSM module [5].

A preliminary interview was conducted to the Autotronics faculty in the USTP Cagayan de oro campus and DepEd Cagayan de oro Automotive faculty, it was found out that there is no available instructional material for vehicle electrical security system. This identified problem leads the students enrolled in the program perceived to be lack of laboratory activities and engagement in the learning process of the course. With this, the program perceived to produce unskillful students or products in Autotronics program particularly to vehicle electrical security system course.

To avoid such consequence, the researcher developed an instructional material using ADDIE process and evaluate the level of acceptability using an instrument of 5 point Likert scale.

The Development Model Framework

Many instructional designers and training developers use the ADDIE instructional systems design (ISD) methodology to create courses [6]. The term is an acronym for the five phases of developing training and performance support tools that it defines: Analysis, design, development, implementation, and evaluation are all steps in the process. The label's origins are unknown; however, the core Instructional Systems Design concepts are based on a model designed for the US armed services in the mid-1970s [7].

Analysis Phase

The main purpose in the Analysis phase is to identify the gap in teaching Autotronics program. On this phase, the researcher conducted a survey to the identify respondent's data that needs to be analyze such as: (a) the respondent's demographic profile; (b) the instructional materials (IMs), equipment used by instructors in teaching Vehicle Electrical Security System; (c) teaching strategies of the use of the available IMs when discussing the topic of Vehicle Electrical Security System; and (d) issues and problems encountered by instructors. On this phase the researcher barrows' an instrument used by Traodio Barbosa [8].

Design and Development Phase

During design phase, a task analysis or inventory (*from analysis phase*) is used as the first step in the design process. The researcher also identified the materials needed to be produced for the desired instructional material model. As the task analysis completed, the research identified the component that need to be incorporate in designing an instructional model that fits to the need of the course.as the result on this phase, the researcher created a blue print or detailed sketch for the proposed trainer model. The researcher evaluated the design process and finished goods before moving on to development in order to continue the formative evaluation [9]. In the development phase, the researcher carefully follows the procedure and blue print or sketch that is produced in design phase in integration of components, assembling, and development of instructional model. Conclusive part of the development phase was the

test run of the trainer in terms of *Technical Values* (functionality, aesthetics & safety).

Implementation and Evaluation

Every designer seeks confirmation that the educational material they have created is valuable [10]. On the Autotronics program is a new program as a replacement of Automotive technology program in college of technology in USTP Cagayan de Oro City that adapts the Outcome-based education (OBE) framework. As a new program, it cannot be denied that unavailability of trainer is a problem in its implementation. The skills and conceptual understanding of the student on Vehicle Electrical Security System and the necessity of integrating interactive trainer in Vehicle Electrical particularly in Vehicle Electrical Security System will always be accounted in this study. To address the identified problem, the researcher developed a trainer model and scrutinized. Specifically, it aims to answer the following question: what is the level acceptability of the vehicle electrical security system trainer according to functionality, aesthetics, and safety.

METHODOLOGY

Research Design

To address the identified problem on this study, the study utilized descriptive research method. The descriptive method in education research is described in the dictionary of education as "the general procedure adopted in studies that have as their main objective the description of phenomena, in contrast to determining what cause them or what their value and significance are" [11].

Research setting and respondents of the study

The study is conducted at the College of Technology, University of Science and Technology of Southern Philippines, Cagayan de Oro city campus. The respondents of the study were three expert faculty member from the college of technology, two expert faculty from DepEd Cagayan de Oro city and one expert from expert from automotive industry. They were purposely selected based on the year of experience in the area of automotive.

Research Instrument

The research instrument used in the study was composed of *Technical Values* such as functionality, aesthetics, and safety of

the developed trainer model. The instrument was adopted from the study of Barbosa [12]. Each item is measured using 5 points Likert Scale. Table 1 shows the Range of Values and Descriptive Equivalent for the Mean.

Table 1. *Range of Values and Descriptive Equivalent basis for Data Analysis*

Numerical Scale	Range of Values	Descriptive Equivalent
5	4.24-5.00	Highly Acceptable
4	3.43-4.23	Acceptable
3	2.62-3.42	Moderately Acceptable
2	1.81-2.61	Fairly Acceptable
1	1.00-1.80	Not Acceptable

Data collection

implementation and evaluation phase, the proposed trainer's functionality, aesthetics and safety will be assessed. This will be done using an evaluation instrument that will be provided to the respondents.

Statement of the Problem

The conduct of *Technical Values* test on the vehicle electrical security system trainer is one of the critical aspects of competency. During the data collection, the purposely selected experts were given a formal invitation letter to participate and rate the developed trainer model. The experts were invited in the college of technology laboratory to physically manipulate and evaluate the trainer base on the *Technical Values* such as functionality, aesthetics, and safety. After the expert evaluate the trainer using the *Technical Values* instrument, the instrument was collected by researcher to prepare for data analysis.

Data Analysis

The data gathered in this study were analyzed using Mean and Standard Deviation. The basis for analysis of the mean score is presented in Table 1.

Prototype Development

The Analysis Phase

Secondary teachers in DepEd with high school technical vocational livelihood (TVL) strands and Higher Education Institution were included in the interview in gathering primary data about the available automotive laboratory resources, pedagogic practices, and instructional materials. The result of the analysis phase will serve as one of the sources in the design of the trainer. The distributed survey questionnaire determines the availability and unavailability of trainers in vehicle electrical security system. On the survey conducted, the result reveals that ninety (90) percent of the faculty/teacher revealed the unavailability of the vehicle electrical security system trainer and ten (10) percent claimed the presence of Power Window Trainer in their respective laboratory. The Autotronics program is found to have the inadequacy of instructional security training components for vehicle electrical security system courses.

With this present scenario, many automotive students feel that automotive electrical troubles are very complicated and beyond their knowledge [13].Instructors in Autotronics program need to conduct interactive lessons especially on the course vehicle electrical security system. With those identified challenges in the field of BS Autotronics program, the researcher finds a need of instructional materials for Alarm, Power Window and Central/Power Locking Systems.

The study premises are to address and to adopt a pedagogical trainer for the vehicle electrical security system trainer as a pedagogical tool in teaching Automotive Basic Electrical Security System Servicing and Installation (ABESSSI).

The Design and Development Phase

The researcher correspondingly conducted benchmarking on the existing instructional trainer. This is similarly another basis in the design of the instructional trainer. The design is evaluated by experts in terms of level of acceptability using a survey instrument for assessing *"Technical Values"* [8]. The assessment on the design likewise considers its

relevance in relation to the Autotronics curriculum program. The researcher reviewed and revised the project according to feedback. The development phase includes; procurement of materials, fabrication of the design trainer, integration and assembly of the design components, testing the functionality of the trainer. After completing the development of the course material, the researcher conducted an imperative pilot test. This is carried out by involving key stakeholders and rehearsing the course material. On the implementation and evaluation phase, the proposed trainer's level of acceptability is assessed. This was done using an evaluation instrument that will be provided to the respondents.

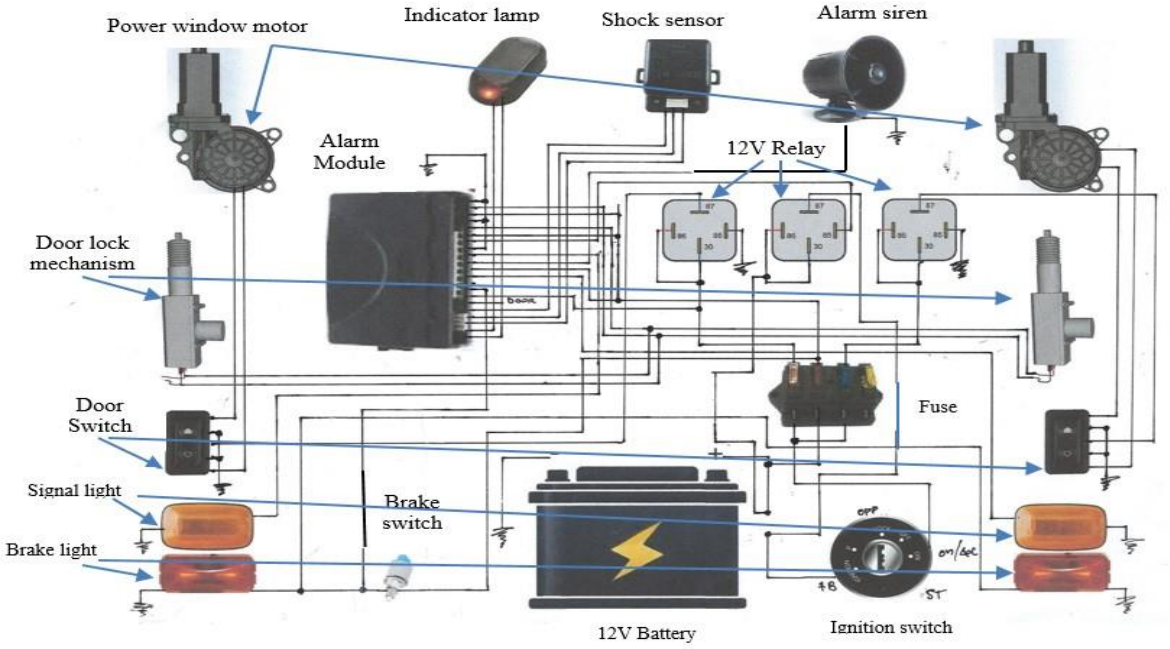

Figure 1. Wiring Diagram on The Vehicle Electrical Security System Trainer

Circuit diagram and Prototype specification

Figure 1 presents the operational wiring diagram of the proposed Vehicle Electrical Security System Trainer using the actual size of the front door panel LH & RH of a sedan and a complete set of an alarm module of a sedan. The study simulates the actual operation of the vehicle electrical security circuit connection and functions. The researcher uses the Tiger Alarm Module that serves as microprocessor that processes the voltage signal for the operations of the vehicle alarm system and vehicle door lock system. This research is expected to deliver and produce a trainer of vehicle electrical security system that simulates the circuit diagram and actual function of a real vehicle as a tool in teaching Autotronics. This trainer or simulation tool will likely create a positive impact for the Autotronics students because it mimics the actual size of door panel used and actual functions of circuit diagrams [14]. In consideration of aesthetics, the trainer measures in 164cm in height, 130cm in length, 135cm in width and 27kgs in weight with 4 roller wheel caster. The pre-program car alarm module that runs the entire vehicle keyless entry system and security alarm system is necessary for the suggested trainer since it functions just like a real vehicle car alarm microprocessor. It has the capacity to lock and unlock vehicle doors using a remote fob. When locking or unlocking the vehicle, the side lights will flash. It has a pop output, remote boot, car locator function, and car immobilizer [15]. Additionally, the alarm module features a silent arm function, a shock sensor, a 120 dB extra loud siren, Anti-hijack, an emergency disarms, valet mode, power off memory, 10 programmed modes, and auto window closing.

Development Process of the Trainer

In the development of the trainer, there were two phases; First is the assembly of the design components which is shown in figure 2, and second is the integration of the systems and circuits. After completing the development of the course material, the designer conducted an imperative pilot test; this was carried out by involving key stakeholders and rehearsing the course material.

Figure 2. Assembly of the Design Components

Implementation and Evaluation Phase

The implementation phase comes after the development phase. On this stage, the researcher presented the developed trainer to the respondents involve of the study for their evaluation and recommendation for any improvement or modification on the trainer [16]. The trainer will be evaluated based on its acceptability in terms of Technical Values as an instructional trainer.

Evaluation on the Acceptability of the Trainer

Indicator	Question Items	Mean	SD	Descriptive Equivalent
Functionality	The design highly provides the full functionality according to known criteria.	4.67	0.82	Highly Acceptable
Aesthetics	The design contributes significantly to the overall aesthetics of the device.	5.00	0.00	Highly Acceptable
Safety	The design significantly increases the safety use of the device.	5.00	0.00	Highly Acceptable
	Overall	**4.89**	**0.27**	**Highly Acceptable**

RESULTS OF THE DATA ANALYSIS

In determining the acceptability of the trainer, the respondents evaluated the instructional trainer's design based on its technical values such as functionality, safety, and aesthetics are all evaluated technically. The summary result and the findings of the data analysis are presented in the Table 2 were the developed trainer is evaluated with a rating of Highly Acceptable in terms of Functionality *(M=4.67, SD=0.816).*

Table 2. *Data Results of the Overall Mean of the Technical Values Assessment*

Meanwhile, the developed trainer evaluated with a perfect rating of Highly Acceptable in terms of Aesthetics *(M=5.00, SD=0.000),* and Safety Features *(M=5.00, SD=0.000)*. Overall results revealed the Highly Acceptable level of acceptability as indicated by the overall mean of 4.89 and standard deviation of 0.27.

CONCLUSION

The study presents the innovative instructional tool or material to be utilized in teaching Autotronics program. The uniqueness of the instructional tool is that, it mimics the actual functionality and operations of vehicle electrical security system (power window, keyless entry, & alarm) for laboratory activities of the students. It allows the student to safely do self-pacing on the course of laboratory activities. The instructional tool has unique features that let the student experience the real-life vehicle electrical security system servicing. Furthermore, the design of the trainer model highly provides the full functionality according to known criteria. The designed trainer model contributes significantly to the overall aesthetics of the device and is significantly increases the safety use of the device.

RECOMMENDATION

Even the trainer receives the high level of acceptability, the trainer still needs to be developed in terms of its functionality features. During the evaluation of the trainer the expert recommends to improve the manual switch window glass into automatic window glass switch and automatic door locking system.

REFERENCES

[1] D. L. Schwartz, J. D. Bransford and D. Sears, ""Efficiency and innovation in transfer."," *Transfer of learning from a modern multidisciplinary perspective,* vol. 3, no. 1, pp. 1-51, 2005.

[2] D. H. Schunk and C. A. Mullen, "Self-Efficacy as an Engaged Learner," *Springer, Boston, MA.*, no. 1, pp. 219-235, 2012.

[3] A. L. Chang, A. A. Dym, C. Venegas-Borsellino, M. Bangar, M. Kazzi, D. Lisenenkov, N. Qadir, A. Keene and L. A. Eisen, "Comparison between simulation-based training and lecture-based education in teaching situation awareness. A randomized controlled study," *Annals of the American Thoracic Society,* vol. 14, no. 4, pp. 529--535, 2017.

[4] N. A. Aguado, "Teaching research methods: Learning by doing," *Journal of Public Affairs Education,* vol. 15, no. 2, pp. 251--260, 2009.

[5] Y. Faridah and W. A. A. W. A. Rahman, "Car alarm detection device," *2016 IEEE Symposium on Computer Applications \& Industrial Electronics (ISCAIE),* vol. IEEE, pp. 195--199, 2016.

[6] H. Dong, "Adapting during the pandemic: A case study of using the rapid prototyping instructional system design model to create online instructional content," *The Journal of Academic Librarianship,* vol. 47, no. 3, p. 102356, 2021.

[7] K. H. Silber, W. R. Foshay, R. Watkins, D. Leigh, J. L. Moseley and J. C. Dessinger, "Origins and Evolution of Instructional System Design," *Handbook of Improving Performance in the Workplace,* Vols. 1-3, pp. 53-92, 2009.

[8] T. M. Barbosa and A. L. San Diego, "Design and Development of An Analog Multimeter Model For A Wider View In A Classroom Setting," *Science International,* vol. 34, no. 1, pp. 7-12, 2022.

[9] T. Dousay and R. Logan, "Analyzing and evaluating the phases of ADDIE," *Proceedings from Design, Development and Research Conference,* pp. 32--43, 2011.

[10] R. M. Gagne, W. W. Wager, K. C. Golas, J. M. Keller and J. D. Russell, "Principles of instructional design," *Wiley Online Library,* pp. 44-46, 2005.

[11] L. H. Johnson, "Limitations of The Descriptive Method," *The Phi Delta Kappan,* vol. 34, no. 6, pp. 241-242,245., 1953.

[12] T. M. Barbosa and A. L. San Diego, "5 Point Likert Scale, "Design and Development of An Analog Multimeter Model For A Wider View In A Classroom Setting."," *Science*

International, vol. 34, no. 1, pp. 7-12, 2022.

[13] A. D. Naelga and R. M. Chavez, "An Instructional Trainer Innovation for Automotive Lighting, Car Alarm, and Central Locking System," *Journal of Engineering and Applied Science,* vol. 12, no. 12, pp. 9331-9336, 2017.

[14] F. Aparicio, F. Jiménez and J. Sánchez, "Development and use of vehicle dynamics simulation software as support for road vehicles theory teaching," *Computer Applications in Engineering Education,* vol. 17, no. 4, pp. 467--478, 2009.

[15] V. K. Sehgal, M. Singhal, B. Mangla, S. Singh and S. Kulshrestha, "An embedded interface for GSM based car security system," *IEEE,* Vols. 2012 Fourth International Conference on Computational Intelligence, Communication Systems and Networks, pp. 9--13, 2012.

[16] M. Treser, "“Getting To Know ADDIE: Part 4 Implementation,”," *eLearning Industry,* p. 2015, https://elearningindustry.com/getting-know-addie-implementation.