The Practicality of Electric Power Distribution System Trainers as Learning Media

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Abstract. Learning media has a salient role in learning process, especially in the Electric Power Distribution System subject. Utilization of learning media will be very helpful in providing real experience for students to simulate the electric power distribution that exists in life into a learning process. Trainer is one medium that can be used for this need. The use of trainers is expected to increase the efficiency of vocational learning, as well as train the skills students need to work. In addition, the use of trainers can also minimize the risk of accidents in the practical process compared to doing direct practice on a large scale from the electric power distribution system itself. This research was aimed to determine the practicality of the Electric Power Distribution System trainer. This research is a continuation of research and development that has been done before, using the ADDIE development model. This research is in the implementation stage to see whether the trainer developed is already in the practical category and is feasible to be applied at the next stage. Data collection was carried out using practicality assessment sheets which were filled in by lecturers of electrical engineering at the Universitas Negeri Padang and also students. The research results show that the distribution system trainer developed has been practical both from the perspective of lecturers and students as practitioners. This practicality meets the aspects of ease of use of media, time efficiency, easy to interpret, and is equivalent to the practical category.

Keywords: Practicality · Trainer · Electric Power Distribution System · Learning Media

1 Introduction

Vocational education graduates are very important human resources and have great opportunities in employment, especially in the industrial sector [1]. Vocational education has an important role in increasing labour productivity and efficiency. In addition,

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graduates of this education are expected to be ready to face the competition of the Asean Economic Community (AEC) and the international labour market in this globalization period.

Improving the grade of vocational education graduates can be accomplished by increasing the quality of education itself. One of the efforts to create contextual learning in the vocational field is to apply appropriate learning media. The use of learning media is expected to make abstract learning more real and more interesting. Learning media has been widely used for independent learning at this time. However, learning media that can make the learning process become more effective, more attractive, and enjoyable is still a problem that must be resolved.

Learning is a process of interaction between students, between students and educators and learning resources in a learning environment [15]. The use of media as a source of learning is of course very much needed, especially in organizing effective vocational education. Therefore, the utilization and management of learning media needs to be improved in order to create interactive, inspiring, fun and challenging learning. thus, learning is expected to be able to motivate students to participate actively and develop their creativity and independence.

Vocational learning needs to encourage students to independently construct their knowledge through direct learning experiences. This experience is carried out realistically and concretely. This aims to assist students in developing their understanding and critical thinking skills.

Learning media has a close relationship between theory and practice. The use of media requires the full role of the lecturer as a facilitator so that students can learn independently and develop higher-order thinking skills within themselves. Proper use of media can also increase students' understanding of the topic or concept being studied. In vocational learning, especially the electric power distribution system, the learning process leads to an understanding of construction, working principles and electrical network circuits.

The electric power distribution system is one of the subjects whose application is very important in human life throughout the world. There are about 7600 Distribution System Operators (DSO) from 175 countries in the world (99.4 world population), of whom more than half are in the United States (about 3100) and in Europe (about 2500) [2]. Distribution System Operator means an individual or legal entity responsible for operating, ensuring maintenance, as well as developing a distribution system in a certain area to ensure the long-term capability of the system to meet electricity distribution demands. This data shows the importance of skill and understanding in every element of the electric power distribution system.

Currently, electricity is not only a necessity in urban areas, but also an urgent need in remote villages. This shows the need for equal distribution of electricity consumption in urban and rural areas through increased distribution network development. The available electric power must meet customer needs properly. Distribution system planning must fulfill a number of objectives according to the economic importance and quality of the electricity supply [3]. In this regard, the electric power system does not endanger humans and the environment and can provide satisfactory service to customers, for example in terms of continuity and quality. Furthermore, the increase in the reliability of distribution

network operations is also increasing along with the development of the national economy and living standards [4]. The process of good planning, implementation of the right development, operation and maintenance of the electric power system must follow the provisions of the applicable technical standards so that the services provided experience an increase.

The results of interviews with several students who took the electric power distribution system course showed their low activity and motivation in the learning process. According to them, this lecture was quite difficult and less interesting because it prioritized theories and lack of supporting media that could be seen and assembled directly during theory lessons. This shows that we need a learning media that can provide direct experience for students in implementing the theory they get.

The use of teaching aids such as figures, specimens, or other aids can help convey information from lecturers to students [5]. This can give real experience, motivation, and upgrade student understanding. One of the tools that can be used is the distribution system trainer. The use of trainers can provide convenience for students in carrying out practice [6].

Trainers have the same role as other learning media in terms of conveying information in a learning process [7]. Trainers can be in the form of a collection of actual components and tools or duplication of a real system that can provide real experience for students in practicing it. Trainers have a significant influence in making students active and creative in the learning process.

The use of trainers must be in accordance with the level of knowledge and skills to be achieved. In addition, trainer development must be in line with the theory presented and facilitate students with practical experience. Furthermore, the trainer must also be able to increase the efficiency and effectiveness of practice implementation.

Trainers can be rated as simulation models, which provide an overview of real-world dynamic processes [8]. The trainer developed in this study is used to simulate distribution networks that are used in the real world. In practice, students seem to be carrying out electrical network distribution activities. This network includes loops, spindles, and radials. Activities carried out through the presentation of simulators, question and answer process, remedial and evaluation.

There are many studies that have developed trainers as learning media, but not much has developed for electric power distribution systems. One of the media developed by Putra is digital learning media for electrical energy distribution systems based on conceptual understanding [16]. the results of his research show that the trainer is suitable for use in learning. In addition, Cahyono in his research also found that the use of trainers as learning media can increase the practicality and effectiveness of learning [17].

The trainer developed in this study is in the form of a media board that explains the distribution network flow that has been modified. This trainer outlines the shape and flow of the distribution configuration of the electricity network starting from the distribution substation to the loads in several cities. This trainer is expected to be able to support the learning process and become a reference for students who do not understand the concept of learning the power distribution system.

This research is a continuation of the research that has been done, where in the previous research a power distribution system trainer was developed. The trainer developed

has passed the validity test stage with an average validity value of 0.9 with a valid category [9]. This validity includes validation of content quality and objectives, instructional, and technical validation.

This study aims to determine the level of practicality of the trainers that have been developed. The practical definition based on the Indonesian Dictionary or *Kamus Besar Bahasa Indonesia* (KBBI) is based on practice, easy and fun to use, and efficient. Practicality refers to the extent to which users consider interventions that are clear, easy to use, and cost-effective [10]. Furthermore, Sukardi stated that the basis for evaluating practicality includes product ease of use, product efficiency, the level of attractiveness of a product and its ease of interpretation, as well as its equivalence [11]. In this research, the product developed is said to be practical if the practitioner states that this media trainer is practically applied in the field. In addition, this trainer is said to be practical if it is easy to use, efficient, easy to interpret, has the same equivalent.

2 Research Methods

This type of research is Research and Development (R&D). This research aims to develop a product through a series of research activities using various methods [12]. The development model used in this study is the ADDIE model. This development model includes 5 stages, namely analyze, design, develop, implement, and evaluate [14] (Fig. 1).

This research is an implementation stage that aims to see the practicality of the product being developed. Assessment is carried out by involving lecturers and students as practitioners. The test subjects were students who carried out the study of the Electric Power Distribution System using the developed Trainer media. The test subjects for the development of the Electrical Power Distribution System Trainer media were DIII students of the Electrical Engineering study program majoring in Electrical Engineering FT-UNP in the July–December semester of the 2019/2020 academic year.

The assessment was carried out by 2 course supervisors and 1 class of students who took the electric power distribution system course, after observing and trying out trainers that were developed according to lecture needs and the curriculum. The practicality

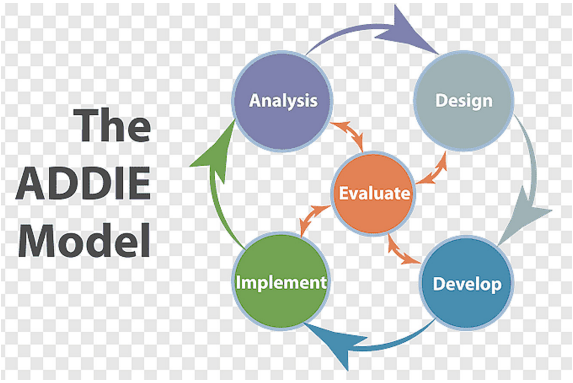

Fig. 1. The stages of ADDIE Model

Table 1. Categories of Practicality

Score	Category
≥0,6	Practical
<0,6	Impractical

Modified from Azwar [13].

assessment carried out includes an assessment on the aspects of ease of use of the media, time efficiency, ease of interpretation, and equivalence aspects.

The practicality assessment was carried out through a questionnaire on media trainers from lecturers. The questionnaire contains indicators or statements to describe the ease of use of the media, time efficiency, easy interpretation, and equivalence aspect. These statements are useful for assessing the practicality of the media trainer and has alternative answers to each statement. The practicality value is calculated using the Aiken's V Statistical formula as used for validity analysis as follows:

$$V = \frac{\sum S}{[n(c-1)]} \tag{1}$$

The practicality category of trainers can be seen in Table 1.

3 Result and Discussion

An electric power distribution system trainer is useful for facilitating students in understanding the concept of an electric power distribution system. The results of the electric power distribution system trainer can describe the configuration of Radial, loop, and spindle networks.

Electric power distribution system trainers that have been developed can be observed in Fig. 2.

The trainer developed has been tested for validity and has a valid category according to material experts, learning media experts, and power distribution system experts. The validity of this trainer is reviewed from the quality of content and objectives, instructional, and technical.

The implementation phase is carried out by preparing the learning environment and student involvement in lectures which consists of the preparation of lecturers and students. In the implementation of this lecture, students are given learning materials and accompanied by a trainer of Electric Power Distribution System to find out the practicality of using it.

The practicality test was carried out through a trainer's assessment which was developed by 2 practitioners who are supervisors of the Electric Power Distribution course, Department of Electrical Engineering, Universitas Negeri Padang. Practicality data was collected using a practicality instrument that was filled in by practitioners after trying out the developed trainers.

According to practitioners, the trainer can represent the distribution network learning with several improvements, such as the voltage value on the transformer, writing

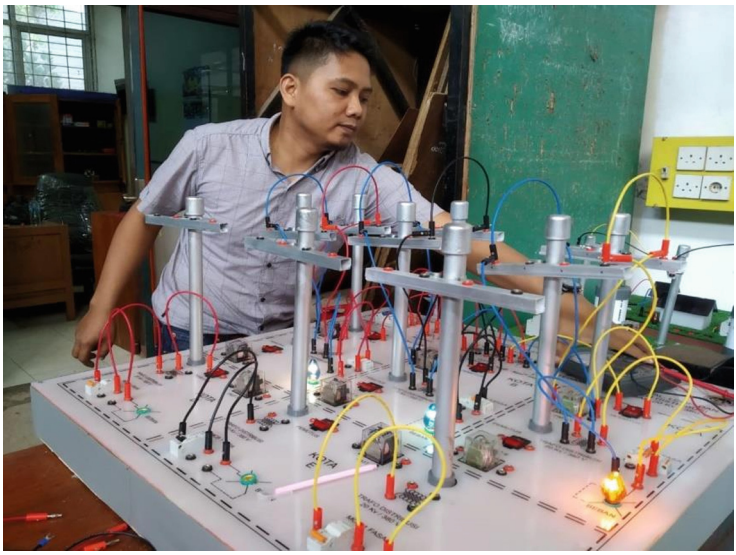

Fig. 2. Electrical Power Distribution System Trainer

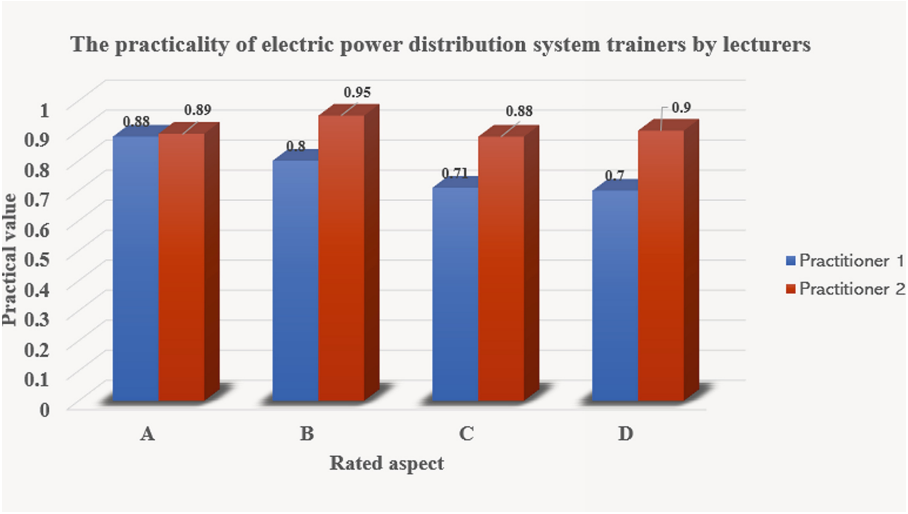

Fig. 3. The Practicality of Trainer by Lecturers

the transformer winding connections, and phase indicators on the network poles. The suggestions and comments of these practitioners are used to improve the product so as to produce a better electric power distribution system trainer.

The results of the analysis of trainer practicality by lecturers as practitioners are depicted as a graph in Fig. 3.

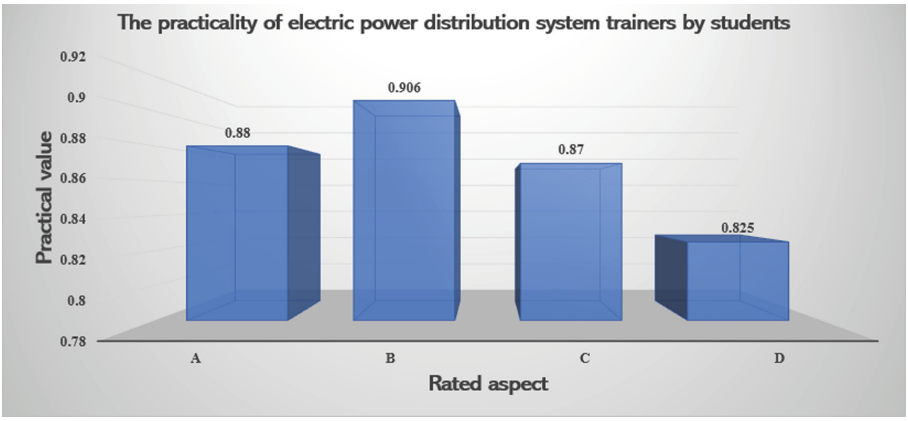

Fig. 4. The Practicality of Trainer by Students

The practicality assessment includes four aspects, namely the ease of use of the media (A), time efficiency (B), easy interpretation (C), and equivalence aspect (D). Based on Fig. 3, it can be observed the results of the analysis for each aspect assessed by practitioners. Assessment of aspects of ease of use of the media has a value of 0.77 and 0.89 respectively by practitioners 1 and practitioner 2 with practical category. Assessments related to time efficiency by each practitioner are also in the practical category with respective values of 0.8 and 0.95. Furthermore, in terms of ease of interpretation, the value by practitioner 1 was 0.71 and the value by practitioner 2 was 0.88 in the practical category. Finally, for the assessment of the equivalence aspect of practitioner 1 and practitioner 2, respectively 0.7 and 0.9 in the practical category.

Overall obtained the average value of the two people practitioners for aspects of ease of use of the media with a value of 0.83 in the practical category, aspects of time efficiency with a value of 0.875 with practical category, aspects of ease of interpretation with value 0.79 in the practical category, and the average value of the equivalence aspect is 0.8 with practical category. Thus it can be concluded that based on the assessment of the lecturer as a practitioner, trainer of electric power distribution system which is developed very practical for used in lectures on the distribution of electric power because it has meet the four practicality criteria.

Furthermore, the results of the analysis of trainer practicality by students as practitioners are depicted as a graph in Fig. 4.

Based on Fig. 4, it can be observed the results of the analysis for each aspect assessed by students. Assessment of aspects of ease of use of the media has a value of 0.88 in the practical category. Assessments related to time efficiency are also in the practical category with a value of 0.906. Furthermore, in terms of ease of interpretation, the score by students is 0.87 in the practical category. Finally, for the evaluation of the equivalence aspect of students it is 0.825 in the practical category.

Overall practicality assessment by students is at an average value of 0.87 in the practical category. Overall, it can be concluded that based on assessments from lecturers as practitioners and students, the electric power distribution system trainer developed

is practical for use in electricity distribution lectures because it meets the four practical criteria.

The practicality assessment includes the four aspects proposed by Sukardi [11], namely the ease of use of media, time efficiency, easy interpretation, and equivalence aspects. Based on the results of the analysis that has been carried out from the assessment of practitioners.

The electric power distribution system trainer developed has been very practical to use in learning. This is also in line with the practical results from students which show that the trainer developed is in the practical category.

The practicality of the trainer from the aspect of ease of use of the media indicates that the trainer developed is easy to use. In addition, this trainer is also easy and safe to store, because it is made of a material that is strong enough, so it is not easily damaged. This distribution system trainer can be used by students to study independently either through group or individual learning. Furthermore, the trainer developed is able to make quite complex material simpler and easier for students to understand.

The use of electric power distribution system trainers in lectures also increases time efficiency. This is characterized by faster delivery of material. In other words, the learning process does not take too long. Not only is it easy to use trainers and increases time efficiency, the trainers developed are also easy for students to interpret. They find it easier to understand circuit systems or networks that are quite complicated. This trainer has the same equivalent. The use of trainers makes them feel as if they are practicing with a real distribution network.

This shows that the use of trainers in learning can help convey information from lecturers to students about the distribution network concept being studied [5]. Furthermore, the use of trainers is proven to be able to help students apply the theory they learn into practical activities [6]. Not only getting information, they also get direct experience of power distribution systems like in the real world.

Learning by using trainers shows that there are variations in the learning process so that learning becomes more fun and challenging. The use of trainers as learning media also trains the skills needed in the industrial revolution 4.0 era, especially students' higher order thinking skills.

4 Conclusion

The trainers developed have met the practical criteria. This practical value is observed in four aspects, namely the ease of use of media, time efficiency, easy interpretation, and equivalence aspects. The assessment is carried out by practitioners who are lecturers in the electric power distribution course and students who are involved in the course.

The trainer developed has a contribution as a medium that can be used to increase the learning efficiency of the power distribution system. However, the trials conducted in this study were limited to a small number of students from the total who took this course in that semester. This happened because research was carried out during the Covid-19 pandemic era, so there were restrictions on the number of students who attended face-to-face lectures. It is hoped that this research can be continued for practicality and effectiveness trials on a large scale, so that the test results obtained can provide a real picture of the trainer's role as a learning medium.

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