

## The Acceptability of A Developed Fire Detection and Alarm System (FDAS) Trainer

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### ABSTRACT

The requirement of the government thru the Bureau of Fire Protection to install Fire Detection and Alarm Systems (FDAS) to high occupancy buildings or structures has raised the need of skilled workers to perform this task. To address this matter, Technical Skills Development Authority (TESDA) included in the Electrical Installation and Maintenance (EIM) NCII qualification the competency of FDAS installation, set-ups, and troubleshooting. With the inclusion of the FDAS in the said qualification a decline of passers was observed from July 2017 to December 2017. In response, the researcher developed a portable device to be utilized in facilitating a retentive means of teaching the required knowledge, skills and attitude of students in the wiring, installation and troubleshooting of FDAS and to encourage training institutions to incorporate this training device in their training programs and institution. This study evaluated the training device to determine its acceptability in premises of design, performance, and safety. The evaluation purposively involved seven senior high school faculty who were teaching electrical installation subjects in the Northeastern part of Leyte Province. A mean of 4.937 was obtained from the evaluation of the portable device, and affirmed that the FDAS Trainer is very acceptable to the evaluators. Having a very acceptable rating in the three criterions, it can be inferred that this portable trainer device can be used as an effective training device that can develop knowledge, skills, and attitude of students and trainees in electrical installation classes, auxiliary systems installation classes, and other allied electrical installation programs.

**Keywords:** FDAS; fire alarm; fire detection; alarm systems; trainer; technology development

### INTRODUCTION

Several policies were set by the 2008 Fire Code of the Philippines that tasks the Bureau of Fire Protection to enforce laws concerning fire safety for all establishments. One requirement to be compliant in this law is to install Fire Detection and Alarm Systems (FDAS) that will provide adequate warning to occupants that will save lives and properties.<sup>(1)</sup>

This FDAS comprises of a controller, detectors, audio and visual devices. The FDAS has been continuously innovated by many to meet the requirement of buildings or structures since it has first been introduced in 1980s.

Due to the enforcement of this law, the installation of FDAS has soared, and increased the need of skilled workers to install this system. To address the need, the Technical Skills Development Authority (TESDA) included the FDAS installation in one of the competencies for the Electrical Installation and Maintenance (EIM) NCII qualification. This qualification comprises of proficiencies that an individual must meet to qualify in the installation and maintenance of electrical equipment and systems that does not surpass 600 volts in buildings. The FDAS is usually rated 24volts, so the FDAS falls under the EIM NCII.<sup>(2)</sup>

With the inclusion of FDAS in the EIM NCII certification system since the late 2017. There has been a significant decline in the number of passers. Comparing a data from TESDA Leyte, the passing rate of the old EIM NCII from January 2017 to June 2017 was 99.03% and declined to 71.63% from July 2017 to December 2017 due to the implementation of the amended EIM NCII Training Regulation.<sup>(2)</sup>

Also, with the first-hand experience of the researcher as an assessor in EIM NCII of TESDA, it was observed that: (1) FDAS equipment were damaged and burnt due to incorrect wiring connection, screw terminals being loosened due to repetitive use, and fast disposal of materials; (2) it would take longer time for students to apply the FDAS concepts learned due to the traditional training process where students will have to strip wire and screw them to the terminals which prolong the training process.

This moved the researcher to develop a portable FDAS trainer to better aid in the training process with much lesser waste of consumables and better understanding of concepts. With this, the researcher developed a FDAS Trainer intended to respond the need of the EIM NCII program. Further, this also addressed the required abilities of trainees, and teachers in learning actual FDAS installation set-ups, wiring procedures, maintenance, and troubleshooting. This portable device will also serve as the stimulus of the learning process and absorbed learnings are the expected responses.

The study aimed to evaluate the acceptability of the developed FDAS Trainer device within the premise of Design, Performance, and Safety.

## METHODS

The evaluation purposively involved seven Senior High School Faculty who were handling electrical installation subjects in the Northeastern part of Leyte Province.

Through quantitative-evaluative design, the study sought to determine the acceptability of the FDAS Trainer device within the three pre-identified dimension. A five point Likert scale was used to obtain responses from five learning schools. Raters were asked to score the device as five (being the highest possible score) based on the design, performance, as well as safety, while one (being the lowest possible score) assigned to the same criteria. Consent forms were distributed to elicit approval for the conduct of the study. The researcher introduced the device in terms of its nature, feature, and manner of operation. A user's manual was handed over for free to reinforce the initial introduction on the developed FDAS Trainer. Lastly, the researcher provided the evaluation tool among respondents to document the degree of acceptability of the device.

## RESULTS

The five point Likert scale used is described as follows, Five – Very Acceptable, Four – Acceptable, Three – Moderately Acceptable, Two– Slightly Acceptable, and One – Not Acceptable.

Table 1. Results of evaluation for design

| Design criteria of the FDAS trainer                                              | Mean | Description     |
|----------------------------------------------------------------------------------|------|-----------------|
| General appearance of the frame / casing                                         | 5.00 | Very acceptable |
| Appropriateness of the materials used for the construction of the frame / casing | 5.00 | Very acceptable |
| Construction and appearance of the control panel                                 | 5.00 | Very acceptable |
| Lay-out of parts and associated wiring                                           | 4.86 | Very acceptable |
| Rigidity / sturdiness of the frame                                               | 5.00 | Very acceptable |
| Weight and mobility of the frame                                                 | 4.86 | Very acceptable |
| Total mean                                                                       | 4.95 | Very acceptable |

The table 1 displays the evaluation results of the FDAS trainer in terms of the six predetermined design criteria.

Table 2. Results of evaluation for criteria

| Performance criteria of the FDAS trainer   | Mean | Description     |
|--------------------------------------------|------|-----------------|
| Testing functional detectors and switches  | 5.00 | Very acceptable |
| Testing functional buzzer                  | 5.00 | Very acceptable |
| Testing functional strobe light with siren | 5.00 | Very acceptable |
| Testing single zone configuration          | 5.00 | Very acceptable |
| Testing two zone configuration             | 5.00 | Very acceptable |
| Testing power supply inputs                | 5.00 | Very acceptable |
| Total mean                                 | 5.00 | Very acceptable |

The results of the performance criteria of the FDAS trainer is shown in table 2, highlighting the homogenous result.

Table 3. Results of evaluation for safety

| Safety Criteria of the FDAS Trainer | Mean | Description     |
|-------------------------------------|------|-----------------|
| Mounting of parts and components    | 4.86 | Very acceptable |
| Wiring and connections              | 5.00 | Very acceptable |
| Access to controls and adjustments  | 4.86 | Very acceptable |
| Stability of the device             | 4.71 | Very acceptable |
| Use of protective devices           | 4.86 | Very acceptable |
| The frame is free from grounding    | 4.86 | Very acceptable |
| Total mean                          | 4.86 | Very acceptable |

The results of the safety criteria of the FDAS trainer is shown in table 3, which perceived to be very acceptable from the end user.

Table 4. Overall summary of the device

| FDAS trainer acceptability criteria | Mean  | Description     |
|-------------------------------------|-------|-----------------|
| Design                              | 4.95  | Very acceptable |
| Performance                         | 5.00  | Very acceptable |
| Safety                              | 4.86  | Very acceptable |
| Total mean                          | 4.937 | Very acceptable |

In table 4, the consolidated result on the acceptability of the FDAS Trainer is illustrated. All three areas were measured and therefore validated to be very acceptable.

## **DISCUSSION**

### **Design of the FDAS Trainer**

The results of the evaluation for the design criteria is shown in Table 1. The design of the FDAS Trainer is evaluated in terms of the general appearance of the frame/casing, appropriateness of the materials used for the construction of the frame/ casing, construction and appearance of the control panel, lay-out of parts and associated wiring, rigidity/sturdiness of the frame, and weight and mobility of the frame.

As a result of the evaluation, the general appearance of the frame/casing got a mean of 5.00. This rating of the evaluators is interpreted as very acceptable in terms of the general appearance of the frame/casing of the research project. Appropriateness of the materials used for the construction of the frame/casing got a mean of 5.00 from the senior high school faculty. This aspect of the design criteria is interpreted as very acceptable. This tells that the evaluators agreed that the use of the said materials for the construction of the frame/casing of the FDAS Trainer is well suited to the research project. The materials used is not too heavy for the FDAS Trainer to be portable. The material is also carefully chosen to ensure safety of the users without sacrificing its aesthetics.

For the construction and appearance of the control panel the FDAS Trainer got a mean of 5.00 also interpreted as very acceptable. The result thus tells that the FDAS Trainer is very acceptable in terms of the construction and appearance of the control panel. Another criterion for the design was the lay-out of parts and associated wiring. In this aspect, the FDAS trainer obtained a mean of 4.86 suggesting that the evaluators coincide the lay-out of the parts and associated wiring of the FDAS Trainer is very acceptable.

In terms of the rigidity/sturdiness of the frame, the FDAS Trainer got an average mean of 5.00. This result implied that the rigidity/sturdiness of the frame was very acceptable. Lastly, for the weight and mobility of the frame, the average mean for this design criteria is 4.86 interpreted as very acceptable.

In general, design of the FDAS instructional material was rated 4.95 interpreted as very acceptable. This result suggests that the design was highly accepted by the evaluators in terms of the above mentioned criterion of the design of the FDAS Trainer, efficiently serves its purpose. The researcher has considered ease of access in designing the instructional material which eliminate complexities in teaching FDAS concepts and processes, portability is another unique selling edge of this instructional material which makes it good for travel trainings. Ergonomics was also considered in its design as evident in the construction and appearance of the control panel and the layout of parts and associated wirings. Essentially, the design fits its purpose as an instructional material that could effectively inculcate learning of concepts and process and enhance student's skills for mastery.

### **Performance of the FDAS Trainer**

The FDAS Trainer was also evaluated in terms of its performance, Table 2 shows the result of the evaluation. Performance of the FDAS Trainer was evaluated in terms of functional detectors and switches, functional buzzer, functional strobe light and buzzer, testing single zone configuration, testing two zone configuration and power supply inputs.

In testing functional detectors and switches the evaluators rated its performance with a mean of 5.00. In terms of the functionality of the buzzer, it was rated with a mean of 5.00. The functionality of the strobe light

and siren was evaluated 5.00 by the senior high school faculty. The single zone configuration of the FDAS Trainer was tested and evaluated and fared an average mean of 5.00, all interpreted as very acceptable.

Another part of the device which has been tested and evaluated for its functionality is the two zone configuration. A mean of 5.00 was obtained from the evaluators. Also a crucial part of the FDAS Trainer that was evaluated was the power supply inputs, it was given an average mean of 5.00. Both being interpreted as very acceptable.

Overall the acceptability of the FDAS Trainer in terms of performance is 5.00 interpreted as very acceptable. Given this result, it is construed that all parts of the FDAS Trainer are functional. The result also suggests that performance wise the device will serve its purpose as an instructional material - for demonstration purposes, hands-on practice and return demonstration.

### **Safety of the FDAS Trainer**

Most significantly, the FDAS Trainer was also tested and evaluated for its safety measures in terms of mounted parts and components, safety of wiring connections, access to controls and adjustments, stability of the device, use of protective devices, and ground-free frame.

Safety in terms of the mounted parts and components was evaluated by the senior high school faculty and garnered a mean of 4.86. Evaluators also rated the safety of the FDAS Trainer in terms of its wiring and connections, and resulted to a mean of 5.00. While in terms of the safety of access to controls and adjustments a rating mean of 4.86 was obtained from the evaluation. All three criterions being interpreted as very acceptable.

One significant aspect of the FDAS Trainer is its stability. The evaluators have tested and rated the device's stability. The evaluation on stability resulted to an average mean of 4.71 interpreted as very acceptable.

The use of protective devices in the FDAS Trainer was evaluated too, and leaded to a mean of 4.86. And lastly for the safety and security of the users, the FDAS Trainer was tested and checked the frame of being free from grounding which got an average mean of 4.86. Altogether, the FDAS Trainer fared well when it comes to the use of protective devices and the being free from grounding, having both interpreted as very acceptable.

Notably, in general these aspect of evaluation yielded satisfactory result with a total mean of 4.86 described as very acceptable. The evaluation ensures that the FDAS Trainer is safe to use for students in a classroom and training setup. In fact, the use of this FDAS Trainer lessens the risk of electrocution among students as it serves as practicing tool where students can better understand concepts and process first and consequently master the skill before doing the traditional and actual FDAS installation on a panel board. Additionally, the material used in the case and frame is sturdy enough to avoid possible breakage due to mishandling. It can be inferred from these findings that the FDAS Trainer device is generally safer to use for the students/trainees.

Having a very acceptable rating and with a grand mean of 4.93, based on the criteria's it can be affirmed that the FDAS Trainer is acceptable to be used as a training device for FDAS as perceived by senior high school faculties. A study of Khaing et. al (2018)<sup>(3)</sup> says that such device can be used by trainees and trainers as a demonstration tool to learn FDAS concepts. With the portable design of the device, moving to different training settings will be a breeze. Features of the device such as built-in battery, pre-built connecting wires, single pole double throw switch, AC power light indicator, 2-zone control panel, and the plurality of input components and output components will brand the FDAS trainer an all-in-one teaching device that can provide trainees the skills and techniques in FDAS wiring, installation, and troubleshooting reducing time to strip wires and turning of screws that is same as the study of Rahmawati et. al (2018)<sup>(4)</sup> and in support of the patented invention of Mizukami (2013)<sup>(5)</sup> that addresses to reduce the amount of materials being used in fire alarm system. This learning devices can encourage learning among students<sup>(6)</sup> and in belief that research and innovation must be focused on new endeavors than on already existing ones<sup>(7)</sup> especially in the innovation of learning materials in the technical aspect.

### **CONCLUSION**

Based on the Final Result of the study. It can be said that the FDAS Trainer is Very Acceptable and thus can be an effective instructional trainer that can be utilized to facilitate a retentive means of teaching the required knowledge, skills and attitude of students in the wiring, installation and troubleshooting of Fire Detection and Alarm Systems and to encourage other training institutions to incorporate this FDAS Trainer in the training of their training programs and institution.

Further, the FDAS trainer should be subjected to continuous testing and utilization to test the durability of materials and components in a continuous training environment. Other functions could also be added to the FDAS Trainer that will include volume control for the sounder/bell to limit and reduce the sound coming from

the device, avoiding false information to near bystanders thinking that an actual fire is happening due to the loudness and realistic sound of the fire alarm. Cable moldings could also be added to the inner sides of the device for cable management, and a pocket can also be attached inside the device for storing and safekeeping the wires and connectors.

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