Developing a Trainer Model of Audio Amplifier Troubleshooting in Vocational High Schools

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Abstract. Vocational high schools should have competencies and be able to meet the needs of the growing industrial world. To achieve skilled human resources, it is necessary to improve the quality of learning media. Therefore, the use of learning media is very important, especially for Audio and Video Equipment Maintenance and Reprair Learning (PPPAV) subject. This study aimed to determine the feasibility level of the trainer troubleshooting audio amplifier as a learning media in PPPAV subject. The method used in this study is Research and Development (R&D) with the data collected by interview and questionnaires. This study was developed trainer with acrylic box size 50 cm × 40 cm × 20 cm which divided to troubleshooting switch, solution switch, test point, input and power. The results showed that the feasibility rate was 91,25%, validated by two learning media experts and the guidebook was 90,21%. Those scores are categorized as very decent. A good response was received from 33 vocational high school students who had tried, with an average score of 85,51%. They are classified in a very decent category. Based on the results of this research it can be concluded that Trainer Troubleshooting Audio Amplifier is worthy used as a learning media on PPPAV subject.

Keywords: Trainer Model · Audio · Amplifier Troubleshooting

1 Introduction

The electronics industry has played an important role in the global market due to its wide application in various sectors [1]. The rapidly progressing industrial world must of course be balanced with the increasing quality of human resources. In that sense, the world of education plays an important role in producing quality human resources, especially Vocational High Schools (SMK). Education through SMK should produce competent graduates capable of competing and meeting with the demands of the growing industrial world [2]. An effort that can be done in order to achieve that goal is by creating innovation in learning.

SMKN 1 Adiwerna was selected for product testing as this school met the criteria needed in this research. The interview results with the teacher of PPPAV subject at SMKN 1 Adiwerna revealed that the teaching learning of concepts in the topic of audio and video equipment maintenance and repair, specifically in the basic competence of

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analyzing various types of damage to audio amplifiers, had only relied on limited media in the form of power point slides and text books. Supporting equipment for practicing audio amplifier troubleshooting had not been available, even though the purpose of this course is that students are able to analyze and repair various types of damage to audio amplifiers. Limited facilities becomes an influential factor, or in this case hindrance, in increasing student skills [3]. The availability of learning media is an important aspect that should be met because it can better clarify the presentation or delivery of messages and information to facilitate the learning process [4]. Moreover, the use of learning media has many benefits, including increasing student motivation, understanding, and learning to be more effective [5]. In addition, the benefits of learning media include clarifying the material being learnt and improving students' attention, interaction, and perception [6]. The many benefits obtained from the use of learning media have made a strong case for underlining the role of learning media in learning process [4]. Therefore, it is necessary to have or create interesting learning innovations, one of them is developing practice equipment to help students understand the material better.

An example of media applications as a practice equipment is a trainer. Trainer is a unit of laboratory equipment that can be used as a practice equipment in order to improve students' skills [7]. Trainer is used to provide direct and real experience to students when doing practices. A research conducted by Suryono provides evidences that the use of trainer kits is able to attract students' interest in learning the material and increase students' motivation [8].

Based on the previous explanation, the author wanted to make some innovation by developing a trainer model for audio amplifiers troubleshooting for SMK, specifically in the subject of audio and video equipment maintenance and repair. This research aimed to produce a trainer model for audio amplifiers troubleshooting, determine the effectiveness of learning media, and determine the feasibility level of the trainer model of audio amplifier troubleshooting as a learning media in PPPAV subjects at SMKN 1 Adiwerna.

2 Method

This research employed a Research and Development (R&D) approach. This approach attempts to produce a certain product and then to test the effectiveness of the product [9]. After the product has been developed, the product quality testing process will be carried out. The product resulting from this research included a trainer model and an audio amplifier troubleshooting guidebook. Data collection techniques used in this research consisted of interviews and questionnaires. The following Fig. 1 presents a flowchart.

This research was conducted from 27th December 2021 to 7th January 2022 at SMKN 1 Adiwena. The trainer model validation test was carried out by two experts. Meanwhile, the subjects of the trial using the audio amplifier troubleshooting media were 33 students from the audio and video engineering expertise program at SMKN 1 Adiwerna.

2.1 Product Trial Design

The product trial design was conducted to determine the students' responses after using the learning media and to measure the effect of the treatment in the form of practice

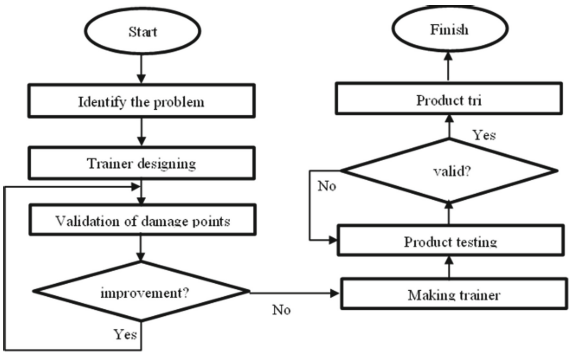

Fig. 1. Flowchart of development trainer

$$O_1 \; X \; O_2$$

Fig. 2. One Group Pretest-Posttest Design

using the trainer model. As this research involved only one class, the research design was one group pretest-posttest [10]. In one group pretest-posttest design model, a group will be subjected to pretest, then the treatment, and finally the posttest. Thus, the results of the treatment will be known more accurately, because there is a comparison before and after treatment [9] (Fig. 2).

Description:
O_1 = Pretest Score.
O_2 = Posttest Score.
X = Treatment.

2.2 Research Instrument

The research instruments used to collect the data were interviews, questionnaires, and tests. The interviews were used to collect initial information as consideration for analyzing the problem. The questionnaires were distributed to experts to validate the learning media whether they were suitable for use or not. In addition, the questionnaires were also used to see students' responses to the learning media. The tests were used to measure the students' skills and see the effectiveness of the learning media. All of the instruments had gone through validity and reliability tests prior to being distributed.

2.3 Data Analysis Technique

After obtaining the necessary data from questionnaires and tests, the data were then analyzed. The data analysis of validation by experts and students' responses were conducted using percentages and averages, while for the analysis method the test instrument was done using the gain test.

Table 1. Validity Criteria

No.	Kriteria Validitas	Subject Matter
1.	81,26% - 100,00%	Very valid
2.	62,51% - 81,25%	Valid
3.	43,76% - 62,50%	Invalid
4.	25,00% - 43,75%	Very Invalid

2.3.1 The Average Percentage Calculation

The questionnaires were made in the form of closed questionnaire using a Likert scale whose answers ranged from 1–4. The formula used to calculate the percentage is presented as the following [8]:

$$\mathrm{P} = \frac{\sum x}{SMI} \tag{1}$$

Description:
P = The average percentage.
$\sum x$ = Total score.
SMI = Ideal Maximum Score.

After obtaining the average data for each aspect, a range of validity criteria needed to be made. The table of validity criteria used in this research referred to Fuada's research [11], as presented in Table 1.

2.3.2 Gain Normality Test (N Gain Test)

After obtaining the pretest and posttest data, the author analyzed the scores. The analysis technique used was the gain normality test. This test was used to determine the effectiveness of the treatment given, with the followings reflects the gain normality test formula [10]:

$$\text{N gain} = \frac{Spost - Spre}{Smaks - Spre} \tag{2}$$

Description:
N gain = Gain normality test score.
S_{post} = Posttest score.
S_{pre} = Pretest score.
S_{maks} = Maximum score.

The criteria for the effectiveness of the normality test values referred to the table from the meltzer in Octavia & Prasasty, 2019:598 which can be seen from the following Table 2 [10].

Table 2. Gain Normality Test Criteria

No	Gain normality value	Criteria
1	$0{,}70 \leq n \leq 1{,}00$	High
2	$0{,}30 \leq n < 0{,}70$	Medium
3	$0{,}00 \leq n < 0{,}30$	Low

Table 3. The Basic Competencies of PPPAV Subject

Basic Competencies	Topics
Analyzing damage and repairing various audio amplifiers	• Audio amplifier • Audio amplifier diagram block • Damage analysis • Damage repair

3 Result and Discussion

Based on the research that has been conducted regarding the development of trainer model for audio amplifier troubleshooting learning media, the following results were obtained:

3.1 Developing Learning Media

The first stage was to identify the problem. This first stage was done by conducting interviews with the teacher in charge of PPPAV subject. This stage aimed to obtain information about the conditions and facts regarding PPPAV learning in the field and to determine what media would be suitable and useful for the curriculum. The interview results revealed a problem in the form of not having a media trainer in this particular subject. The trainer was then developed based on the PPPAV Lesson Plan, with the following Table 3 of basic competencies used as a reference in developing the model trainer.

The second stage was the trainer designing. The trainer was designed with an acrylic-based box frame where the base is supported by 4 footstools. The trainer design can be seen in Fig. 3 and the block diagram can be seen in Fig. 4.

The third stage was validation of damage points in which there are 13 points made to simulate the symptoms of damage occurring in audio amplifier. This validation process was carried out by the teacher in charge of PPPAV subject, so that the determination of the point of damage was adjusted to the needs of the practice.

The fourth stage was improvement. This stage was needed when the trainer design did not meet the validator standards. The trainer must be made based on the approval of experts regarding the design.

The fifth stage was the process of making a troubleshooting audio amplifier product based on the already-validated trainer design. The production of the trainer also coincided

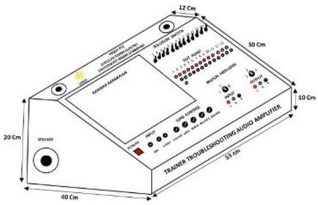

Fig. 3. The audio amplifier trainer design

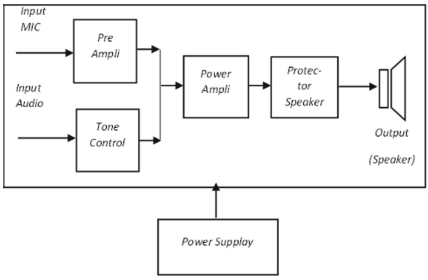

Fig. 4. The block diagram

Fig. 5. The audio amplifier troubleshooting trainer

with the practice guidebook. The creation result was in the form an audio amplifier troubleshooting trainer measuring 50 cm × 40 cm × 20 cm with 3 mm acrylic-based material. The audio amplifier troubleshooting trainer can be seen in Fig. 5, while Fig. 6 shows the design of the trainer practice guidebook.

The sixth stage was product testing. The product that has been produced was then subjected to tests to find out whether the product was ready or not. Before the media trainer was given on the subjects, it was validated by two experts.

The last stage was the trial, after the trainer has been validated and approved to be used as a media by the experts, the product was then used to teach PPPAV subject in the twelfth grade students of SMKN 1 Adiwerna. The students then worked on posttest questions, amounting to 20 multiple choice questions with a time allocation of 20 min.

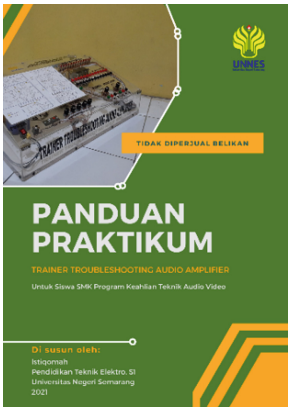

Fig. 6. The design of the trainer practice guidebook

3.2 The Feasibility of Learning Media and Guidebook as Reviewed by the Experts

The feasibility level of the produced learning media can be seen from the assessment results by the experts covering several aspects, including learning media design, technical quality, and the benefits of using the trainer. Meanwhile, the feasibility level of the guidebook can be seen from the aspects of guidebook design, material quality, and the benefits of using the guidebook. In addition to expert assessments, students' responses after using the trainer were recorded using questionnaire. This questionnaire was assessing several aspects, namely: trainer design, technical quality, benefits of using the trainer and the guidebook.

3.3 Trainer Assessment by the Experts

The assessment of the audio amplifier troubleshooting trainer was carried out by two experts, namely a lecturer in electrical engineering at the State University of Semarang and an audio video engineering teacher at SMKN 1 Adiwerna. The scores for this assessment are presented in Table 4.

Based on the data obtained from Table 4, the average value of scores obtained from the two experts from the aspect of trainer design was 87.5%. The average value for technical quality was 92.5%, and the trainer benefits aspect obtained a score of 93.75%. The overall average from available scores by two experts was 91.25%, which based on Table 1 belongs to very feasible category. The scores for each aspect can be seen in Fig. 7.

The average rating from the two experts was 91.25%. Therefore, it can be categorized as very feasible. For this reason, the audio amplifier troubleshooting trainer in terms of the three aspects is feasible to use for student practice in the classroom.

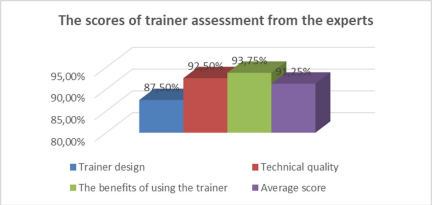

Fig. 7. The scores of Trainer Assessment from the Experts

Table 4. The Results of Assessment by the Experts

	Trainer design	Technical quality	Benefits of using the trainer	Average score	Result
Expert 1	83%	90%	88%	86,94%	Very effective
Expert 2	92%	95%	100%	95,56%	Very effective
Average score	87,5%	92,5%	93,75%	91,25%	Very effective

Table 5. Displays the Results of The Assessment by the Experts

	Guidebook design	Quality of material	Benefits of using the guidebook	Average score	result
Expert 1	75%	84,38%	90%	83,13%	Very effective
Expert 2	95%	96,88%	100%	97,29%	Very effective
Average score	85%	90,63%	95%	90,21%	Very effective

3.4 Guidebook Assessment by the Experts

This assessment was carried out by two experts with three aspects being assessed, namely: the guidebook design, the quality of the material, and the benefits of using the guidebook. Table 5 displays the results of the assessment by the experts.

Based on Table 5, the average score obtained by the two experts on the guidebook design aspect was 85%, the quality of the material was 90.63%, and the benefits aspect was 95%. All of these aspects fall into the very feasible category, with an average overall aspect of 90.21%. The scores from the experts for the guidebook can be seen in Fig. 8.

The average rating given by the two experts for the guidebook achieved 90.21%, so it can be categorized as very feasible. The audio amplifier troubleshooting trainer learning media was reviewed from various aspects, including design aspect, technical quality aspect, and benefits aspects. The results revealed that this guidebook is very suitable to be used as learning media for student practice in the classroom.

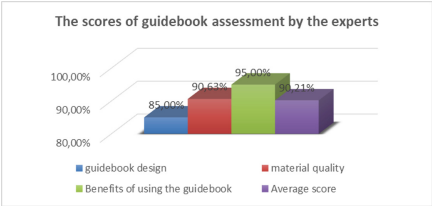

Fig. 8. The scores of guidebook assessment by the experts

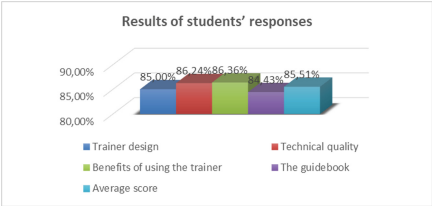

Fig. 9. Results of students' responses to trainer and guidebook

3.5 Students' Responses to Trainer and Guidebook

A total of 33 students at SMKN 1 Adiwerna tried using the audio amplifier troubleshooting media trainer after which the students gave their opinions regarding the media by filling out a number of questions that had been validated and tested for reliability. The results are presented in Fig. 9.

3.6 The Effectiveness of Trainer and Guidebook

The effectiveness level of the audio amplifier troubleshooting trainer learning media can be measured using the students' learning outcomes through pretest and posttest. The trainer can be said to be effective if most students get better learning outcomes compared to their previous results. It is said to be ineffective if there is no improvement in students' learning outcomes [6]. The following are the results of the students' tests, as presented in Fig. 10.

This research involved 33 twelfth grade students at SMKN 1 Adiwerna. The data generated from the pretest and posttest can be seen in Fig. 10. The average pretest score was 52.5 while the average of posttest was 87.5. The effectiveness of the media can be seen from the significant increase in their learning outcomes. To determine the level of effectiveness of the media, the n-gain analysis was conducted (Table 6).

Based on the obtained data on the students' learning outcomes, the average score was 0.73 which belonged to the very high category, as stated in Table 2. Therefore, the trainer and the guidebook are categorized as very effective to be used in facilitating the student practice in learning [6].

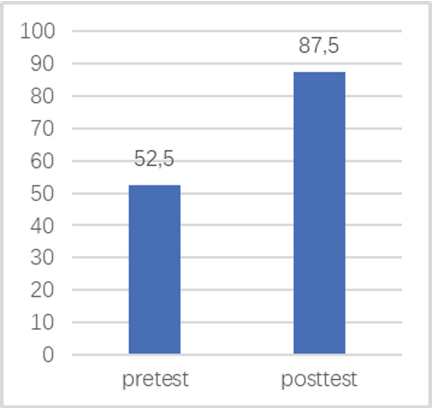

Fig. 10. Students' Learning Outcomes

Table 6. Displays the results of calculating the effectiveness of the learning media.

Score average	Category
0,73	Very high

4 Conclusion

Based on this research results and the subsequent discussion, it can be concluded as follows: The resulting product is a trainer measuring 50 cm × 40 cm × 20 cm and a guide book. The feasibility level of the trainer from all aspects reached 91.25%, The feasibility level of the guidebook obtained a percentage score of 90.21%, The student's response from the aspects of design, technical quality, benefits of using the guidebook can be categorized as very good, with a score of 85.51%. As for the effectiveness of the trainer as a learning media, it can be seen from the students' learning outcomes, which were 52.5 before using the media and 87.5 after using the media.

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