Mathematics interactive CD media based on discovery learning on congruence material and its effect on the students' generalization thinking skills.

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Abstract. Technology is very much needed in learning in the current era of globalization. Technology-based learning using interactive CDs can activate students which can ultimately improve learning achievement. This is because teachers have always used conventional learning media so that learning outcomes are less than optimal. This study aims to describe the creation of interactive CDs on mathematics in two-dimensional figure chapters in grade IX SMP / MTs using Adobe Flash. In this study, the authors used a data collection method and problem approach which included: literature, observation, interviews, analysis, system design and manufacturing, testing and implementation. This research was conducted at MTs Nahdlatuth Thalabah. The results of this study are in the form of interactive CDs for mathematics subjects in two-dimensional figure material. The use of interactive CDs is highly recommended for use in learning so that the atmosphere is fun and interesting for students in mathematics so that student-centered learning can be realized to the maximum. This Research aimed at studying the students' generalization thinking skills and the implementation of discovery learning to improve their generalization thinking skills in a comparative study. This research used a mixed-method combining quantitative and qualitative methods. This research involved 68 respondents that were divided into two classes, 34 students in the experimental class and 34 students in the control class. The results of this research showed that there was a significant difference which was proven by the independent t-test value for the post-test. The data analysis presented the independent sample t-test value of the post-test was sig. $0,000 \leq 0.05$ which means it was significant. Thus, there was an effect of implementing discovery learning in improving the students' generalization thinking skills in learning by using interactive CDs on the congruence material.

1. Introduction

Teachers as the front line of the success of education are required to have qualified expertise and creativity in order to package the learning process in the classroom as mandated. The presence of learning media has a significant meaning, the obscurity of the material presented can be helped by

presenting the media as an intermediary. The complexity of the material that will be explained to students can be simplified with the help of the media. The media can represent what teachers are less able to say through certain words or sentences, even the abstractness of the material can be concretized by media. During the learning process to describe the meaning of congruence and similarity of the two-dimensional figure, the teachers immediately mentioned the characteristics and illustrated the example of the two-dimensional figure on the board. The next task for the students was to record and memorize the material. It was less efficient because it did not rule out the possibility that students might forget the material. However, it might be different, if the students were involved in finding out where the traits were found, how the concordance was made and so on. From there, the formation of concepts played a role in providing experiences that might not be easily forgotten by the students. Teachers must remember that the students are not inanimate objects that do not have any potential except to accept only what the teachers convey, but students are human beings, each of which also has extraordinary potential to be explored and developed. Thus, this is where the role of teachers is needed to guide the students in finding their own knowledge by connecting these materials with their everyday life.

The effort that could be done in the context of the effectiveness of the students' learning process and concrete the abstract things by using an interactive CD of Mathematics learning. The interactive CD would greatly help children who lack space and learning abilities through their ears. Mathematical abstract concepts that are presented in concrete form would be more understandable and understandable and could be embedded at a lower level. It was important for the teacher to develop an interactive CD so that students feel comfortable to learn in the classroom. Thus, the students would be able to absorb all the learning materials properly and the learning objectives could be achieved.

One of the media that use computer technology is Interactive CD media. The interactive CD is chosen because it could combine media in the learning process, for example, texts, pictures, audio, video, and animation into a unity so that the user is able to navigate, interact, create, and communicate. The process of using an interactive CD is highly possible to be applied. Most of the teachers have a laptop and the availability of a computer lab, as well as an LCD projector, allows the students to use it anytime to support the learning.

Thinking skills that can be trained are including the ability to think logically, analytically, systematically, critically, creatively and think generalizations. Generalization thinking is a thinking skill that is used to educate students so that reasoning emerges. This skill can help students in solving mathematical problems in discrete mathematics. The stages of mathematical generalization according to Mason consist of four stages, namely: (a) perceptions of generality which at this stage students just arrived at the stage of introducing a rule or pattern. At this stage, students have also been able to perceive or identify patterns. Besides that, the students knew that the problem presented could be solved using attitudes or patterns, (b) expression of generally which at this stage students are able to use the results of pattern identification to determine the next structure/data. At this stage, students have also been able to describe a rule or pattern, (c) symbolic expression of generality which at this stage students have been able to produce a general rule and pattern and are able to formulate numerically or verbally general, and (d) manipulation of generality which at this stage students have been able to use the results of generalizations to solve problems, and students have been able to apply the rules of the pattern of problems[1].

Discovery learning' is a broad term for a philosophy of education in which students discover ideas and knowledge via exploration, projects, and play. Although the idea has an extensive (and impressive) pedigree in educational philosophy, it is difficult to implement in practice and remains controversial in debates among educators. This entry summarizes the major historical literature on discovery learning; sketches the current debates on the topic; describe several ways in which current work in cognitive science may be relevant to these debates, and outlines promising areas of future research and development in discovery learning".

The discovery learning model is a learning model developed based on the view of constructivism. According to [2], discovery learning is a learning process occurred when the learning material is not presented in its final form, but the students are expected to organize it themselves. Discovery Learning gives the students the opportunity to be actively involved in the teaching and learning process [3]. Discovery

models are able to provide opportunities for students to be more active in the learning process, besides that the application of discovery learning could improve students' generalization thinking skills.

The implementation of learning by using the interactive CD as a learning tool in mathematics which refers to the discovery learning model can be used to see the students' generalization thinking skills based on the indicators contain in generalization thinking skills. This research aimed at studying students' generalization thinking skills and the implementation of discovery learning by using interactive CD. Based on the explanation above, the researcher needs to conduct a further research. Therefore, the research was titled Developing Mathematics Interactive CD Media based on Discovery Learning on Congruence Material and Its Effect on the Students' Generalization Thinking Skills.

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2. Research Methods

The method used in this research was a mixed method combining quantitative and qualitative methods. The design used was sequential explanatory: Quantitative data is collected first, followed by qualitative data that can explain the findings from quantitative data (e.g., after assessing pragmatic competence at group-level, following up on several participants to gain understanding about their characteristics) and [4],[5],[6] models were also used in this research. The design of experiment of this research was to arrange the experimental and control classes which had been chosen through purposive random sampling and analyzed by using pre-test and post-test through the following design.

Table 1. Research Design

A	O	X	O
A	O	C	O

Information :
A   : Random sampling
X   : Treatment given (Independent Variable)
C   : Control of treatment
O   : Pretest / Postes (Dependent Variables observed)

In this design, the research was carried out in one class as the experimental class. Before conducting the research, the experimental class was given a pretest to know its initial ability. During the research, the experimental class was given a treatment by using discovery learning (X). Then, in the end of the research, the experimental class was given a posttest to see the result of the treatment given. This design was used to see the effect of the treatment (independent variable) on the change or completion of dependent variable observed.

2.1 Population

This research was conducted to the IX grade students of Mts. Nahdlatuth Thalabah in Jember regency, the sampling technique used was random sampling by choosing two classes randomly, the first class was the experimental class where discovery learning was implemented and the class consisted of 34

students and the second class was the control one where a conventional learning was implemented and the class consisted of 34 students.

2.2 Instruments
The instruments used in this research were test, observation, and interview. The following figure shows the combination of research method with research procedures in which it covered two stages related to research design, they were: preliminary research (qualitative research), the analysis of generalization thinking skills and the implementation of Discovery learning (quantitative research). The research procedures are illustrated on the chart as follows:
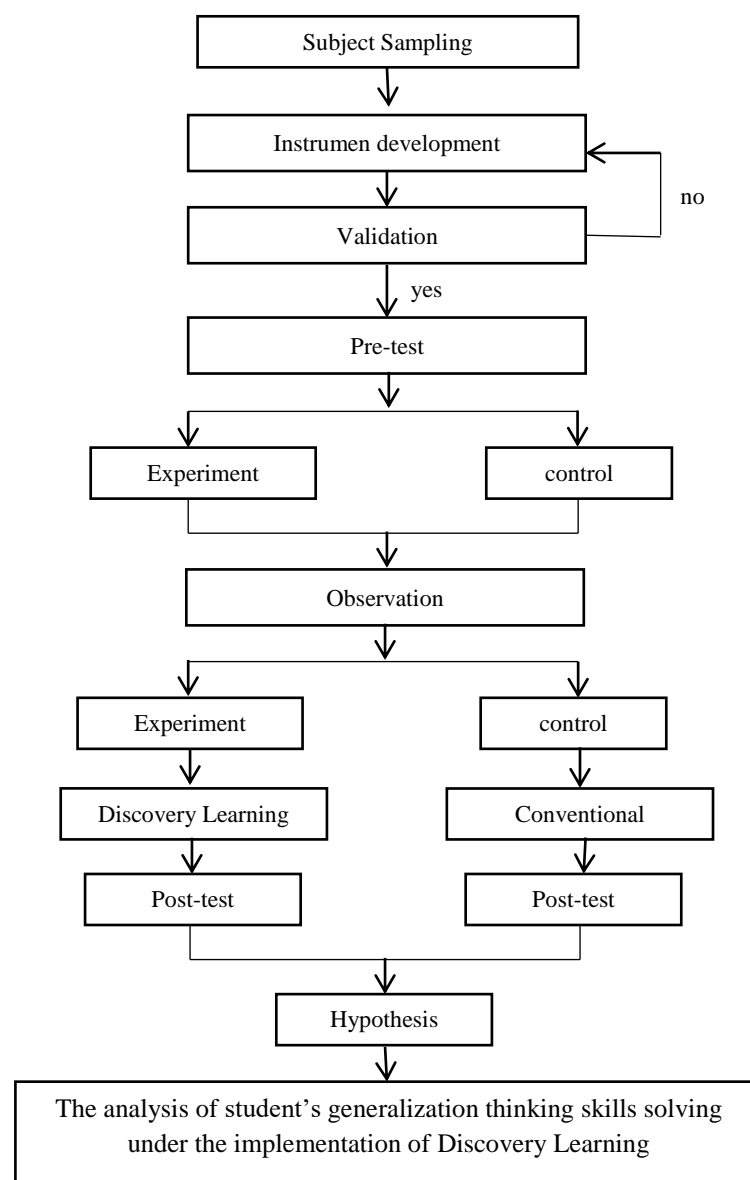

Figure 1. The Model of Mixed Method

   The students' generalization thinking skills were measured based on the indicators that were already converted on the assessment instrument. Quantitative method was used to analyze the students' skills after discovery learning method was applied. Whilst, qualitative method was intended to analyze the data obtained from the observation and interview of the selected students. This research

investigated two variables involving the implementation of discovery learning as an independent variable and the students' generalization thinking skills.

To test the research hypothesis formulated, used independent samples t-test with a significance level of 5% or 0.05

H_0 = Generalization thinking Skills of students using Discovery learning is lower than or equal to Generalization thinking Skills of students not using Discovery learning.

H_1 = Generalization thinking skills of students using Discovery learning is higher than to Generalization thinking skills of students not using Discovery learning.

Information:

- If $p_{value} < 0.05$ then reject H_0 and accept H_1
- If $p_{value} \geq 0.05$ then accept H_0 and reject H_1

3. Research Finding

This research was done in two classes consisting of the experimental class and the control class by using qualitative method to find out the students' generalization thinking skills. The validity and reliability tests were performed on the instruments before the research was carried out. Then the experimental class and the control class were given pre-test to find out the students' initial generalization thinking skills.

After delivering the pretest in the control class and the experimental class, Discovery learning model was then applied in the experimental class while the conventional learning was implemented in the control class, after that the data were analyzed by using SPSS. The following is the result of data analysis done by using SPSS and ms. excel.

3.1 Validity Instrument

Test reliability and validity of the pre-test and post-test assessment instruments. The following table shows the results of validity and reliability.

Table 2. The test result of the validity instrument Correlations

		NO_1	NO_2	NO_3	NO_4	Total
NO_1	Pearson Correlation	1	.100	.077	.162	.436**
	Sig. (2-tailed)		.516	.618	.292	.003
	N	44	44	44	44	44
NO_2	Pearson Correlation	.100	1	.231	.065	.499**
	Sig. (2-tailed)	.516		.132	.676	.001
	N	44	44	44	44	44
NO_3	Pearson Correlation	.077	.231	1	.374*	.836**
	Sig. (2-tailed)	.618	.132		.012	.000
	N	44	44	44	44	44
NO_4	Pearson Correlation	.162	.065	.374*	1	.615**
	Sig. (2-tailed)	.292	.676	.012		.000
	N	44	44	44	44	44
Total	Pearson Correlation	.436**	.499**	.836**	.615**	1
	Sig. (2-tailed)	.003	.001	.000	.000	
	N	44	44	44	44	44

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

As shown on the table, it can be seen that the r_count values of number 1 was 0.436, number 2 was 0.499, number 3 was 0.836, number 4 was 0.615. All items produced $r_{count} > r_{table}$. And N = 44, so that all items were valid.

Table 3. The test result of the realibility question

Reliability Statistics	
Cronbach's Alpha	N of items
.311	4

According to the table, the overall reliability value obtained was 0,311 and r_{table} of the significance level of 5% with dk = N - 1 = 43, r_{table} = 0,311. Therefore, $r_{count} > r_{table}$. Based on these results, it can be concluded that the instrument items were reliable

3.2 Result

The preliminary research was conducted to 34 students in the control class to determine their level of generalization thinking skills. 34 subjects were given pretest in figure 2, it was found that regarding generalization thinking skill, there were 47% of students were in the poor category, 23% of students were in the fair category, 21% was in the good category, and 9% was in the excellent category.
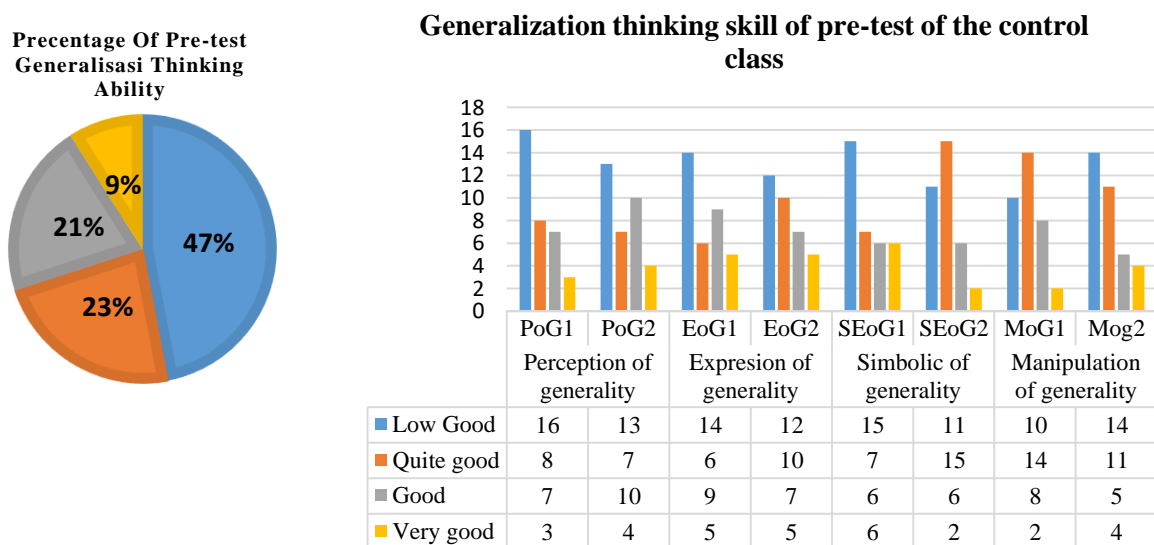

	PoG1	PoG2	EoG1	EoG2	SEoG1	SEoG2	MoG1	Mog2
	Perception of generality		Expresion of generality		Simbolic of generality		Manipulation of generality	
Low Good	16	13	14	12	15	11	10	14
Quite good	8	7	6	10	7	15	14	11
Good	7	10	9	7	6	6	8	5
Very good	3	4	5	5	6	2	2	4

Figure 2. The Distribution of Pre-test of student Generalization thinking skill in the Control Class

The research was conducted to 34 students in the experimental class to find out their generalization thinking skills. 34 subjects were tested by pre-test in figure 3, in the experimental class, it was found that the generalization thinking skills obtained 35% of the students belonged to poor category, 24% belonged to fair category, 35% belonged to good category and 6% of the students belonged to excellent category.
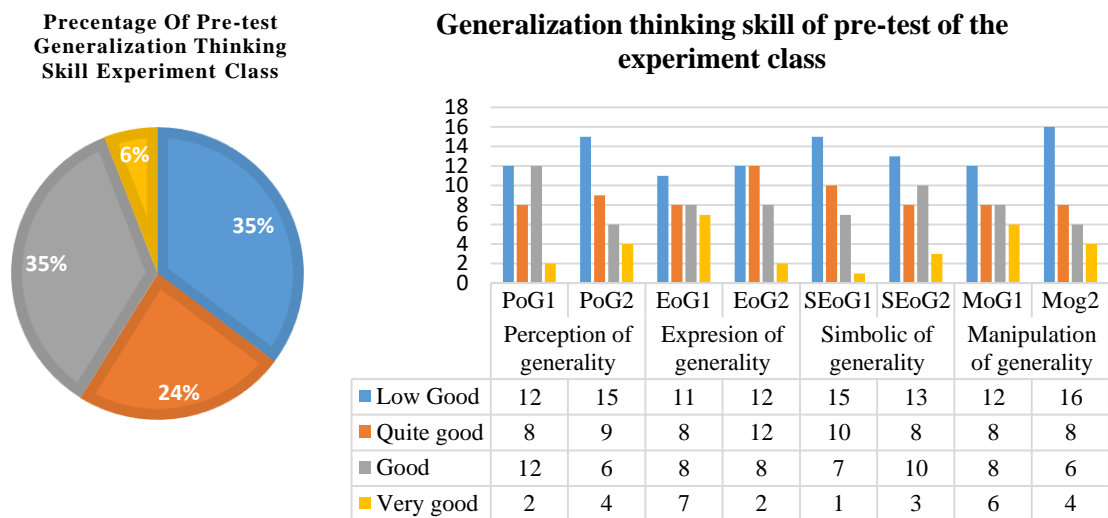
Figure 3. The distribution of Pre-test of student Generalization thingking skill in the experiment class

The data analysis of statistical quantitative of variance to find out the difference of discovery learning implemented. The data analysis used SPSS application with the data results of learning achievement of the pre-test. Based on the table 2, the homogeneity test got the result of sig. 0.130. This was significant because it was higher than 0.05 (based on the mean = 0.144 > 0.05), so the data variance of the pre-test of the control and experimental classes were homogeneous.

Table 4. Test of Homogeneity of Variances

	Value		
Levene Statistic	df1	df2	Sig.
1.744	8	22	.144

The implementation data of the pre-test in the experimental and control classes found that the data variance were homogeneous. Then, the independent t-test was done significantly if the sig value was higher than 0.05. The sig value (2-tailed) based on the mean = 0.165 > 0.05). Ho was accepted, there was no difference between the mean scores of the pre-test in the control and experimental classes

Table 5. Independent Samples Test

t-test for Equality of means						
T	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
					Lower	Upper
-1.403	66	.165	-.971	.692	-.2351	.410

The further implementation of the research was by conducting conventional learning, then the post-test was done. The research was done to 34 students in the control class to know the students' generalization thinking skills after the learning. 34 subjects were tested by the post-test in figure 4, in the control class found that the generalization thinking skills obtained 15% belonged to poor category,

32% belonged to fair category, 35% of the students belonged to good category and 18% of the students belonged to excellent category.
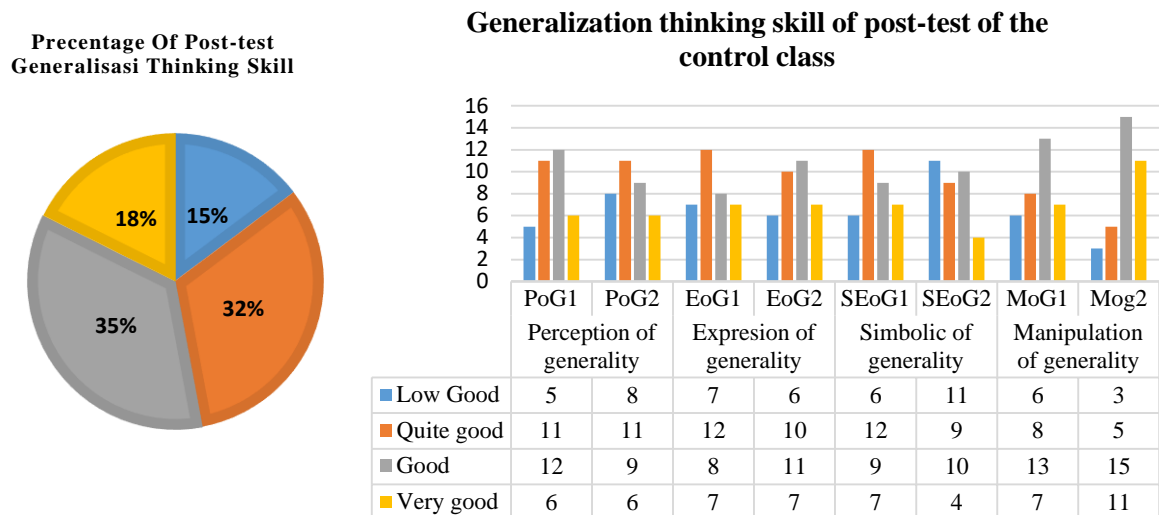

Figure 4. The distribution of Post-test of student Generalization Thinking Skill in the Control class

The next implementation of the research was by conducting learning by using discovery learning model, then the post-test was conducted. The research was done to 34 students in the experimental class to find out the students' generalization thinking skills after the learning. 34 students were tested by the post-test in figure 5, in the experimental class revealed that the generalization thinking skills of 12% of the students were at poor category, 13% of the students were at fair category, 20% of the students were at good category, 50% of the students were at excellent category.
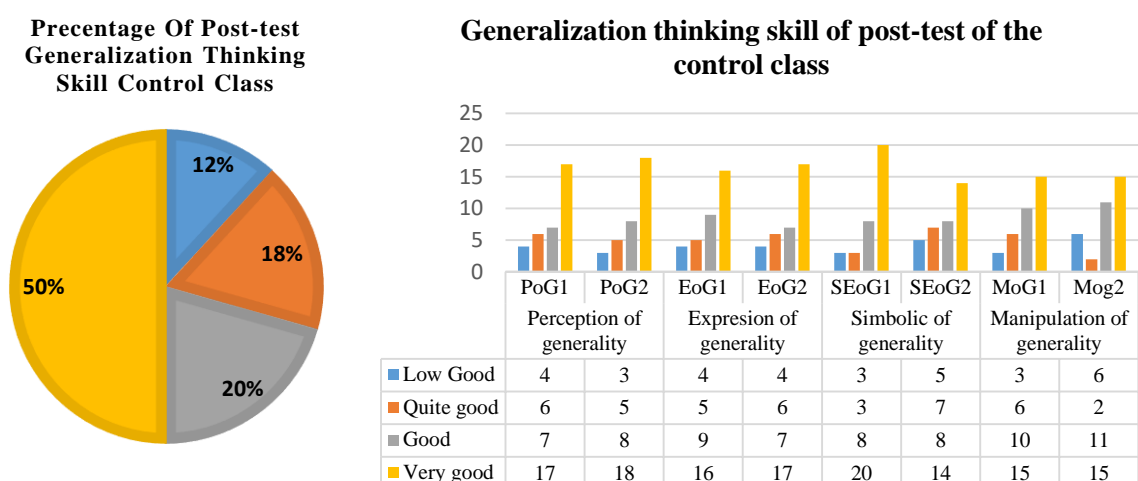

Diagram 5. The distribution of Post-test of student Creative Thinking Ability in the experiment class

Normality test analysis was done on the post-test results. The data distribution will be said to be significant if the value is greater or equal to 0.05. Table 6 shows the significant value of the experimental class was $0.200 \geq 0.05$ and the control class was $0.149 \geq 0.05$. So this means that the data from both classes were normally distributed.

Table 6. Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Control	.131	34	.149	.967	34	.385
Eksperiment	.096	34	.200	.969	34	.429
a. Lilliefors Significance Correction						

The result of independent sample t-test based on table 7 obtained the sig value. (2-tailed) $0,000 < 0.05$ then H_0 is rejected and H_1 is accepted. It was concluded that the results of the post test between the control class and the experimental class had significant differences after the implementation of learning with discovery learning.

Table 7. Independent Samples Test

			t-test for Equality of means			
T	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
					Lower	Upper
-9.927	66	.000	-5.971	.647	-7.263	-4.679

The experimental class has an average of 24.85 while the control class has an average of 18.88 meaning that the average results of Generalization Thinking Skills of experimental class students are higher than the average results of Generalization Thinking Skills of control class students and showed that problem based learning had a greater influence on students' Generalization thinking skills significantly.

4. Disscusion

The previous research concerning the implementation of discovery learning had been conducted to the students to improve their creative thinking skills [7] and increase the students' combinatorial thinking skills [8], then this research found the results of learning to students to improve their generalization thinking skills.

In the control class found that the generalization thinking skills obtained 15% belonged to poor category, 32% belonged to fair category, 35% of the students belonged to good category and 18% of the students belonged to excellent category. in the experimental class revealed that the generalization thinking skills of 12% of the students were at poor category, 13% of the students were at fair category, 20% of the students were at good category, 50% of the students were at excellent category.

The results of the independent sample test analysis showed that the learning achievements applied to the teacher at the pre-test stage were not different and at the post test stage the different analysis tests showed significant value ($p \leq 0.05$) which means that the post learning had different results

5. Conclusion

The research that had been conducted showed that the implementation of Discovery Learning had a significant effect on the students' generalization thinking skills in the experimental class. The students in the experimental class showed their generalization thinking skills improved significantly by using interactive CD media based on discovery learning compared than the control class by using the

conventional learning. The results of the research revealed that the improvement of the results of the students' learning achievement and generalization thinking skills were seen through the post-test.

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