Design and Construction of an Electrical Installation Trainer for Laboratory Experimental

Muhammad Aulia Rahman Sembiring[1], Jongga Manullang[2], Lia Maharani Lubis[3], Denny Haryanto Sinaga[4], Reza Arbi Azizi Lubis[5], Ricky Nelson Tampubolon[6]

{marsembiring@unimed.ac.id[1], mjongga@yahoo.com[2], maharaniilia@unimed.ac.id[3], denny.sinaga@unimed.ac.id[4]; rickyntampubolon@mhs.unimed.ac.id[5]; rezaarbiazizilubis@gmail.com[6]}

Department of Electrical Engineering Education, Faculty of Engineering, Universitas Negeri Medan, Indonesia, Indonesia[1,2,3,4]

Abstract. The Department of Electrical Engineering Education, Faculty of Engineering, Medan State University uses a limited number of conventional project boards for electrical installations. It is necessary to add a modular electrical installation trainer. This study aims to design a trainer for lighting electrical installations as a learning medium and to test the feasibility of trainers in the electrical installation laboratory. This research method is Research and Development. Based on this method, what is done is to plan and build a lighting installation trainer, then give it to students to use as learning media. This research examines the feasibility and trials of electrical installation trainers by giving questionnaires to lecturers and students. The expected results from the electrical installation trainer are very feasible to use.

Keywords: Trainer Module, Electrical Installation, Modular.

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1 Introduction

Electrical installation is a core topic in electrical engineering and requires practical experiences for a comprehensive understanding. However, setting up and maintaining electrical installation laboratories can be challenging due to its cost and complexity. Therefore, a cost-effective and accessible trainer for electrical installation can provide students with in-depth knowledge and practical experience. This is one of the courses that need knowledge of technical advancements. This course will examine lighting setups as a tool for enhancing laboratory learning. Practical exercises are used to assess the competencies of professional students. The five stages of competency assessment are: (1) devising an evaluation plan; (2) creating an evaluation tool; (3) carrying out the evaluation; (4) putting the evaluation results to use; and (5) reporting the evaluation results. Electrical installation technology students inspect, among other things, the application of lighting installation procedures. This is crucial for creating instruments to assess the effectiveness of electric illumination in real-world applications.[1]

Media are generally defined as graphical, photographical, or electronical tools that are used to note, progress, and reorganize word or visual information in the context of education. All forms of media can be used to spread or transmit information. Learning is essentially an effort to instruct learners (students and youngsters). Learning is everything that can enrich the on-going discussions between teachers and students with new knowledge and information. In this case, the learning medium helps spread educational messages. Learning media are described as "everything that can convey or distribute messages from a source in a planned manner, so that there is a conducive learning environment where the recipient can carry out the learning process efficiently and effectively" after understanding the meanings of all words "media" and "learning" separately [2].

According to the findings of the introduction theory, undergraduate students had less productive practicum time and limited access to media during the lecture activities of the residential electrical installation practice. So that undergraduate students may comprehend the abilities that each student must possess after graduating and being prepared to work, the competency in residential electrical installation practice needs to be optimized for the learning process. Based on these issues, the authors are curious as to how the impact of the electrical installation trainer media will work to maximize undergraduate students' learning outcomes in the home electrical installation practice course and to encourage excitement, interest, and activity.

2 Literature Review

2.1 Learning Media

Learning media as a whole is a teaching and learning tool. By arousing the learner's thinking, emotion, focus, and abilities or skills, anything can be used to assist learning. This constraint is fairly comprehensive and addresses a variety of subjects, such as knowledge of resources, the environment, people, and training techniques. Books, movies, videos, and other materials are examples of learning materials that physically transmit instructional information. The National Education Association later said that learning media comprised print and audio/visual media for communication in addition to hardware technologies. [3]

In the traditional teaching and learning process, only the knowledge offered by the lecturer and a tiny amount from books are used as teaching resources. Although there are many free learning resources available both inside and outside of schools, less emphasis has been paid to alternative tools that help boost students' interest in studying. The focus should be on the lessons' content as good as learning resources and instructional media that will use in order to produce the optimal learning results. Media that has an educational or promotional purpose is referred to as instructional media. Students can be taught a lesson through pictures, videos, posters, audio recordings, and other forms of media.[4]

A variety of teaching methods can be used by lecturers to help students understand what they are saying. Depending on the learning style, There are numerous educational media accessible, such as audio, visual, and audio-visual content. "Audio media" is a term used to describe content that is delivered through sound. In this case, sound can come from a recording, a radio, or another source. Visual media is defined as media that conveys information through images that can be seen with the naked eye. Audio-visual media can be made by fusing moving and still visual and aural material.[5]

2.2 Electrical Installation

A study by Ajinkya et al. emphasized the need for a skilled workforce to carry out electrical installations safely and efficiently. Furthermore, the authors highlighted the training and certification requirements for electrical professionals to ensure that they are competent in handling electrical systems.[6] Ensuring safe and effective operation of electrical systems requires accurate selection and installation of electrical breakers, wires, switches, and other components. A paper by Montanari et al. reviewed the importance of selecting the right cable type and size for specific applications and the effect of incorrect cable selection on electrical system performance. Miniatur Circuit Breaker (MCB) is one of the main materials in electrical installations.

Fig.1 Miniatur circuir breaker

A security circuit known as a MCB is furnished with an electromagnetic hand-off for hamper as well as warm security (bimetal) for over-burden insurance. These are the advantages of using a MCB: Can be used again after the circuit has been redressed because of a short out or over-burden and Has a decent responsiveness in the event that a short out or over-burden happens. can break a three-phase circuit even if one phase experiences a short circuit. Warm and electromagnetic wellbeing are two sorts of security found in MCBs. While thermal safety stops excessive currents, electromagnetic safety stops short circuits. Thermal safety and thermal overload on MCBs are predicated on the use of two mixed metals (bimetal). Warm security is more slow than electromagnetic wellbeing, which utilizes a curl that can attract an iron armature.

3 Methods

R & D is method used to produce specific assess and pruduct their effectiveness. Some products are made using research that is used to analyze customer wants, and other items must undergo efficacy testing in order to be used in a larger population. As a result, research and development are long-term (and may span several years). Designing and building a learning media product is the goal of this project. This project resulted in the creation of a electrical installation media trainer, which can be found in the Electrical Engineering Department at Universitas Negeri Medan. This research on the evolution of learning media was produced using research and evolution. There are 10 steps in using the Research and Development (R&D) model description on Figure 2.

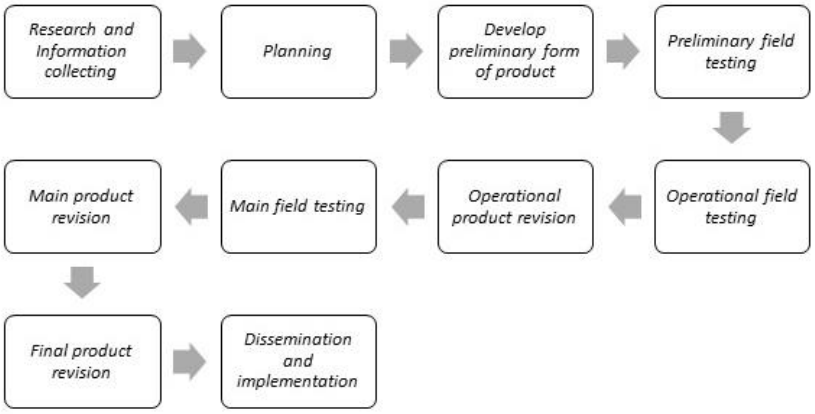

Fig 2. The step in R&D model

Product media are included for learn more and gather the data that will be used to determine a product's level of efficacy, efficiency, or feasibility, as well as whether the finished product is indeed of high quality. On this review, illustrative measurements of rates were utilized as the information examination method and quantitative information were utilized as the information type. Enlightening insights are measurements that are utilized to assess information by portraying or describing the got information as they are, without endeavoring to draw speculations or inductions that apply to a bigger populace. To assess the nature of the plausibility and the subsequent learning assets, a plan explore should be led. Testing should be finished on the ideal item as an outcome. The learning materials for electrical installation were reviewed to media and subject matter lecturers before being tested on 30 students on A class in the fifth semester. [5]

4 Result and Discussion

The process of producing educational materials for electrical installation consists of two steps. Testing the materials with journalists and subject matter experts is the initial step. professors of electrical engineering with backgrounds in teaching and media learning tests. An electrical instructor with expertise in electric installation evaluated the content of the test. The second phase is to test media goods on students at UNIMED's Electrical Engineering Department. In order to create training materials for lecturers in electrical installation, understand the media, and quantify students' responses to learning subjects, RnD of Electrical Installation Trainer Learning Media is being conducted in the Department of Electrical Engineering's Electrical Installation Subjects.

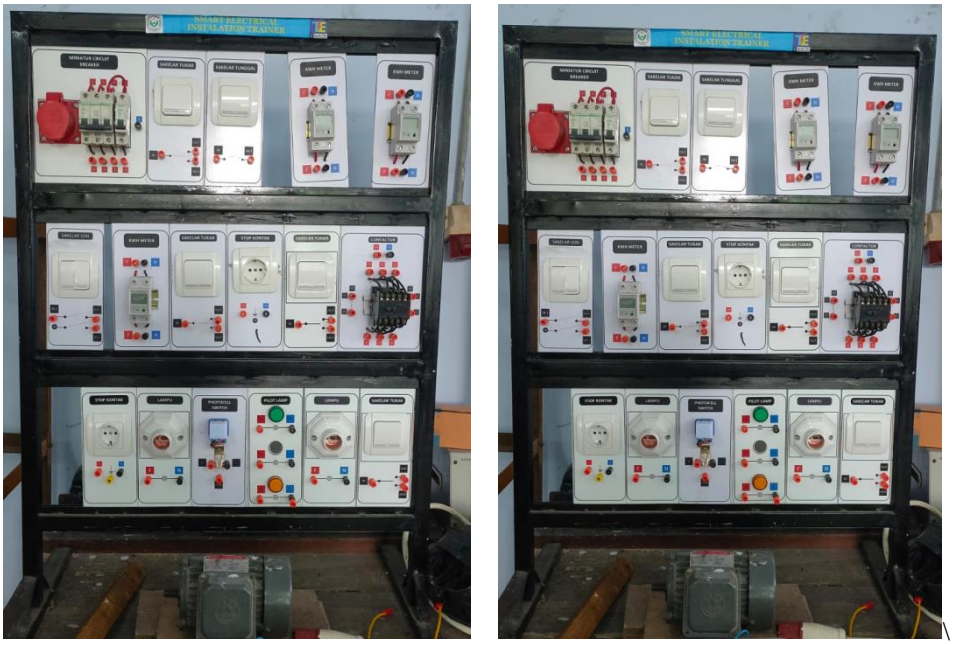

Fig 3. Electrical installation trainer kit

It is affirm that learning media the researcher team produced are extremely viable for media experts, material or subject expertise, as well as exceptionally high student response rates because the researcher's hypothesis is supported by her research. To enable the Universitas Negeri Medan, engineering faculty's electrical engineering department to provide instructors with training materials centered on electrical installation.suitable for students studying electrical installations in the department of electrical engineering to utilize as a teaching tool.

If an instrument uses a Likert scale, design validation would result in more accurate assessment of the pov respondent's perspective or attitude. With respect to electrical establishment material's substance or content, plan, convenience, language, and usefulness, a media practicality test was done. It is declared that the learning media the scientist created are incredibly practical for media specialists, material or content subject matter experts, and have exceptionally high understudy reaction rates since the examination the analyst led upholds the analyst's reason. To make it feasible for the electrical designing division of the UNIMED designing staff to offer instructors preparing materials in view of electrical establishment.

Table 1. Point of Criteria.

Test	Total Points	Percentage	Qualification
Content Test	36	81 %	Very Good
Media Test	85	97 %	Very Good
Small Group Test	225	-	Very High
Big Group Test	754	-	Very High

5 Conclusion

Because the researcher conducted to supports the researcher's premise, it is affirm that the learning media the researcher team produced are extremely viable for media experts, material or content specialists, and have very high response rates among students. To Understudies signed up for the UNIMED electrical designing division's electrical establishment course are extremely keen to the electrical establishment coach and may involve it as a learning device, as per the review's discoveries and conversations. With entirely good capabilities, the approval test discoveries by media experts got a 97% pass rate. The validation test results from subject matter experts achieved a pass rate of 81%, which is very respectable.

The study's findings support the following suggestions for instructional materials on electrical installation: It is anticipated that lecturers would be able to assist students in learning how to utilize and regulate electrical installation by using the training resources for electrical installation trainers as a tool or trainer. It is anticipated that having a smart relay-based control trainer on hand would help pupils understand how to use and regulate

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