

LIGHTING SYSTEM AND AIRCONDITIONING INSTRUCTIONAL TRAINER FOR AUTOMOTIVE TECHNOLOGY

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Abstract

This study determined the level of acceptability and efficiency of the automotive trainer system as instructional device as evaluated by the automotive instructors and students of Palompon Institute of Technology. Specifically, this study looked into the technical requirements in the construction of the device as to planning and designing, assembling, and installation of components; the level of acceptability and efficiency of the device in terms of design, adaptability and safety measures; the level of performance of students; and, the suggestions and recommendations to improve the trainer. This study employed a descriptive research design using the survey method. Survey questionnaire were used in gathering the necessary data. The major findings of the study are: In terms of acceptability, the respondents rated all components of the device in terms of design, adaptability and safety measures as highly acceptable and highly efficient. In terms of students' performance on the fourteen competencies, the trainer was highly acceptable and highly efficient in improving their competencies. It can be concluded that the automotive instructors and students of Palompon Institute of technology had evaluated the automotive lighting system trainer as highly acceptable and highly efficient to be used as an automotive instructional device. It was recommended that the manual for the Trainer be used as an instructional device in automotive classes.

Keywords: Mobile Airconditioning, Automotive Technology, Trainer System, Instructional Automotive Device

Introduction

Technical Education and Skills Development Authority (2018) implemented the competency standards entitled Basic competencies (Integrated with 21st Century Skills), 21st century skills are a wide set of knowledge, skills, work habits, and character traits that is very important to individuals' success in today's world. Life - long learning was one of the main goals of the trainers, instructors and technician which the learner able to understand the principles and operations of the components and how the technology does works. Innovation was one way of improving the existing system trainer and to compete in the fast evolving of technology in this modern day.

Fernandez, J.S, (2006) Individualized Trainer in Auto Lighting System needed to design and develop an instructional device used to identify the concepts of lighting system and providing knowledge in the lighting system of the vehicle. The use of the Trainer in Auto Lighting system will enhance the knowledge, abilities and skills of each learner. The study reveals also that the use of instructional devices as one of the instructional materials were recommended in different state universities and colleges offering automotive technology. It was recommended also to upgrade both learnings and skills in the lighting system was beneficial to the students and encourage them to excel their competitiveness to other students.

The mock-up trainer has a positive impact with the students' performance not only with the repair/testing or connecting but also the way how the students analyse/troubleshoot in case there's a short circuit in the lighting system trainer. Understanding the operations and principles will help to aid and enable to be more confident in performing various task related to instructional devices (Chavez, R.M., and Naelga, Arnelo D, 2017).

The trainer enabled them to gain practical experience in a controlled and safe environment, which prepares them for the challenges of the real-world scenarios (Tagle, 2023). The study reveals that the instructional trainer was an effective tool in teaching for the improvement in the curriculum instruction as one way to help the learners understand the principles and operations of each component to avoid necessary damage to the components.

Sec. Lapeña (2019) in his speech addressing the regional directors and other key officials of TESDA that they will strengthen the industry partnership in order to meet the demands of industry 4.0 and focus the curriculum industry-driven. To provide continuous training for all trainers with updated and good training equipment was being mentioned in his speech, which helped the trainers upgrade their knowledge and skills from old model to updated with electronic controlled technology in order to produce effective and highly skilled worker which has a higher percentage of employability in the industry around the world.

Technician, trainers and instructors of different state universities and colleges requires continuous training in order to couple up with the new trends of technology and to be able to promote and improve the system in which will compete in the modern world of technology. The solution is to develop a fully operational car lighting system trainer that will help to aid and understand the principles and operation of each component, enhance their technical skills, ability and obtain new knowledge in their field of expertise.

This instructional lighting system trainer will give a lot of benefits for classroom and curriculum instruction. There are several studies confirmed that using the instructional trainer, the learner able to performed and compete better compare to the learner who focus on theory. Technology students always performed various types of workshops and may encounter any kind of problem during their laboratory workshop. The effect is that the students must conduct troubleshooting and may replace or repair the damage wires or components of the system.

The main reason of this research, to be able to determine the effectiveness of the automotive lighting system and air conditioning as instructional device in automotive. To help the instructor initiate action plan for the improvement of the instructional material to be used in automotive and air-conditioning technology.

Objectives of the Study

This study determined the level of acceptability and efficiency of the automotive lighting system and air conditioning. Specifically, it sought to answer the following specific objectives:

1. What are the technical requirements in the construction of Automotive Lighting and Air conditioning System Trainer as to:
 - 1.1 design
 - 1.2 assembling and
 - 1.3 components
2. As evaluated by both experts and students, what is the level of acceptability and efficiency of the device as to:
 - 2.1 design,
 - 2.2 adaptability,
 - 2.3 safety measures?
3. What is the level of performance of students using the trainer along competency performance?

Methodology

This study employed a descriptive research design using the survey method. Survey questionnaire was used in determining the level of acceptability and efficiency of the automotive lighting and air conditioning system trainer as evaluated by the experts and students. The design was also used in describing the construction of the device as to the planning and designing, assembling and installation of components. Through this method, the objectives of the study were attained and an automotive lighting system trainer as instructional automotive device were proposed.

Respondents

The respondents of this study were; Instructors, 2nd year and the 3rd year students of Palompon Institute of Technology major in Automotive Technology. There 2 Instructors for Automotive Technology, 35 students for 2nd year, and 30 students for the 3rd year. The involvement of respondents in the TESDA Competency where the students must take the National Competency (NC) II assessment every year for the improvement of their technical skills related to automotive. The researcher selected all the population in order to identify if there was a lacking of instructional material that can be used in the near future of the students. Table below presents the distribution of the respondents.

Table 1. Distribution of Respondents

Respondents	Overall population (N)	Sample (n)
2 nd Year	35	35
3 rd Year	30	30
Instructors	2	2
TOTAL	67	67

Statistical Treatment of the Data

The data collected were tallied, tabulated and treated using the appropriate statistical treatment. The measurement indicators were used to make more discernible and understandable to the students.

The statistical formula used in this study was the weighted mean. This formula was used in computing for the level of acceptability and effectiveness of the automotive lighting and air conditioning system trainer. The following responses will have each own category: Weights, Scale and the Verbal Description. Each procedure to be employed were to determine the appropriate responses.

For the for the acceptability and efficiency, the following interpretations were used:

Weights	Scale	Verbal Description
4	3.26 – 4.00	Highly Acceptable/Efficient (HA/HE)
3	2.51 – 3.25	Moderately Acceptable/Efficient (MA/ME)
2	1.76 – 2.50	Acceptable/Efficient (A/E)
1	1.00 – 1.75	Not Acceptable/Efficient (NA/NE)

Results and Discussions

The results are discussed along with the technical requirements of the automotive lighting and air conditioning system trainer, its level of acceptability and efficiency as evaluated by both experts and students, and the performance of students who utilized the trainer.

Technical Requirements in the Construction of the Automotive Lighting and Air conditioning System Trainer

The trainer was designed to replicate real-world automotive trainer systems, including headlamps, tail lights, turn signals, brake lights, dashboard indicators and airconditioning system. The layout followed a modular format to allow easy troubleshooting and component replacement. Figure 1 present the schematic wiring diagram of the trainer system.

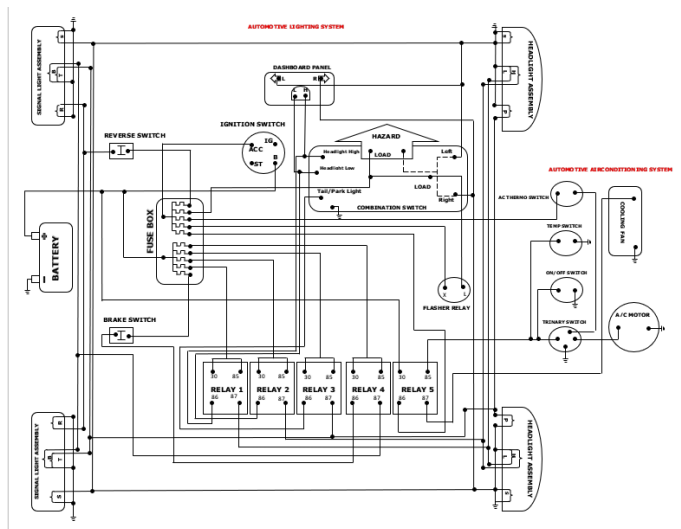


Figure 1. Schematic wiring diagram of trainer system

The assembly process included mounting the lighting components onto a steel table, wiring connections using standard color codes, and integrating fuses, relays, and switches. Industry-grade tools and materials were used to ensure durability and ease of instruction (figure 2).



Figure 2. Assembly of the trainer system

The main components included LED and halogen bulbs, toggle switches, multi-pin relays, resistors, fuses, and a 12V power source. Components were selected for their availability, compatibility, and instructional value. The trainer also included safety features such as a main circuit breaker and overcurrent protection.

Level of Acceptability and Efficiency

The level of acceptability and efficiency were evaluated after the researcher orient the respondents and let the respondents test the instructional device.

The results imply that the design is highly acceptable and efficient because of the following: drawing is simple and detailed, shows the individual dimensions of components, marketability, affordability, and availability of supplies, materials, components and accessories in the locality, rigidity and usefulness of the trainer, security in using the device, and enough time is needed in assembling the device.

All these factors are very important in the design of the automotive lighting and air conditioning system so that instructors will find it easy and efficient in teaching using the instructional device and the students, on the other hand, will find it comprehensible in learning and constructing the device.

Table 2. Acceptability and Efficiency in terms of Design

	DESIGN	Acceptability	Efficiency
1	Drawing is simple and detailed	3.75 (HA)	3.76 (HE)
2	Shown individual dimension of components	3.82 (HA)	3.69 (HE)
3	Marketability of supplies and materials in the locality	3.52 (HA)	3.55 (HE)
4	Availability components, accessories and materials	3.75 (HA)	3.70 (HE)
5	Supplies and materials are affordable	3.63 (HA)	3.63 (HE)
6	Rigidity of the trainer	3.70 (HA)	3.70 (HE)
7	Usefulness of the trainer	3.76 (HA)	3.66 (HE)
8	Security in using the instructional device	3.67 (HA)	3.61 (HE)
9	Enough time for assembling the device	3.52 (HA)	3.55 (HE)
10	Proper usage of the device	3.76 (HA)	3.76 (HE)
11	Safety practices <u>is</u> applied	3.84 (HA)	3.79 (HE)
Overall Weighted Mean		3.70 (HA)	3.67 (HE)

Table 3 presents the overall weighted mean for the acceptability in terms of adaptability is 3.76 which interpreted as highly acceptable. On the other hand, for its efficiency, it got a weighted mean of 3.72 interpreted as highly efficient.

Table 3. Acceptability and Efficiency in terms of Adaptability

ADAPTABILITY		Acceptability	Efficiency
1	Skills transfer to the actual competency application in the automobile	3.67 (HA)	3.66 (HE)
2	Instrument testing and its application to the lighting system of the car	3.79 (HA)	3.75 (HE)
3	Safety application in testing the lighting system in the car using the knowledge application of the trainer	3.82 (HA)	3.76 (HE)
Overall Weighted Mean		3.76 (HA)	3.72 (HE)

It can be noted that the automotive lighting system device is highly acceptable and highly efficient as an instructional device because of the following criteria: skills transfer to the actual competency application in the automobile, instrument testing and its application to the lighting system of the car, and safety application in testing the trainer system in the car using the knowledge application of the trainer.

Table 4. Acceptability and Efficiency in terms of Safety Measures

SAFETY MEASURES		Acceptability	Efficiency
1	Head lights remain intact after the operation	3.81 (HA)	3.78 (HE)
2	Signal and Hazards remain intact after the operation	3.82 (HA)	3.81 (HE)
3	Stop Light & Tail Light remain intact after the operation	3.75 (HA)	3.70 (HE)
4	Reverse light remains intact after the operation	3.82 (HA)	3.78 (HE)
5	Accessories remain in place after the operation	3.85 (HA)	3.79 (HE)
Overall Weighted Mean		3.81 (HA)	3.77 (HE)

For the safety measures, the device is highly accepted by the respondents with an overall mean of 3.81 and was found highly efficient with an overall mean of 3.77, both interpreted as high. The results imply that the respondents found the device highly acceptable in terms of safety measures because the head lights, signal and hazards, stop light and tail light, reverse light remain intact and accessories remain in place after the operation.

Level of Performance of Students using the Trainer

The level of performance of the students in using the trainer is evaluated using the component of operation in the questionnaire. Operations, in this study, refers to the performance of an actual work or something principle, process and cycle is applied. This data for operations is found in Table 5. There were fourteen (14) statements reflected in this component.

Table 5. Level of Performance of Students using the Trainer

	Competencies	Acceptability	Efficiency
1	Installing and connecting body lighting system	3.85 (HA)	3.74 (HE)
2	Inspecting circuit for loose connection, wrong connection and circuit faults (short circuit and grounded circuits).	3.58 (HA)	3.58 (HE)
3	Measuring reserve voltage of the battery using voltmeter.	3.58 (HA)	3.65 (HE)
4	Measuring input voltage of switches and relays using voltmeter.	3.69 (HA)	3.69 (HE)
5	Measuring input and output resistance of switches, relay and lighting system loads using ohmmeter.	3.69 (HA)	3.71 (HE)
6	Connecting, Testing and troubleshooting headlight circuit.	3.85 (HA)	3.80 (HE)
7	Connecting, Testing and troubleshooting park and taillights including plate light circuit.	3.72 (HA)	3.72 (HE)
8	Connecting, Testing and troubleshooting directional signal and hazard circuits.	3.77 (HA)	3.72 (HE)
9	Connecting, Testing and troubleshooting stop light circuit.	3.78 (HA)	3.80 (HE)
10	Connecting, Testing and troubleshooting reverse light circuit.	3.85 (HA)	3.82 (HE)
11	Connecting, Testing and troubleshooting panel instrument lights.	3.71 (HA)	3.75 (HE)
12	Observing correct handling of measuring instruments.	3.83 (HA)	3.72 (HE)
13	Observing orderliness in wiring harnessing.	3.75 (HA)	3.68 (HE)
14	Practicing aftercare of surrounding and tools at the end of activities.	3.88 (HA)	3.80 (HE)
	Overall Weighted Mean	3.75 (HA)	3.73 (HE)

The table shows the data on the performance of the students using the trainer. They evaluated the device in terms of operations as highly acceptable ($M=3.75$) and highly efficient ($M=3.73$). This implies that, in terms of operations of the device, the students found the device as highly acceptable and highly efficient in installing and connecting trainer system; connecting, testing, troubleshooting headlight circuit; observing correct handling of measuring instruments; practicing aftercare of surrounding and tools at the end of activities; and the like. In other words, the trainer system device has been highly accepted and is highly efficient in using as an instructional device.

Conclusion

It can be concluded that the automotive instructors and students of Palompon Institute of technology had evaluated the automotive lighting and air conditioning system trainer as highly acceptable and highly efficient to be used as an automotive instructional device.

Recommendation

It is recommended that the manual for the Automotive Lighting and air-conditioning System Trainer be used as an instructional device in automotive classes. Moreover, it is also recommended that instructors and future researchers improve the device for further innovations in the future.

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