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DEVELOPMENT OF ELECTRICAL CIRCUIT TOOLS TO IMPROVE THE UNDERSTANDING OF THE CONCEPT OF DYNAMIC ELECTRICAL MATERIALS IN SMP PLUS ONE ROOF INTEGRATED 1 OF WASUR MERAUKE

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ABSTRACT

Research has been carried out which aims to improve the understanding of the concept of electrical circuit material through a practicum method using an electric circuit trainer that is made and developed using tools and materials in Merauke. Product development is carried out by making electrical circuit props, if usually the electrical circuit practicum uses a cable as a connection to the electric current on the development that has been carried out the cable is replaced with PCB (Printed Circuit Board). Questionnaire response to the use of dynamic electric circuit props 0.745> 0.05 and learning outcomes / posttest 0.971> 0.05, the questionnaire response data using teaching aids and student learning outcomes are normally distributed. Significance value (Sig.) For each data obtained is greater than the significance value of 0.05. The ttable value = 1.699 and from the table data above shows that tcount 11.045> t table 1.699 with a significance value of 0.00 <0.05 for the influence of the application of dynamic electric props on student learning outcomes, where there is an effect of the application of teaching aids to student learning outcomes.

Keywords: props, electrical circuits, concept enhancements, subject matter.

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1. INTRODUCTION

Natural Sciences (IPA) is knowledge obtained through data collection with experiments, observations and deductions to produce an explanation of a natural phenomenon that can be trusted. Good science learning not only comes from books but science learning must be equipped

with practice and connected with the surrounding environment. Students will be encouraged to develop scientific skills and attitudes in learning so that they change the mindset of students. The teaching and learning process, especially science lessons, should be able to provide real learning experiences to students so that students can find their own material concepts. Besides that the learning method used must be able to make students more active because the current learning system requires students who are the center of learning (Student Centered Learning) [5]. Teacher-centered learning methods are less appropriate to be applied especially in Physics science lessons because in Physics science studies learn about natural phenomena and almost all concepts in Physics can be found by students themselves. Student Centered Learning requires teachers to use or combine several appropriate learning methods. For example for science learning Physics can be used combining experimental learning methods, discussion and question and answer. From the results of the experiments conducted by students, the students held discussions with their team to find concepts from the material that had been experimented with. Experimental-based learning methods have a major impact on learning physics, especially in understanding natural phenomena that occur in the world [2]. Experiments are the most important education because they teach abstract material to be real [3].

Giving Student Worksheets (LKS) is very instrumental to guide students to discover concepts from the material that has been experimented with. Experimental and practical activities as one method that prioritizes processes and work to find out for themselves a scientific concept based on a process, observation, analysis, verification and drawing conclusions from an object [1]. The problem that is usually faced by teachers to apply the experimental method is the availability or limitations of the practical support tools in the school [6]. The lack of availability of practicum supporting tools can be overcome by making a simple practical tool by utilizing the tools and materials that are around and easily accessible.

2. METHODS

2.1. Design

This research is classified into research and development. Research and development methods (Research and Development) are research methods used to produce a particular product, and test the effectiveness of these products. Research and Development is a research method that intentionally, systematically, aims or directed to find, find, formulate, improve, develop, produce and test the effectiveness of a product, method / strategy / way, service or particular procedure in order to become superior, new effective, efficient, productive and meaningful. In this case an Electric Circuit Viewer was developed for Dynamic Electric material practice.

2.2. Subject

Subjects in this study were class IX SMP Plus One Roof Integrated 1 Wasur, Merauke.

2.3. Definition stage

The procedure of the research carried out begins at the defining stage starting from the Analysis of Practical Tools, Literature Analysis Practical Guidance Module, Practical Analysis and Concept Analysis.

2.4. Design stage

The steps that are passed in the design stage are the stages of designing the Electric Circuit props with steps:

- Electrical Circuit Analysis
- Describes the Electric Circuit scheme

- Making electrical circuit props

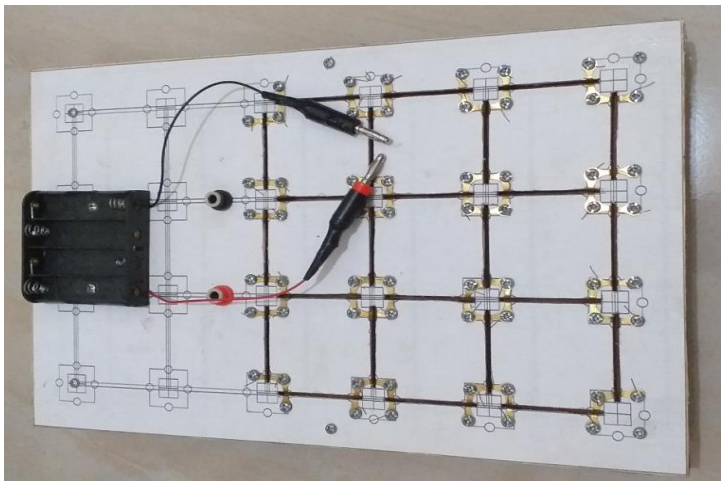

Figure 1. Electric circuit props

2.5. Testing phase

The testing phase of the electric circuit props is carried out in the implementation of the lab. The guiding module for the implementation of practicums and worksheets is used as a tool in the implementation of lab work. Module design is done by making cover, preface, table of contents, practicum report writing format, practicum implementation instructions, experimental objectives, tools and materials, theoretical basis, work steps, observational data, final evaluation and bibliography. Before testing, the module is validated by experts / experts.

2.6. Development phase

The development phase includes validation and questionnaires. Before the tool is tested in a series, the tool is calibrated first. Tool calibration is done to adjust between tools made with standard product tools. After calibration the product is tested for the product. Product testing is done to prove that the parameters used meet the requirements for use. Validation of props for electrical circuits is used as a feasibility test and an increase in the quality of the products produced. In addition to the tools validated by experts / experts, the tools are tested and measured according to standard tools or products. The testing of the tools carried out is: Accuracy, resolution, accuracy, sensitivity and stability of the tool.

Table 1. Aspect of product evaluation

Validation of Practical Module			
No	Aspect	Method of collecting data	Instrument
1	Feasibility content	Validator	Validation sheet
2	Feasibility construction		
3	Language component		
4	Technical		

Table 2. Practicing electric circuit props

No	Aspect	Method of collecting data	Instrument
1	Easy in using electric circuit props	Questionnaire	Practical questionnaire sheet
2	Students response in practikum use electric props with the help of practical module.	Questionnaire	Questionnaire response

2.7. Data Types

There are 2 types of data in this study, namely:

2.7.1. Qualitative data

Qualitative data uses text data from interviews, questionnaires, author notes and activity photos, qualitative data used namely:

1. Initial analysis
2. Review of research subjects

2.7.2. Quantitative data

Quantitative data in the form of numerical scores, quantitative data used, i.e.:

1. Score criteria from research subjects
2. Value of understanding concepts after the teaching and learning process.

2.8. Instruments for data collection

The research instruments used in this study are as follows:

1. Questionnaire validation sheet
2. Validation sheet about test questions for understanding students' concepts.

2.9. Data analysis techniques

The data obtained will be analyzed using qualitative descriptive statistics to measure product development validity and the level of understanding of students' concepts. Qualitative descriptive statistical analysis uses the following formula:

$$\text{Percentage } (\%) = \frac{\sum(\text{answer choice } \times \text{ weight of each choice})}{\text{n } \times \text{weight of each choice}} \times 100\%$$

where n is the number of items

Table 3. Achievement of validation value

Value	Validity	Criteria
25 – 40	Invalid	Cannot be used
41 – 55	Less valid	May not be used
56 – 70	Quite valid	May be used, big revision
71 – 85	Valid	May be used, small revision
86 – 100	Very valid	May be used, small revision

3. RESULTS AND DISCUSSION

3.1. Initial product development

Product development is carried out by making electrical circuit props, if usually the electrical circuit practicum uses a cable as a connection to the electric current on the development that has been carried out the cable is replaced with PCB (Printed Circuit Board). It aims to make it easier for students to do practicum and more interesting in its implementation, because the arrangement of the series is almost the same as arranging a puzzle. In addition, students can also better understand to be able to distinguish series, parallel and mixed electrical circuits.

Questionnaire development aims to determine students' attitudes towards the use of dynamic electric props. Questionnaire attitude towards the use of teaching aids was developed based on the formulation of indicators of student attitudes towards the development and application of learning aids. Questionnaire consists of 30 statements compiled based on indicators of student attitudes towards the development of dynamic electric props. The student attitude questionnaire indicator for the use of dynamic electric props is table 4. below:

Table 4. Indicator of student attitude to the use of dynamic electric propos

Category	Aspect	Question	
		Positive	Negative
Students response to the use of dynamic electric props	Cognitive	1, 2, 3,4,5, 6, 7, 26, 27	8, 9,10, 30
	Affective	11,12, 13, 14, 15, 28, 29	16, 17, 18
	Psychomotor	19, 20, 21, 22, 23	24, 25

The attitude questionnaire is in the form of a checklist that contains the student's attitude statement towards the development and application of the use of dynamic electric circuit props. The rating scale model that will be used is the Likert scale model which consists of four types of responses, namely: strongly agree, agree, disagree, and strongly disagree. The statement on the attitude questionnaire consists of positive statements and negative statements. For the determination of the score items are divided into two ways, namely for positive statements given a score of four, three, two, and one, while for negative statements given a score of one, two, three, and four. Scores for positive statements or negative statements are given for each consecutive response strongly agree, agree, disagree, and strongly disagree. After the learning process of dynamic electric material using developed teaching aids is complete, students are asked to fill in the lift. The purpose of the student attitude questionnaire is important to see the influence of the use of props that have been developed in dynamic electrical material.

3.2. Product trials

The development of Dynamic Electric learning material teaching aids has been tested to students based on questionnaire data and learning outcomes that have been processed using the following results:

Table 5. Results of normality Chi-Square

Descriptive Statistics

	N	Mean	Std. Deviation	Minimum	Maximum
Questionnaire	35	57.83	7.808	44	75
Posttest	35	68.29	12.899	35	90

Table 6. Results of normality Kolmogorov-Smirnov

Descriptive Statistics

	N	Mean	Std. Deviation	Minimum	Maximum
Questionnaire	35	57.83	7.808	44	75
Posttest	35	68.29	12.899	35	90

The normality test in this study used the Kolmogorov-Smirnov test assisted by SPSS ver.20. The criteria of this test are if the significance value (Sig.)> 0.05 then the data is normally distributed and vice versa if the significance value (Sig.) <0.05 then the data is not normally distributed. The results of the test can be seen in the following table:

Table 7. Normality Kolmogorov-Smirnov

One-Sample Kolmogorov-Smirnov Test			
		Angket	Posttest
N		35	35
Normal Parameters[a,b]	Mean	57.83	68.29
	Std. Deviation	7.808	12.899
Most Extreme Differences	Absolute	.115	.083
	Positive	.075	.083
	Negative	-.115	-.075
Kolmogorov-Smirnov Z		.679	.488
Asymp. Sig. (2-tailed)		.745	.971

The table above shows that the significance (Sig.) Of the response questionnaire using dynamic electric circuit props is 0.745> 0.05 and the learning outcomes / posttest is 0.971> 0.05, the questionnaire response data for the use of teaching aids and student learning outcomes are normally distributed. Because the significance value (Sig.) For each data obtained is greater than the significance value of 0.05.

The data shows the significance number (Sig.) 0,00 <0,05 so that there are differences in learning outcomes before and after treatment. While the hypothesis test variables influence the use of props on learning outcomes used the Paired-Simples T-Test test.

Tabel 8. Hypothesis analysis Paired-Simples T-TestSPSS ver.20

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Questionnaire - Posttest	-10.457	5.601	.947	-12.381	-8.533	-11.045	34	.000

The ttable value = 1.699 and from the table data above shows that tcount 11.045> t table 1.699 with a significance value of 0.00 <0.05 for the influence of the application of dynamic

electric props on student learning outcomes, where there is an effect of the application of teaching aids to student learning outcomes.

3.3. Final product

The props developed must be superior, new, effective, efficient, productive and meaningful, so that based on the results of the validation of the teaching aids that have been developed meet these requirements so that it is feasible to be used in serial, parallel and mixed electrical circuit practicums. The final product consists of dynamic electric teaching aids, Student Worksheets (LKS), reasoning ability tests and attitude questionnaires for mathematics, each of which has met the valid criteria with good categories. Dynamic electricity learning devices have been revised based on input or suggestions from experts so that it is feasible to use.

In the implementation of the learning process using electric circuit props, students are divided into groups with the aim that students work together to carry out practicum and fill in the LKS. Group division is carried out heterogeneously, besides being able to work together LKS is given before starting practicum and is used as a practical guide. The use of LKS is very helpful in practicum implementation and makes it easier for students to follow the steps according to the flow in the lab. Based on the LKS assessment on average each practicum group gets the lowest score of 80 and the highest score of 90. The implementation of the teaching and learning process uses a dynamic electrical circuit maintenance device reaching 90%, this is seen from the KKM value of 85% students passing the KKM. The use of electric circuit kits can improve cognitive and psychomotor students, because students can better understand simple electrical circuits by learning using electric circuit display kits [4].

Figure 2. Experiment using props

4. CONCLUSION

Based on the results of research that has been carried out the use of dynamic electric learning props in the teaching and learning process has an influence on student learning outcomes. This can be seen from the value of student learning outcomes in which 85% of students pass the KKM and the implementation of the teaching and learning process using a dynamic electric circuit guard reaches 90%. Questionnaire response to the use of dynamic electric circuit props 0.745> 0.05 and learning outcomes / posttest 0.971> 0.05, the questionnaire response data using teaching aids and student learning outcomes are normally distributed. Because the significance value (Sig.) For each data obtained is greater than the significance value of 0.05. The ttable value = 1.699 and from the table data above shows that tcount 11.045> t table 1.699 with a significance value of

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