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Research Article

Effect of Application Smart Circuit Learning Media to Mathematics Learning Outcomes: A Case Study of Islamic School Students

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Abstract
One of the supporting factors for success in the learning process is the use of learning media. One of the existing learning media but not yet fully used is smart circuit learning media. In this study used quantitative experimental methods, data analysis using statistical formula. The population in this study were all seventh grade students in the even semester of Islamic School of Bandar Lampung in the academic year 2018/2019. The population is spread in 7 classes. Two classes were sampled, namely class VII C as the experimental class and VII D as the control class. Sampling uses techniques *cluster random sampling*. Based on the results of research that the authors describe that results t_{count}=2,93from the distribution table at the level 5% known t_{tabl} =1,99 and at the level 1% known t_{table}=2,65. Proven $t_{count}>t_{table}$so that it can be concluded that there is an influence of the application of smart circuit learning media to the mathematics learning outcomes and the average mathematics learning outcomes that apply smart circuit learning media are higher than the average results Mathematics learning students who apply conventional learning media to class VII students in the even semester at Islamic School of Bandar Lampung.

Keywords
smart circuit learning media, normality test, homogeneity test, cluster random sampling

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Introduction

Mathematics in the world of education is one of the basic sciences that can be used to support the existence of other sciences such as physics, chemistry, computers, and so forth (Sagala, Umam, Thahir, Saregar, & Wardani, 2019). In addition, mathematics is also flexible, which always develops in accordance with the demands of the times (Diani, Irwandani, et al., 2019). This is what encourages educators to be more creative in developing and applying mathematics as a basic science (Cetin & Tortop, 2018). Mathematics has a very important role in the development of science and technology (Kasayanond, Umam, & Jermsittiparsert, 2019), the more advanced technology, the more the use of basic mathematical knowledge that demands many tools and servants in other sciences (Muhamad Syazali et al., 2019), the more important the position of mathematics in the world of education (Listiana, Abdurrahman, Suyatna, & Nuangchalerm, 2019), both in applied aspects and they reasoning has a very important role because mathematics has a clear and close structure and interrelationship (Rufaidah, AtIrsyadi, Saregar, & Umam, 2018) between the concepts that enable us to be skilled in thinking rationally (Hartinah et al., 2019). In addition, mathematics is an abstract science, to support this in mathematics learning which has a subject that is so abstract and varied that there is a need for assistive devices such as learning media to help students learn to understand mathematical concepts(Abdurrahman, Saregar, & Umam, 2018).

We realize that the abilities available to students to accept mathematics are different and there may even be some students whose memory is lacking or low so that they cannot imagine objects that are abstract so students cannot receive the subject matter given (Gulgor & Tortop, 2018), thus can lead to low mathematics learning outcomes of students, not received with good mathematics learning material provided may be caused by a lack of use of facilities in the teaching and learning process (Lestari et al., 2019).

Based on preliminary observations on the learning process of class VII mathematics in Islamic School of Bandar Lampung, information was obtained that during the learning process mathematics was rarely used learning media and student mathematics learning outcomes were not fully satisfactory. Mathematical learning also does not escape the tendency of the teacher centered learning process (Kesumawati & Octaria, 2019). Such conditions certainly make the learning process only mastered by the teacher (Yilmaz & Tortop, 2018). Moreover, mathematics learning is a subject that has abstract objects and is built through a deductive reasoning process so students are required to have a deeper understanding of the material delivered by the teacher (Rahmi Ramadhani, Umam, Abdurrahman, & Syazali, 2019). Efforts to improve learning outcomes of class VII students at Islamic School of Bandar Lampung in mathematics learning have been

carried out by teachers in various ways, such as giving students the opportunity to ask questions and design learning in the form of group discussions (Rahman, Abdurrahman, Kadaryanto, & Rusminto, 2015). However, the results of mathematics learning have not been satisfactory. From the observations made in Islamic School of Bandar Lampung, students' mathematics learning outcomes still have not produced satisfactory test scores, namely the values that are in accordance with the Minimum Completion Criteria which have been determined, namely 70. VII in Islamic School of Bandar Lampung, the writer attempts to apply smart circuit learning media in mathematics learning. Smart circuit learning media is a media that is designed to facilitate learning in mathematics (Noviyanti, Sugiharta, & Farida, 2019), because smart circuit learning media can create a learning process with nuances of play (Ridho, Anggoro, & Andriani, 2019). The use of smart circuit learning media (Figure 1) in the mathematics learning process is a variation in the learning process, so that students do not feel bored and bored in learning mathematics in the classroom (R. Ramadhani & Narpila, 2018).

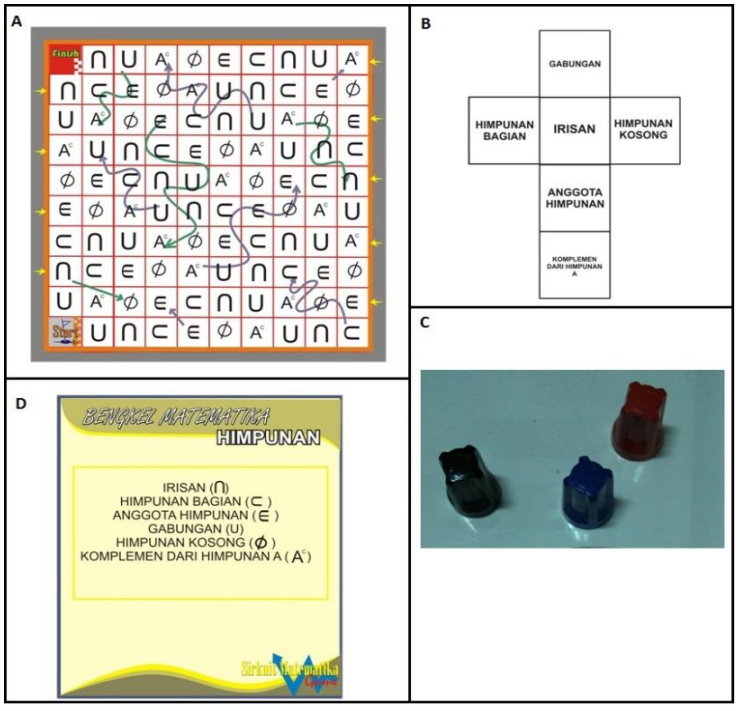

Figure 1.

(A) Set Material Smart Circuit Board Games; (B) Dice Side Design of the Smart Circuit Material Set; (C) Bidak Smart Circuit Games; (D) Set Material Mathematics Workshop

Smart circuit learning media provide nuances of play for students, so that unconsciously students have done the learning process. Based on these conditions,

the author was moved to conduct research with the title "Effect of Application Smart Circuit Learning Media to Mathematics Learning Outcomes: A Case Study of Islamic School Students ".

From this, the research was conducted with the following objectives:

- To find out whether or not there is an effect of the application of smart circuit learning media to the learning outcomes of mathematics in class VII students in the even semester of Islamic School of Bandar Lampung year 2018/2019.
- To find out whether the average mathematics learning outcomes of students who apply smart circuit learning media are higher than the average mathematics learning outcomes of students who apply conventional learning media to class VII students in the even semester of Islamic School of Bandar Lampung academic year 2018/2019.

Method

Research Model

In this study to find out the data obtained need to be made a measurement of variables, in the measurement of variables carried out tests, both tests in the experimental class namely classes that apply smart circuit learning media and control classes namely classes that apply conventional learning media to determine the effects that occur(Maskur, Syazali, & Utami, 2019).

Data analysis

The test kits used were ten (10) essay test essays. By giving a score as follows Table 1.

Table 1.

The Test Kits Score

	Score
For correct answers	(10)
For the half answer or the final answer is wrong but the description process is correctly	(5)
For the final answer correct but without the completion step in the question that requires a description but without the description	(0)
Wrong answers	(0)

Thus, the maximum score students can get is 100 and the minimum score is 0. Thus the score ranges from 0 - 100.The grading system that will be used:

$$\left(N = \frac{score\ obtained}{maximum\ score} \times 100\right)$$

Participants

The population in this study were all seventh grade students in the even semester of Islamic School of Bandar Lampung in the academic year 2018/2019. The population is 253 students spread in 7 classes. The total population of this study can be seen in Table 2 below:

Table 2.

Total of Class VII Students Even Semester in Islamic School of Bandar Lampung Academic Year 2018/2019

No	Class	Gender		Total
		Male	Female	
1	VII A	14	22	36
2	VII B	20	17	37
3	VII C	18	19	37
4	VII D	18	18	36
5	VII E	16	19	35
6	VII F	12	24	36
7	VII G	18	18	36
	Total	**116**	**137**	**253**

To carry out research, the determination of a sample of two classes was made into two groups, namely:

- Classes that apply smart circuit learning media as an experimental class, namely class VII C.
- Classes that apply conventional learning media as a control class, namely class VII D.

Data Tools and Process Analysis

In the sampling process used cluster random sampling technique. Cluster random sampling is from several classes or groups that exist in populations that are truly considered to represent the population. Samples taken as many as two classes randomly from seven existing classes, namely class VII C as an experimental class which amounted to 37 students and class VII D as a control class totaling 36 students.

To test the truth of the hypothesis, the authors collect data in the form of numbers or values and to obtain data, in this study the authors used data collection techniques, namely test techniques (Sriyakul et al., 2019).

In this study, the tests were given in the same type for the control class and the experimental class. The test used in this study is an essay test, a set of tests consisting of 10 items essays. The grid of test instruments used can be seen in Table 3 below:

Table 3.
Test Instrument Grid (Competency Standards: Using Set Concepts and Venn Diagrams in Problem Solving)

Basic competencies	Indicator	Assessment aspects	Number of Question	Difficulty level
Understand the understanding	Students can explain the meaning of the set	Memory	1	Easy
and notation of the set and presentation	Students can distinguish members and not members of the set	Memory	2	Easy
Understand the concept of subsets	Students can determine the number of subsets of a set	Application Understanding	3 4	Normaly Easy
Performs slices, joints, less operations and complements on the set	Students can determine, distinguish, and resolve slices and combinations of two sets	Application Understanding	5 6	Normaly Normaly
Presents sets with venn diagrams	Students can complete the complement of a set with a venn diagram	Application Understanding	7 8	Difficult Difficult
Using the concept of set in problem solving	Students can solve problems using venn diagrams and set concepts through story problems	Application Understanding	9 10	Difficult Difficult

Results

Based on the research carried out by the author, data obtained from the experimental test math scores (class VII C) and the control class (class VII D) were analyzed as follows(Lestari et al., 2019):

Normality Test of Experimental Class Data

From the math test scores for the experimental class is obtained Table 4.

Table 4.
Frequency Distribution List of Experimental Class Test Results (Lestari et al., 2019)

Value	f_i	x_i	x_i^2	$f_i . x_i$	$f_i . x_i^2$
50 – 58	2	54	2916	108	5832
59 – 67	7	63	3969	441	27783
68 – 76	7	72	5184	504	36288
77 – 85	10	81	6561	810	65610
86 –94	6	90	8100	540	48600
95 – 103	5	99	9801	495	49005
Total	**37**	**459**	**36531**	**2898**	**233118**

Source: Data Processing

To calculate the theoretical frequency will be determined first(Lestari et al., 2019):

1. Determine class limits (x_i).
2. Calculates Z for boundaries, by formula :
$$Z = \frac{x_i - \overline{x_1}}{S_1}$$
3. Calculate the area of the interval class by looking at table F.
4. Calculate the expected frequency (Ei) by multiplying the area of each class with the amount of data that is (E_i) = L_i.n.

From the provisions above, the results shown in Table 5 below can be obtained:

Table 5.

Expected Frequency Distribution List and Frequency of Experimental Class Observations (Lestari et al., 2019)

X_i	Z	Z_i	L	E_i	O_i
49,5	-2,21	0,5000			
58,5	-1,52	0,4357	0,0519	2,38	2
67,5	-0,83	0,2967	0,1378	5,14	7
76,5	-0,14	0,0557	0,2410	8,92	7
85,5	0,55	0,2088	0,2645	9,79	10
94,5	1,24	0,3925	0,1837	6,80	6
103,5	1,93	0,5000	0,0807	3,98	5

Source: Data Processing

Normality Test of Control Class Data

From the Table 6, list the value of the mathematics test in the control class is obtained:

Table 6.

Frequency Distribution List of Control Class Test Results(Lestari et al., 2019)

Value	f_i	x_i	x_i^2	$f_i . x_i$	$f_i . x_i^2$
45 – 52	2	48,5	2352,25	97	4704,5
53 – 60	6	56,5	3192,25	339	19153,75
61 – 68	7	64,5	4160,25	451,5	29121,5
69 – 76	10	72,5	5256,25	725	52562,5
77 – 84	8	80,5	6480,25	644	51842
85 – 92	3	88,5	7823,25	265,5	23496,75
Total	**36**	**396**	**29273,5**	**2522**	**180881**

Source: Data Processing

From the provisions of the theoretical frequency, the results shown in Table 7 can be obtained:

Table 7.
List of Expected Frequency Distribution and Frequency of Observation of Control Classes (Lestari et al., 2019)

X_i	Z	Z_i	L	E_i	O_i
45,5	-2,33	0,5000			
			0,0449	1,97	2
52,5	-1,60	0,4452			
			0,1374	4,95	6
60,5	-0,87	0,3078			
			0,2521	9,08	7
68,5	-0,14	0,0557			
			0,2781	10,01	10
76,5	0,59	0,2224			
			0,1842	6,63	8
84,5	1,32	0,4066			
			0,0732	3,36	3
92,5	2,05	0,5000			

Source: Data Processing

Test of Variance Homogeneity

Based on the testing of two populations that have been shown to be normally distributed the next step is testing the homogeneity of the variants of the two samples:

The hypothesis is:

H_0 : $\sigma_1^2 = \sigma_2^2$both samples have the same variance.

H_1 : $\sigma_1^2 \neq \sigma_2^2$both samples have different variances.

The test statistics used are :

$$F = \frac{Biggest\ variance}{Smallest\ variance}$$

After counting, it turns out $F_{count} < F_{table}$to a significant degree 5% obtained 1,42< 1,75 and significant level 1% obtained 1,42< 2,23means that both data have homogeneous variances.

Hypothesis Testing

Average Two Similarity Test

To test the first hypothesis: "There is the influence of the application of smart circuit learning media to the learning outcomes of mathematics in class VII students in the even semester of Islamic School Bandar Lampung in the academic year 2018/2019".

The hypothesis formula:

$H_0.1 : \mu_1 = \mu_2$ There is no effect on the application of smart circuit learning media to the learning outcomes of mathematics in class VII students in the even semester of Islamic School Bandar Lampung academic year 2018/2019.

$H_0.1 : \mu_1 \neq \mu_2$ There is the influence of the application of smart circuit learning media to the learning outcomes of mathematics in class VII

students in the even semester of Islamic School Bandar Lampung academic year 2018/2019.

Based on the results obtained t_{hit} = 2,93 by involving test criteria with a significant level 5% and 1% then:

Test criteria: accept H_0 if $t_{(1-\frac{1}{2}\alpha)} < t_{count} < t_{(1-\frac{1}{2}\alpha)}$ otherwise it is rejected.

Turns out for α = 0,05 and α = 0,01. $T_{count} > t_{table}$ to a significant degree 5% obtained2,93> 1,99 and level 1% obtained2,93> 2,65 so the hypothesis H_o rejected, means Ha accepted, that is, there is the influence of the application of smart circuit learning media to the learning outcomes of mathematics in class VII students in the even semester of Islamic School Bandar Lampung academic year 2018/2019.

Test for Two Difference Averages

To test the second hypothesis: "The average mathematics learning outcomes of students who apply smart circuit learning media are higher than the average mathematics learning outcomes of students who apply conventional learning media to the seventh semester students of Islamic School Bandar Lampung".

The hypothesis formula:

$H_0.1 : \mu_1 \leq \mu_2$ The average mathematics learning outcomes of students who apply smart circuit learning media are smaller or equal to the average mathematics learning outcomes of students who apply conventional learning media to class VII students in the even semester of Islamic School Bandar Lampung.

$H_0.1 : \mu_1 > \mu_2$ The average mathematics learning outcomes of students who apply smart circuit learning media are higher than the average mathematics learning outcomes of students who apply conventional learning media to class VII students in the even semester of Islamic School Bandar Lampung.

The results of hypothesis testing using t_{tes} = 2,93 and from the distribution table at a significant level 5% obtained t_{table}= 1,67 and to a significant degree1% obtained t_{table} = 2,38.

This shows that $t_{count} > t_{table}$to a significant degree 5% or to the level 1%, so the hypothesis H_0 rejected, means H_a is accepted, namely the average student mathematics learning outcomes(Pratama, Sudiyanto, & Riyadi, 2019) with the application of smart circuit learning media is higher than the average student who applies conventional learning media(Kasayanond et al., 2019).

Follow-up of Observation Results

Table 8.

Comparison of the Average Percentage of Activity of Experimental Class Students with the Control Class

No	Average Percentage of Activities ($\bar{X}$% Ai) Experiment Class	Activity Category	No	Average Percentage of Activities ($\bar{X}$% Ai) Control Class	Activity Category
1	83%	Active	1	50%	Not active
2	50%	Not active	2	67%	Active
3	67%	Active	3	50%	Not active
4	67%	Active	4	50%	Not active
5	83%	Active	5	83%	Active
6	50%	Not active	6	50%	Not active
7	67%	Active	7	50%	Not active
8	83%	Active	8	67%	Active
9	100%	Active	9	50%	Not active
10	50%	Not active	10	67%	Active
11	67%	Active	11	67%	Active
12	83%	Active	12	50%	Not active
13	50%	Not active	13	67%	Active
14	67%	Active	14	50%	Not active
15	83%	Active	15	67%	Active
16	67%	Active	16	50%	Not active
17	50%	Not active	17	67%	Active
18	67%	Active	18	67%	Active
19	83%	Active	19	67%	Active
20	67%	Active	20	67%	Active
21	50%	Not active	21	50%	Not active
22	83%	Active	22	67%	Active
23	83%	Active	23	67%	Active
24	50%	Not active	24	83%	Active
25	83%	Active	25	67%	Active
26	50%	Not active	26	50%	Not active
27	67%	Active	27	67%	Active
28	83%	Active	28	67%	Active
29	83%	Active	29	67%	Active
30	83%	Active	30	67%	Active
31	50%	Not active	31	83%	Active
32	83%	Active	32	50%	Not active
33	67%	Active	33	67%	Active
34	67%	Active	34	50%	Not active
35	67%	Active	35	33%	Not active
36	83%	Active	36	50%	Not active
37	83%	Active	37	50%	Not active
	$\sum \bar{X}$% Ai = 2599			**$\sum \bar{X}$% Ai = 2188**	
	Overall average = 70,24%			**Overall average = 60,78%**	

Source: Data Processing

From the table above it can be concluded that the activeness of students who apply smart circuit learning media has a higher average of activity compared to the average activity of students who apply conventional learning media, which is equal to 70.24% while the activeness of students applying learning media conventional 60.78% (Figure 2).

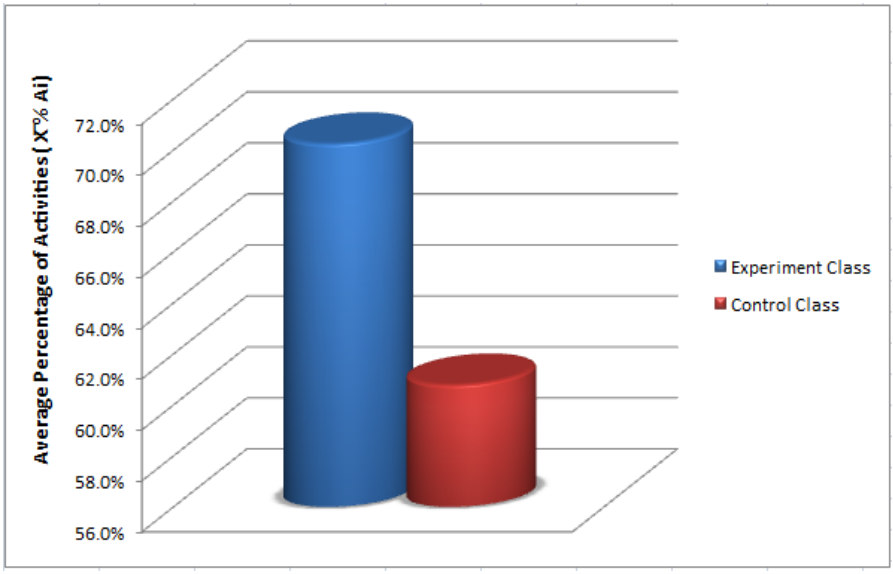

Figure 2.

Percentage of Activities ($\bar{X}$% Ai)

Discussion

Based on the research that has been done and based on the results of the calculation obtained the average value of the learning ability of the experimental class or class that applies smart circuit learning media is$\overline{X_1}$ = 78,32and the average learning ability of the control class or class that applies conventional learning media is $\overline{X_2}$ = 70,06(Habibi et al., 2019).From the results of the research that has been carried out, it can be seen that for the similarity test, two averages are obtained t_{count} = 2,93. The test criteria used are accept H_0 if $t_{(1-\frac{1}{2}\alpha)} < t_{count} < t_{(1-\frac{1}{2}\alpha)}$other than that rejected with dk = $n_1 + n_2 - 2$. By taking a significant level α = 0,05 obtained t_{table} = 1,99while at a significant level α = 0,01 obtained t_{table} = 2,65. It can be seen that t_{count} does not meet the acceptance criteria H_o good for a significant level α = 0,05 or α = 0,01(Muhamad Syazali, 2015). This shows that the results of the test are quite meaningful and can accept the provisional assumption that(Suriati, 2019) there is an influence of the application of smart circuit learning media to the

mathematics learning outcomes(Syahrir et al., 2019) of seventh graders in the even semester at Islamic School of Bandar Lampung in the academic year 2018/2019.

As for testing the difference in the two averages with t_{count} = 2,93and the test criteria used are accept H_o if $t \leq t_{(1-\alpha)}$, other than that H_o rejected with dk = n_1 + n_2 – 2. By taking a significant level α = 0,05 obtained t_{table} = 1,67while at a significant level α = 0,01 obtained t_{table} = 2,38. It can be seen that$t \geq t_{(1-\alpha)}$at a significant level α = 0,01 or α = 0,05. So that H_o rejected and H_a be accepted, which means that the average mathematics learning outcomes of students who apply smart circuit learning media are higher than the average mathematics learning (Murti, Nasir, & Negara, 2019)outcomes of students who apply conventional learning (Maskur et al., 2019) media to class VII students in the even semester at Islamic School of Bandar Lampung academic year 2018/2019.

Then the answer to the problem posed is "There is the influence of the application of smart circuit learning media on mathematics learning outcomes in class VII students of the Islamic School of Bandar Lampung academic Year 2018/2019" and "The average mathematics learning outcomes of students who apply smart circuit learning media higher than the average mathematics learning outcomes of students who apply conventional learning media (M. Syazali et al., 2019) to class VII students in the even semester at Islamic School of Bandar Lampung academic year 2018/2019". From the results of the research that has been done it can be seen that the differences in the treatment of learning media (Hartinah et al., 2019), in this case by applying smart circuit learning media affect the student learning outcomes (Diani, Herliantari, Irwandani, Saregar, & Umam, 2019). Then it can be seen that by implementing smart circuit learning media in the teaching and learning process (Anwar, Choirudin, Ningsih, Dewi, &Maseleno, 2019) can improve student learning outcomes. So that there is a positive influence on students' mathematics learning outcomes by applying smart circuit learning media (Rahayu & Osman, 2018).Thus the application of smart circuit learning media has a positive effect on the mathematics learning outcomes of class VII students in the even semester at Islamic School of Bandar Lampung in the academic year 2018/2019.

Conclusion

Based on data analysis and hypothesis testing that the author has described in Chapter IV in the appendix and discussion, a conclusion is obtained as follows:

- There is the influence of the application of smart circuit learning media to the learning outcomes of mathematics in class VII students of the even semester at Islamic School of Bandar Lampung year 2018/2019.

- The average mathematics learning outcomes of students who apply smart circuit learning media are higher than the average mathematics learning outcomes of students who apply conventional learning media.

Seeing the conclusions described above, also to improve student learning outcomes and the quality of education especially in mathematics learning, the authors provide the following suggestions:

- To improve students' mathematics learning outcomes, teachers must be able to motivate students to feel happy in learning mathematics and learning more interesting for students, teachers can use learning media.
- Mathematics is a science that is abstract for it in the process of learning mathematics associated with the lives of students in accordance with the level of development, because for mathematics lessons will be easily accepted if events and examples are around students, for that we need a tool in teaching and learning including learning with using learning media.
- The results of this study can be used as a consideration material in preparing the next education plan.

Thus the results and conclusions of this study and some suggestions that can be useful in improving student learning outcomes, especially in the field of mathematics studies by applying smart circuit learning media.

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