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Trainer Effectiveness in Basic Electrical and Electronic Practices in Vocational High Schools

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Abstract

Basic Electricity and Electronics is one of the subjects in VHS. This subject teaches theory and practice. Practical subject matter includes: how to measure the components of resistors, capacitors, coils, transistors and other components. This study aims to determine the effectiveness of practical trainers that have been developed for basic electricity and electronics subjects that have been developed and designed as practical learning media. The method used in this study is research and development (R n D), using the Hannafin and Peck model. The feasibility of practice trainers is based on the results of expert assessments, namely (1) assessment by material experts with a percentage gain of 92.50%, (2) assessment by media experts with an acquisition percentage of 82.60%, (3) assessment of student use obtains a percentage of 86.89 %. from the results of the assessment of the experts and students, it can be concluded that the basic electronics practice trainer is said to meet the requirements and is suitable for use as a learning medium for Basic Electricity and Electronics Class X for the Department of Audio-Video Engineering at Vocational High Schools. For the effectiveness of the trainers that have been developed it is done by comparing the results of the initial test with the results which result in an increase in learning outcomes by an average of 42.98%, so it is concluded that there is an increase in learning outcomes. To test the effectiveness obtained tcount = 98.2 and ttable = 2.056, because tcount> ttable, it can be said that this trainer is effective for use in practice. A gain value of 0.8 is in the range > 0.7, this means an increase in basic electrical and electronics practical skills before and after using a basic electrical and electronics practicum trainer with a high category.

Keywords: Audio-Video, Basic Electronics Practicum Trainer, Vocational High School

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INTRODUCTION

Improving the quality of school human resources plays a very important role. A learning process can run well if there is good interaction between students and professional teaching staff. Interaction can occur with the help of anything that can be used to send or convey messages or information from senders to recipients which are often referred to as media that can stimulate students' thoughts and feelings and attention in such a way that the learning process occurs (Heinich et., Al, 2002). In the learning process the teacher acts as a figure who

helps, guides, and facilitates students. The results of Isrok's research (Isrok'atun et.,al, 2018), the teacher's task as a motivator, director, mentor, and facilitator has proven to be very helpful to students in the learning process, therefore teachers in learning activities must be oriented towards student-centered learning, not teacher centered. On the other hand, the teacher in the learning process has not optimized the role of learning media that can help and facilitate students' understanding of the material being studied. Learning media that are deliberately designed for the needs of students in learning can increase student motivation. Vika Palera (2020) cites the results of Eyler and Giles' research which proves that the effectiveness of learning is influenced by the media used by the teacher.

Azhar Arsyad (2017) cited Hamalik's opinion that the use of learning media at the learning orientation stage will greatly help the effectiveness of the learning process, increase understanding, facilitate interpretation of data, and condense information. There is also research conducted by Hamid (2020), who wanted to see the feasibility of e-trainee learning media to improve learning outcomes in basic electromechanical work subjects. The results of the study show that the e-trainer learning media is very suitable for use in learning activities with a percentage of 95.3%. Learning media has an important role to improve student learning outcomes. The use of appropriate media and in accordance with the needs of students can motivate and attract students to be more active in participating in the learning process (Ningtyas & Jati, 2018), in his research by developing project-based electronic trainers to improve learning outcomes in basic programming learning. The development of learning trainers that are integrated with audio-visual media can also be used as learning materials carried out by teachers in class. Prasasti (2018), the development of the trainers was very effective which was used by 30 students and showed a significance increase based on the results of the t-test with a significance level of 5%. From the results of the design and material experts' assessment, was quite feasible (8.6%), was feasible 71.4%, and was very feasible 20%.

The reality at Vocational High School 7 Bekasi, was stated above has not been implemented as it should to improve the quality of learning. In addition, the means for practice are minimal. The existence of learning media should be able to make students actively carry out the learning process so that students get meaningful learning experiences. Learning media that will be used in each learning activity must also be in accordance with the material to be delivered by the teacher, because not all media can be used in all learning materials. Therefore, when designing a basic electricity and electronics trainer, it must look at its practicality in its use and adjust to the needs and character of the students. The design of a basic electricity and electronics trainer must pay attention to the principles of learning media, the first is practicality in operating it; second, learning media must also the characteristics of the students who will use it, and the third is a means of practice to facilitate during the learning activities take place (Robert A. Reiser, 1996).

Identifying students' needs, problems faced by students, and the media needed in the learning assessment process is important to find out the right learning media to be used in the learning process. Needs analysis is carried out to refer to achieving optimal student learning outcomes as expected (Rahayu &

Sukardi, 2020). Student learning outcomes increased from 68.53 to 80.24 because students used learning media which greatly influenced success in learning. Student success in learning increased from 68.53 to 80.24 because the influence of the use of learning media used by students in the learning process was very large (Mustofa Abi Hamid et al., 2017).

Referring to previous studies, the difference in this study lies in the basic electronics practical trainer in which there are good and damaged components. This is also supported by initial observations made by researchers, the process of learning activities in Basic Electricity and Electronics for the Department of Audio and Video Engineering at VHS Negeri 7 Bekasi is not yet effective. There are still many students who have difficulty understanding and analyzing material on electronic components. The difficulties experienced by students in understanding learning material due to limited media and learning facilities so that students who practice cannot take advantage of the time allotted by the school. In this regard, the standard of competence in Basic Electricity and Electronics subjects needs to be improved in the learning process, so that students are expected to have sufficient knowledge and a strong understanding of Basic Electricity and Electronics mastery. Thus, students can have competency standards that have been determined for prospective students to enter the.

From the explanation above, it is necessary to develop learning media that can help the process of learning Basic Electricity and Electronics, on basic competencies identifying physical and non-physical conditions and measuring passive and active electronic components that are able to provide an overview, skills, and knowledge, so that the competency standards fulfilled. The intended learning media is the Basic Electronics Practice Trainer. With the Development of a Basic Electronics Practice Trainer for Basic Electrical and Electronics Subjects, it is expected that students can easily carry out the process of analyzing the physical state and measuring an electronic component.

LITERATURE REVIEW

Basic electronics practice trainers in vocational high schools are needed as a support in the learning process activities. This trainer is designed to make it easier for students to understand and practice Basic Electricity and Electronics subjects. The purpose of designing learning media is to develop students' abilities in the process of analyzing physical conditions and measuring an electronic component.

The use of practical trainers as learning media greatly influences student learning outcomes. Electronics practice trainers as learning media can influence student learning success because these electronics practice trainers can be seen in real terms and can be practiced directly by students, making it easier for students to understand and study learning material for electronic components. Briggs (Gagné et., al, 1992), explains that learning media are physical means for conveying content or learning materials such as: books, films, videos and so on. In line with Briggs' opinion, Gagne (Gagné, 1977), also argues that instructional media are all components of learning resources that can stimulate students to learn. Furthermore, Reiser and Dick (Robert A. Reiser, 1996), expressed their

opinion about media as physical means including traditional media such as chalk, whiteboards, textbooks and modern facilities such as videos, tapes, recorders, computers, overhead projectors, and others. others present in instructional activities to be conveyed to students.

This designed basic electricity and electronics practical trainer has several advantages for use in the learning process, including:

1. This trainer can see directly the real components for active components (transistors and diodes) and passive components (RLC).
2. Can directly measure to determine whether or not damaged active components and passive components
3. This electronic practice trainer contains basic components of electricity and electronics so it is very important to master it because it becomes the basis for further practice.
4. This trainer includes components that are still good and components that are damaged, so that students can distinguish between good and damaged components.

This basic electricity and electronics practical trainer also has drawbacks, namely;

1. Practical trainers in the basics of electricity and electronics are very basic in nature, and are in one package so it costs a lot of money to design and manufacture the trainer products so that each student has one trainer.
2. Trainers for basic electrical and electronics practices are not yet equipped with precision measuring instruments such as ampher meters and volt meters.

METHODS

The method used in research is research and development (R&D) which was proposed by Borg & Gall regarding educational research and development (R&D) is a process used to develop and validate educational products (Meredith D. Gall, Joyce P. Gall, 2007). Furthermore, Seals and Richey (2007), research and development as a systematic study of the design, development and evaluation of programs, processes and learning products that must meet the criteria of validity, practicality and effectiveness. This research produced a product in the form of a basic electrical and electronics practice trainer and its development process, therefore this research adopted the Model from Hannafin and Peck (1998). The learning design model consists of three phases, namely the needs analysis phase, the design, development and implementation phases can be seen in the following figure:The research method describes: the approach, scope or object, operational definition in each variable/description of research focus, place, population and sample/informant, main source and tool, technique of data collection, and technique of data analysis. The methods are described clearly and in detail.

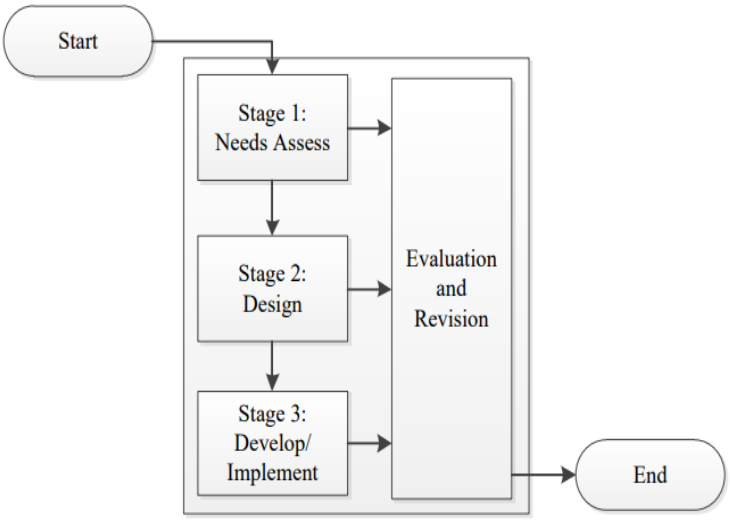

Figure 1. Hannafin and Peck's Development Model (Ely Kurniawan et al., 2019)

In this model, formative assessment needs to be carried out in each phase. This model is more product oriented, going through three phases:

1. The first phase, is a needs analysis carried out by identifying the needs and practice facilities at VHS 7 Bekasi which in fact really need practical facilities in the form of electronics trainers which have not been available so far.
2. The second phase is the design phase, in this activity designing a practical trainer in terms of component placement, artistic art, and ease of structuring component placement and ease of practice.
3. The third phase is the development and implementation phase, after the second step has been deemed sufficient, then it is implemented in the form of assembling electronic components, both passive and active components according to the design in the second step.

Questionnaire and test instruments were used by students in collecting data to see learning outcomes regarding practical abilities, interviews and observations of teachers and students. The data analysis technique used in this research is descriptive quantitative. Data regarding the feasibility of learning media for basic electrical and electronics practice trainers by media experts, material experts and students are data collected in research and development. The feasibility data uses descriptive statistical analysis techniques. According to Sugiyono (2008), Descriptive statistics are used to analyze data by describing the data that has been collected as it is without intending to make general conclusions or generalizations. For the effectiveness of the use of electrical and electronics basic practice trainers by comparing the results of the pretest and posttest which will then be calculated using the t test formula. In addition, a gain score is also calculated to see how effective the trainer is in the basic practices of electricity and electronics.

RESULTS & DISCUSSION

Results

This electrical and electronics practice trainer was developed based on a needs analysis at the 7 Bekasi State Vocational High School. There are no trainers for electrical and electronic practice as learning media in the process of learning activities in Basic Electricity and Electronics subjects. The development of electrical and electronic practical trainers is designed to facilitate students in learning, so that students' abilities increase in carrying out the process of analyzing physical conditions and measuring an electronic component properly. This electrical and electronic practical trainer is designed as a learning medium in the form of passive and active electronic components which students are expected to learn in practice directly.

The design of a basic electricity and electronics practice trainer is hardware that is used as the main equipment in the Basic Electricity and Electronics practicum. In supporting the practicum activities for the Basic Electricity and Electronics subject, trainers for electrical and electronics practice are being developed. The results of the basic electrical and electronic practice trainer design are as follows: Describes the outcome can be an increase in knowledge, skill or product. The results also reveal the level of achievement of the target activity. If in the form of objects there needs to be an explanation of product specification, its advantages and disadvantages. Output writing should include photos, charts, graphs, charts, drawings and more. The discussion is sequential in the order in which the objectives are, and it has been described first. The discussion is accompanied by a logical argument by linking the results with theories, other results and/or research results.

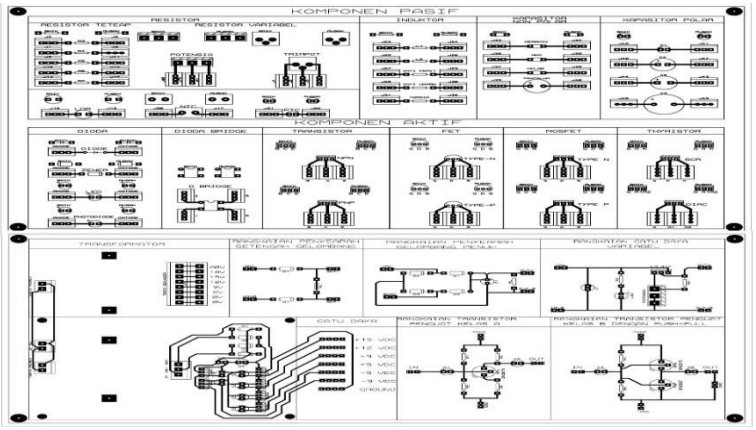

Figure 2. Design of a Basic Electrical and Electronics Practice Trainer

The development of electric and electronics basic practice trainers is through tests from experts to see the feasibility of 2 experts, namely; material experts and media experts. To see satisfaction from the use of electronics practice trainers used a questionnaire given to students. The feasibility results of the assessment from material and media experts on basic electrical and electronic practice trainers in electronics practice are as follows:

1. Material Expert Validation Result

The material expert's assessment is carried out for the assessment of Basic Electricity and Electronics material which includes material aspects. Figure 2 shows the recapitulation of the material expert validation results. Learning trainers are made in accordance with the existing curriculum at VHS 7 Bekasi which is passed down to the syllabus and then from the syllabus a lesson plan is made for the basic competencies of Basic Electrical and Electronics subjects.

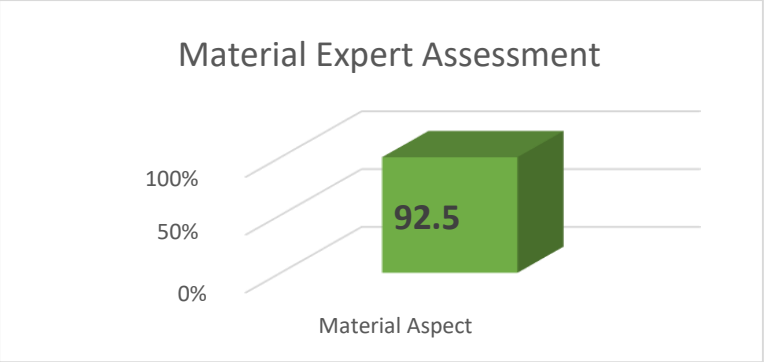

Figure 3. Diagram of Material Expert Assessment Results

Based on Figure 3, the feasibility value obtained from the material expert is 92.5%. Therefore it can be said that the material presented in the electronic trainer can be categorized as very feasible for students of the VHS Department of Audio Video Engineering.

2. Validation result of Media Experts

The media expert's assessment was carried out to assess the feasibility of the assembled components and materials in accordance with the design of the electronics practice trainer shown in Figure 2. The expert's assessment includes several aspects, namely material aspects and appearance aspects (component layout, distance between components). The results of the media expert's assessment can be presented in Figure 4.

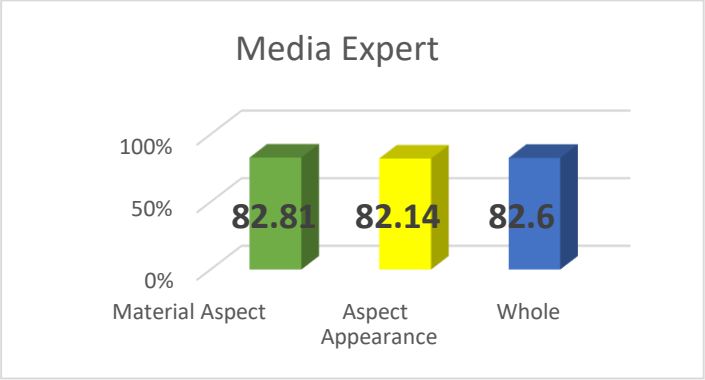

Figure 4. Diagram of the results of the media expert's assessment of each aspect

Based on Figure 3, the feasibility value of the learning is 82.81%, while in terms of Display Aspects it gets a percentage of 82.14%, if each aspect is combined it will get an overall percentage (average). of 82.60%. it can be said that electronics practicum trainers as learning media are very appropriate to use for basic electronics and electricity practice for VHS students majoring in audio video.

3. Trial result from Students

Product evaluation was carried out by 27 students of class X Audio Video Engineering VHS 7 Bekasi. The following are the stages in collecting learning media feasibility data through the stages of filling out a feasibility questionnaire.

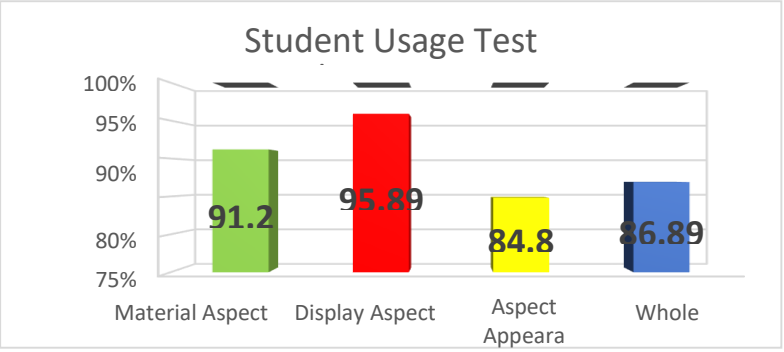

Figure 5. Diagram of Student Assessment Results for Each Aspect

Based on Figure 4 the data on the results of the assessment of use by 27 students of learning media Basic electronics practice trainers in terms of material aspects get 91.20%, technical aspects get 95.89%, appearance aspects 84.40%. While overall get 86.89%. Based on the Rating Scale eligibility category table that has been determined, it can be said that the learning media in the form of practicum trainers can be categorized as very feasible to be used as practical trainer learning media for VHS students in the Audio Video Department.

The Effectiveness of Using Electronics Practice Trainers

After implementing this electronics practice trainer at VHS 7 Bekasi, the Audio Video Department proved to be very effective. These results can be seen from the pre-test and post-test. The formula for calculating the t test and, N gain and the criteria are as follows:

$$t = \frac{Md}{\sqrt{\sum xd^2/n(n-1)}}$$

Information:

di = difference between the score after and the score before each subject (i)

Md = Average of the gain (d)

xd = Deviation of the gain score to the mean
(xd = di – Md) x2 d = Square deviation of the gain score to the mean
n = Number of samples

$$N\ gain = \frac{\text{score post test} - \text{score Pre test}}{total\ score\ ideal - \text{score Pre test}}$$

Category Interpretation of Effectiveness

Percentage (%)	**Interpretation**
< 40	Ineffective
40 − 55	Less effective
56 − 75	Effective enough
> 76	Effective

N-gain Score Criteria

N-gain value	**Category**
g > 0,7	High
$0,3 \leq g \leq 0,7$	Currently
g < 0,3	Low

Table 1. Calculation of the effectiveness test

No	Pre	Post	%	d	Xd=di -Md	Xd^2	n(n -1)	$\sum Xd^2/n(n-1)$	$\sqrt{\sum Xd^2/n(n-1}$	t_h	t_{tabel}
	X_1	X_2	increase								
				3			702	0,13	0,35	98,3	2,0
1	42	76	41,98	4	-0,81	0,66				2	6
				3							
2	31	65	41,98	4	-0,81	0,66					
				3							
3	41	75	41,98	4	-0,81	0,66					
				3							
4	37	71	41,98	4	-0,81	0,66					
				3							
5	41	75	41,98	4	-0,81	0,66					
				3							
6	33	70	45,68	7	2,19	4,80					
				3							
7	37	71	41,98	4	-0,81	0,66					
				3							
8	44	78	41,98	4	-0,81	0,66					
				3							
9	44	78	41,98	4	-0,81	0,66					
				3							
10	43	77	41,98	4	-0,81	0,66					
				3							
11	44	78	41,98	4	-0,81	0,66					
				3							
12	42	76	41,98	4	-0,81	0,66					
				3							
13	42	76	41,98	4	-0,81	0,66					
				3							
14	42	76	41,98	4	-0,81	0,66					
15	42	76	41,98	3	-0,81	0,66					

				43		
16	43	77	41,98	43	-0,81	0,66
17	44	78	41,98	43	-0,81	0,66
18	30	70	49,38	40	5,19	26,94
19	22	56	41,98	43	-0,81	0,66
20	32	70	46,91	38	3,19	10,18
21	26	60	41,98	43	-0,81	0,66
22	34	71	45,68	73	2,19	4,80
23	37	71	41,98	43	-0,81	0,66
24	26	60	41,98	43	-0,81	0,66
25	39	73	41,98	43	-0,81	0,66
26	28	62	41,98	43	-0,81	0,66
27	31	71	49,38	40	5,19	26,94
average	36,93	71,74	42,98			88,07

Table 2. Calculation of N-gain

No	Pret x1	Post x2	x2-x1	Scorer ideal	N gain	% N gain score
1	42	76	34	39	0,87	87,2
2	31	65	34	50	0,68	68,0
3	41	75	34	40	0,85	85,0
4	37	71	34	44	0,77	77,3
5	41	75	34	40	0,85	85,0
6	33	70	37	48	0,77	77,1
7	37	71	34	44	0,77	77,3
8	44	78	34	37	0,92	91,9
9	44	78	34	37	0,92	91,9
10	43	77	34	38	0,89	89,5
11	44	78	34	37	0,92	91,9
12	42	76	34	39	0,87	87,2
13	42	76	34	39	0,87	87,2
14	42	76	34	39	0,87	87,2
15	42	76	34	39	0,87	87,2
16	43	77	34	38	0,89	89,5
17	44	78	34	37	0,92	91,9
18	30	70	40	51	0,78	78,4

19	22	56	34	59	0,58	57,6
20	32	70	38	49	0,78	77,6
21	26	60	34	55	0,62	61,8
22	34	71	37	47	0,79	78,7
23	37	71	34	44	0,77	77,3
24	26	60	34	55	0,62	61,8
25	39	73	34	42	0,81	81,0
26	28	62	34	53	0,64	64,2
27	31	71	40	50	0,80	80,0
			average		0,8	80.04

Testing the effectiveness of the trainers that have been developed is carried out by comparing the results of the pretest and posttest using the t formula. From the results of calculations using the t test, there is an increase in average learning outcomes of 42.98% as shown in table 1 above, so it can be concluded that there is an increase in learning outcomes. To test the effectiveness obtained tcount = 98.2 and ttable = 2.056, because tcount> ttable, it can be said that this trainer is effective for use in practice. The gain score of 0.8 is in the range > 0.7 as shown in table 2. This means an increase in basic electrical and electronics practical skills before and after using a basic electrical and electronics practicum trainer with a high category, if referring to the interpretation of the percentage gain value of 80.4% which means the results are very effective.

Discussion

This learning media was made through two stages, namely the design stage of the basic electricity and electronics practice trainer and the second stage of making the basic electricity and electronics practical trainer. Electrical and electronics basic practice trainers are made in accordance with the syllabus and basic competencies of the Basic Electricity and Electronics subject. The basic electricity and electronics practical trainer consist of 2 parts, namely: The first part describes the basic electricity and electronics practical trainer, procedures for use, procedures for borrowing the trainer and a list of components available in the basic electricity and electronics practical trainer. The second part contains a collection of jobsheets that will be practiced. Electrical and electronics basic practice trainers are made in the form of one whole box. The basic electricity and electronics practice trainer block consists of an introduction to active components, passive components, simple electronic circuit blocks, namely half-wave rectifiers, full-wave rectifiers, variable power supplies, class A amplifiers and class B amplifiers.

Based on the feasibility assessment of learning media experts regarding basic electrical and electronics practical trainers, it is in a valid and feasible category, from the media aspect and the appearance aspect of the basic electronics trainer it meets the standard criteria and principles of making learning media and can be used as learning media. Furthermore, for the assessment of material experts, it received a very decent value category, which was adjusted from the curriculum, syllabus and learning implementation plans and the needs and

characteristics of class X students of VHS 7 Bekasi. The development of an electronic learning trainer was also developed and implemented by Rahmi (2019), in class X high school) which is valid based on saga text based on Project Based Learning (in terms of content, presentation, language, and graphics), practical (in terms of ease of use and suitability for time), and effective (in terms of student activities, learning outcomes, and student affective). The fairly good (high) scores obtained by students after using the basic electronics practical trainer can be the basis that the trainer is feasible and can be used as a supporting medium in the practical learning process to improve students' abilities in the process of analyzing physical conditions and measuring an electronic component.

In line with Huda (2019), who designed an electronics trainer in the form of robotics in the digital electronics said that this trainer received a positive response from students (90%), where students felt happy and motivated by using a learning trainer equipped with teaching aids. Thus, the results of the development of electronic trainers are feasible for use in learning digital electronics courses. The results of Sumiyati's (2020) research, concerning the development of learning media in the Basic Electricity and Electronics subject are very suitable for use. The results of the media expert's assessment were 0.84 and the results of the material expert's assessment were 0.74. Based on the assessment of the two experts, the Basic Electrical and Electronics electronics trainer is very suitable for use in the learning process. From the posttest scores, the students obtained effective results, namely 0.00, which is smaller than 0.005, which means it is significant from the values of the experimental class and the control class. The design of learning media is very important and beneficial for the success of learning outcomes and students' abilities in learning process activities.

CONCLUSION

The development of learning media for basic electricity and electronics practical trainers that has been developed is proven to be effective and practical for use in practical learning, besides that it can increase student activity in learning.

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