The Validity Of Trainer On Materials Science And Devices Subject At Department Of Electrical Engineering

Fivia Eliza, Dwiprima Elvanny Myori, Hastuti, Oriza Candra, Syaiful Islami

Abstract: Devices characteristics of electrical and electronics is an important thing that must be mastered by students majoring in electrical engineering. This can be obtained through practice of materials science and devices. But the problem that arises is the absence of trainer model to facilitate the practice, so that students need more time to practice. While the time available for this course is only 1 credit (100 minutes). This study aims to develop the device trainer model to assist students in practice. The research was adopted Borg and Gall model that have 10 development steps. Validity of the trainer model was measured by instrument of validity that had been validated before. The average calculation result from the validity analysis of the trainer model is 94% with very valid category. So it can be concluded that trainer model on materials science and devices was valid to be used as a learning media.

Index Terms:Material sciences and devices, trainer, electrical, engineering.

1 INTRODUCTION

Material sciences and devices is one of the compulsory subjects of electrical engineering. In this study discussed the concept of semiconductor diodes, diode as half wave rectifier, diode as full wave rectifier, zener diode characteristic, zener diode application, bipolar transistor, bipolar transistor characteristics, transistor as amplifier, Silicon Controlled Rectifier (SCR), SCR ignition, Triode for Alternating Current (TRIAC), switching with TRIAC (TRIAC switch), Alternating Current Diodes (DIAC), and DIAC applications. From this basis, substantial training will prepare them to analyze real-world circuits**.** Material sciences and devices is one of compulsory courses for students in department of electrical engineering, faculty of engineering, Universitas Negeri Padang. So that the students must achieve good grades in this subject, both theoretically and practice learning. Since 2008, students who take this course practice it manually. They make a circuit by arranging electronic components on a circuit board and using a cable to connect to a power source and measuring device. The results obtained are often incompatible with previously learned theories, 100 minutes of available time often does not get any results. Beside the students must work in groups. This causes the learning process less than the maximum practice so that the ability to catch students to what is practiced to be reduced, the discipline of students who are still lacking (not good).

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The same thing also revealed that "In fact many students who follow the lab activities but have not mastered the theory so that the implementation of the lab does not follow the Standard Operational Procedure (SOP) and even many labs that failed because of mistakes in stringing" [1]. This shows that the results obtained by the student learning is not maximal or can be said that the student concerned has not been completed. Students tend to be passive and have not been able to know the meaning of the results of learning activities, students are still not able to grow the potential that is on him and has not been able to cultivate a great motivation in following teaching and learning activities [2] ased on the results of the above observations, indicators of non-achievement of learning objectives are caused by several factors such as limited resources available, both from students and from lecturers, learning models are still dominated learning model, the interaction between students and lecturers are still lacking, which is less conducive and less of learning media such as unavailability of teaching media in the form of props and trainers as appropriate. Learning media is one of the important components in supporting the process of learning practice. Media learning is an important factor that will affect student learning outcomes [3]. This cause the students are still confused and less understood with the material presented by the lecturer. By using trainer, lecturers can more easily deliver learning materials and facilitate students' understanding in the subject practice of materials science and devices.

2 LEARNING MEDIA REVIEW

When the media carries messages or information that is appropriate instructional or contains teaching purposes then the media is called learning media [4]. Media is defined as a means whose functions can be used as a goal [1]. If we want to select learning media need to consider several things. It could be the media used even complicate the achievement of learning objectives. The use of appropriate media will greatly support the success in the learning process. Conversely, improper use of media will only squander costs and energy, especially for the achievement of learning goals will be far from what is expected. In order to use media in accordance with their needs, it is necessary to know the criteria of media

selection in learning. Criteria of media selection as follows: In accordance with the goals to be achieved. Media is selected based on predetermined instructional goals that generally refer to one or a combination of two or three cognitive, affective, and psychomotor domains. It is appropriate to support the content of the lesson in terms of facts, concepts, principles, or generalizations. In order to help the learning process effectively, the media must be aligned and in accordance with the needs of learning tasks and mental abilities of students. Practical, flexible and enduring. The selected media should be used anywhere and anytime with the equipment available in the vicinity, as well as easy to move and carry around. Skilled teachers use it. Whatever the media, teachers should be able to use it in the learning process. The value and benefits of the media are greatly determined by the teachers who use them. Grouping of goals. Effective media for large groups is not necessarily equally effective if used in small groups or individuals. Technical quality. For example, the visuals on the slides should be clear and the information or messages that are highlighted and want to be submitted should not be interrupted by other elements of the background [4].

3 Practice Materials Science and Devices Review

Practice Materials science and devices is one of the compulsory subjects for electrical engineering students at the Department of Electrical Engineering Faculty of Engineering Universitas Negeri Padang. The purposes of this course is the students mastered about the basics of semiconductors, diodes, transistors and understand the characteristics and working principles of SCR, DIAC and TRIAC. From the job sheet it appears that this is a basic practice of semiconductor components. Semiconductor materials are materials that conduct their electrical conductivity between conductors and insulators. Semiconductors are atoms containing four valence electrons. Since the number of valence electrons in a semiconductor is in the middle between one (conductor) and eight (isolators), then the semiconductor atom is not a good conductor and not a good insulator [5].

4 Solution Procedure

The research uses a research and development approach (R&D). The R & D approach is a process used to develop and validate educational products, such as modules and instructional media. Research and Development is a research method used to produce certain products and products of that effectiveness [6]. The research step of R & D according to the following figure:

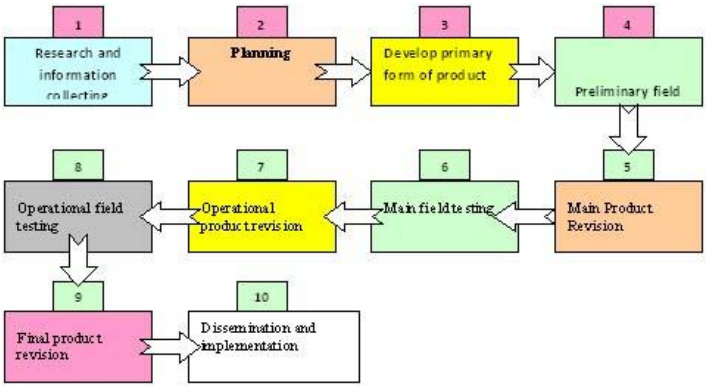

Fig 1 - *Borg & Gall step of R&D*

5 Results and Discussion

5.1 Research and Information Collecting

Information collected through observations at the learning process of practice materials science and devices subject. It is known that practice equipment is not enough for each student, so that they have to practice in group (4-5 students). They have to arrange manual electric circuit and it takes more time (time available only 100 minutes for the subject).

Table 1 - *Need Assessment of Research*

No.	Indicators	Sub Indicators	Learning Media
1.	Diode Charac-teristics	a. Introduction of semiconductor diodes. b. characteristics of semiconductor diodes c. Analyzing forward and reverse bias circuits on a semiconductor diode	White Board Trainer Trainer
2.	Diode as Half-Wave Rectifier	a. Benefits of diodes as rectifiers. b. How a half-wave rectifier works. c. Analyzing half-wave rectifier circuit. d. How the full-wave rectifier works	White Board Trainer Trainer
3.	Diode as Full-Wave Recti-fier	How a full-wave rectifier works	Trainer
4.	Characteristics of Zener Diodes	a. Introduction of the zener diode as a device b. Characteristics of zener diode	White Board Trainer
5.	Bipolar Transistors	a. How to find the leg of the transistor (Emitter, Base, Collector) b. Determine the value of α, β and current	White Board Trainer
6.	Characteristics of Bipolar Transistors	Understanding the characteristics of a bipolar transistor	Trainer
7.	Silicon Controlled Rectifier (SCR)	Understanding trigger current (IGT), saturation voltage (VAKsat), and holding current (IH)	Trainer
8.	Ignition of Silicon Controlled Rectifier (SCR)	a. Able to operate SCR circuit at source dc and ac source. b. Able to analyze the currents and voltages contained in parts of the SCR ignition circuit	Trainer Trainer

5.1 Planning

This step started with make a design that referring to the principles of good learning media. The results of the information gathering stage are used as references for product design. Media validation tools (instruments) should also be planned.

5.2 Develop Primary Face of Product

Primary Face of Product:

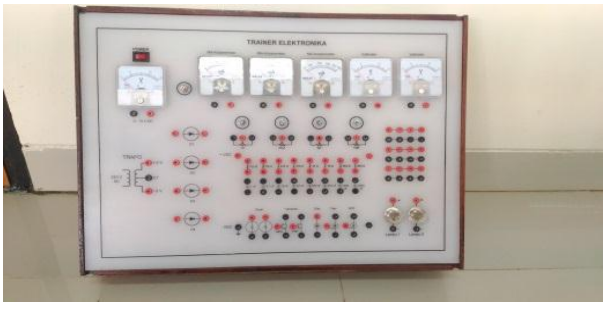

Fig 2 - *Face of Trainer*

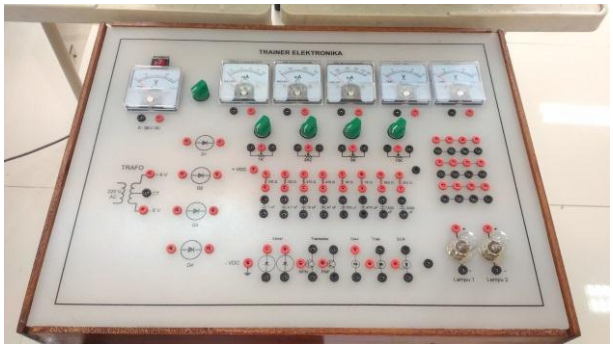

Fig 3 - *Face of Trainer*

5.3 Product Validation

Validity of the trainer was measured by instrument of validity. This trainer tool is tested for use in front of the validator, then validator rate and provide the trainer's recommendation is valid or not. If this trainer is declared to be valid then proceed to the next process that is trial usage by user [7]. The measurement scale used in the validation is Guttman scale. This measurement scale only has two answer interval "agree" and "disagree". The answer would agree to be worth 1 and the answer disagrees to 0. Guttman Scale can be made in the form of multiple choice, also can be made in the form of checklist. Answers can be made the highest score of one and the lowest zero. For example, the answers agree to be given a score of 1 and do not agree a score of 0. The analysis used the Likert scale [6]. Data were analyzed with the formula:

$$\text{Validity} = \frac{obtained\ score}{Maximum\ score} x\ 100\% \quad (1)$$

After obtaining the validity number then adjusted with table criteria:

Table 2 - *Criteria of validation category*

No	Level of Achievement (%)	Category
1	81 – 100	Very Valid
2	61 – 80	Valid
3	41 – 60	Quite Valid
4	21 – 40	Less Valid
5	0 – 20	Not Valid

Validation is performed by validators who have competence in the field of instructional media and learning materials practice materials science and devices. The goal for validation results can be recognized and accounted for. Validation activity begins with product observation by validator, trainer system demonstration, then validator fill validation sheet (10 there are 10 statements with the choice agree or not) as validation data. Validation activities by validators in detail can be seen in the following table:

Table 3 - *Validation Result*

Validator	Score	%	Category
1	10	100	Very Valid
2	9	90	Very Valid
3	10	100	Very Valid
4	9	90	Very Valid
5	9	90	Very Valid
Validity score		94	Very Valid

The average calculation result from the validity analysis of the trainer model is 95% with very valid category. Validation result stated that valid trainer is used as learning media. Assessment given by the validator reveals that the material contained in the trainer in accordance with the contents and objectives of the course Practice Materials science and devices. The learning information delivered using the trainer becomes clearer. This is in accordance with the terms and criteria of media selection In accordance with the objectives to be achieved, appropriate to support the content of the lesson [4]. The role of the trainer as a learning media makes the learning of the abstract becomes more concrete. Application of trainer in learning makes students active, more independent and increase student's learning motivation. Data validation results show that the media create a more interactive learning. This is in line with the benefits of the media according to laying the concrete foundations for thinking [8][9]. Many aspects are taken into consideration in making learning media. These aspects must be met so as to produce good media, suitable media used in learning. This is in line with the criteria of media selection according to practical, flexible and enduring [10][11]. The time required to use the media in accordance with the time available in the Materials and Tools Practice course. The lecturer responds that the media has the same equivalence and is easily interpreted. The effectiveness of instructional media is a measure related to the success rate of a learning process [12]–[15]. The success of the learning process is indicated by the success of the students mastering the given material.

6 Summary

In this paper, a trainer for training students in the framework of teaching practice materials science and device was presented. The novelty of the R&D research is that it is making the students centered learning and increasing students interesting to practice. Furthermore, the Material sciences and devices learning process can be students centered learning. The main benefit is that trainer on practice materials science and device was valid to be used as a learning media. The result of research and development is expected to provide new innovations in education or provide solutions to existing problems. So that can be conclude that the trainer as a model can be used to specify quality models that provide valid automated quality assessments of learning. Future work will focus on developing the trainer into a universal trainer that can be used for other basic courses (e.g. basic and electrical measurements, power electronics, and electrical circuit) to refine the impact evaluations in order to achieve better results with regard to diversification among practice materials science and devices. Moreover, we plan to extend the quality model to include more quality characteristics and measurements.

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