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The Differences of Realization Ability between Students' Learning Model Problem Based Discovery Learning Model in Smk Private Laksamana Martadinata Medan

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Abstract

The purpose of this study was to examine differences in overall mathematical reasoning abilities and based on indicators among students who received problem based learning with students who obtained discovery learning based on early math skills. This study was a quasi experimental research, with the study population was all students of class XI SMK Laksamana Martadinata consisting of twenty classes. By purposive sampling, two classes were chosen, with experimental class 1were given problem-based learning treatment and experiment class 2 were given discovery learning treatment. The instrument of mathematical reasoning ability, the ability of early mathematics and observation sheet were stated to have fulfilled the validity requirements of the contents, and the reliability coefficients of 0.740 and 0.830 respectively. Data analysis of mathematical reasoning ability was done by analysis of covariance (ANAKOVA). The results showed that there were significant differences in mathematical reasoning ability both overall and per indicator between students who were given problem-based learning with students who were given discovery learning, with problem-based learning showed better results. The results suggest that problem-based learning is an alternative to improving the ability of mathematical reasoning.

Keywords

problem based learning, discovery learning, reasoning skills and student learning activities

1. Introduction

Mathematical understanding is a very important aspect in the principle of mathematics learning. Students in learning mathematics must be accompanied by good reasoning, this is the vision of learning mathematics. In addition to the mathematical understanding that became the focus of mathematical learning, reasoning ability or logical thinking should also be given attention. Logical reasoning or thinking cannot be separated by mathematics, given that mathematical material is understood through reasoning or logical thinking. In everyday life almost every day we use reasoning ability or logical thinking. The same is stated by Saragih and Napitupulu (2015), that students are expected to use mathematics and mathematical thinking in everyday life, and to study various types of knowledge that emphasize logical arrangements and build student character as well as the ability to apply mathematics.

This will give effect to the learning activity of mathematics so that aspect of understanding and reasoning become the goal that must be achieved. Bekaitan with the above then one of the priority objectives in learning mathematics is the development of logical reasoning ability that is owned by students. Logical reasoning is one aspect of the assessment done by the teacher on the subject of mathematics.

Mathematics subjects in Indonesia according to the provisions of the government through the National Education Standards Agency (BSNP) contained in the regulation of Minister of National Education number 20 of 2006 on the standard content, aiming for students to have the following skills; (1) Understanding mathematical concepts, explaining the interconnectedness of concepts and applying concepts or algorithms, flexibly, accurately, efficiently, and appropriately, in problem solving; (2) Using reasoning in patterns and traits, performing mathematical manipulations in generalizing, compiling evidence, or explaining mathematical ideas and statements; (3) Solve problems that include the ability to understand problems, design mathematical models, solve models and interpret the solutions obtained; (4) Communicating ideas with symbols, tables, diagrams, or other media to clarify circumstances or problems; (5) Have an appreciation of the usefulness of mathematics in life, which has a curiosity, attention, and interest in learning mathematics, as well as a tenacious attitude and confidence in problem solving.

Meanwhile, according to PERMENDIKBUD (2013) learning mathematics must have Completeness of Core Competence (KI) and mastery in Basic Competence (KD). For Competence of Basic Competence (KD) depends on the indicator of graduation achievement that is to be achieved in accordance with its standard of graduation (SKL) and minimum limit of Minimum Exhaustiveness Criteria (KKM), while for Completion of Core Competence (KI) includes several things, KI-1 and KI-2 about the mastery of the students' attitudes, KI-3 about the students' educational mastery, and KI-4 on the mastery of the skills of the students.

Trianto (2011), states that 21st century education (Commission on Education for the "21" Century) recommends four strategies in the success of education: First, learning to learn, that is how the learner is able to dig up information around him from the information explosion own; Second, learning to be, the student is expected to be able to recognize himself, and be able to adapt to his environment; Third, learning to do, namely in the form of action or action, to generate ideas related to sainstek; And Fourth, learning to be together, which contains how we live in an interdependent society of one another, so as to compete in a healthy and cooperative and able to appreciate others.

Accordingly, NCTM (2000) states that what students learn almost entirely depends on the experience of teachers teaching in the classroom each day. To achieve high-quality mathematics education teachers must understand deeply the math they teach, understand how students learn mathematics including knowing the development of individual students' math and selecting tasks and strategies that will improve the quality of the teaching process. "The task of teachers is to encourage students to think, ask questions, solve problems, and discuss ideas, strategies, and completion of students".

The difficulties experienced by students in learning mathematics and low learning outcomes obtained can be caused because the delivery method is not in accordance with the ability of learners. Selection of learning approach becomes very important to be considered mean selection of learning approach must be able to accommodate all ability of heterogeneous student mathematics so that can maximize student math ability.

According to Lwin (2008) "Logical-mathematical intelligence is the ability of numbers and calculations, patterns and logical and scientific thinking". This ability is not only required by students when they study math or other subjects, but it is needed every human being when solving problems or when deciding. The expected mathematical learning is the emergence of various competencies that can be mastered by the students, including the ability of reasoning which is a very important ability in achieving optimal mathematics learning outcomes. One of the mathematical skills required in learning is reasoning ability. According to Anderson (Ima, 2014) that reasoning refers to the mental processes involved in making and evaluating logical arguments. Another understanding is explained by Johnson-Laird (Ima, 2014) that reasoning generates conclusions from the mind, clarity and firmness and involves solving problems to explain why something happened and what will happen. Mathematics means that science is derived from reasoning and is a science of logical reasoning and problems related to numbers. Reasoning or the ability to think through logical ideas is the basis of mathematics. Based on the above opinion mathematics and reasoning are two things that are related and mathematics is a science that has special characteristics of reasoning. Mathematics also works to develop reasoning skills. Mathematical material and reasoning are two inseparable matters, namely mathematical matter understood through reasoning, and reasoning understood and trained through learning mathematical material. In learning mathematics, reasoning is one of the main standards that matters, meaning that if the students' mathematical reasoning ability is good, then students will tend to solve mathematical problems, otherwise if the students' reasoning ability is low then it will affect learning achievement. Through reasoning students are expected to see that mathematics is a reasonable study without feeling dependent on instant ways of solving mathematical problems. Students can think and reason a mathematical problem if they can understand the math problem. Thus students feel confident that mathematics can be understood, thought, proved and evaluated. The reasoning ability makes students solve problems in their lives, inside and outside school.

To measure the reasoning ability, there are several indicators that must be achieved by the students, as stated in Dirjen Dikdasmen Regulation No. 506/C/PP/2004 (MoNE, 2004) on reasoning indicators to be achieved by students. Indicators that show reasoning include; (1) Ability to present math statements orally, in writing, drawings and diagrams; (2) Ability to file allegations; (3) Ability to perform mathematical manipulation; (4) Ability to compile evidence, provide a justification for the truth of the solution; (5) The ability to draw conclusions from statements; (6) Checking the validity of an argument; (7) Finding the pattern or nature of mathematical phenomena to make generalizations. According to Arsefa (2014) the characteristics of reasoning are: (1) the existence of a thought pattern called logic, in this case can be said that reasoning activity is a process of logical thinking, logical thinking is interpreted to think according to a particular pattern or according to certain logic; (2) the process of thinking is analytic, where reasoning is an activity that relies on the framework of thinking used for the analytical reasoning logic is concerned. From the above description can be concluded logical reasoning of students is very important in learning mathematics in school. Responding to problems arising in mathematics education we need to apply the learning approach that can improve students' reasoning ability. According to Piaget (Ima, 2014) says:

The good pedagogy (learning): should involve overshadowing situations in which the ordinary child to get experiments, which in the widest sense of the word-test things to see what happens, to manipulate symbols, to ask questions and to find answers themselves, to reconcile what which were found at another time and compared their findings to the findings of other children.

Based on the above explanation of a teacher must provide a problem that is able to trigger student learning thinking to find a solution of the problem given so that students can form a new concept using the math skills it has. The learning model that suits the problem is problem based learning. Cognitive development is largely determined by the child's active manipulation and interaction with the environment. Knowledge comes from action. Piaget believes that physical experiences and environmental manipulation are important for developmental change. Nur (Trianto, 2009) states that social interaction with peers, especially arguing and discussing helps to clarify the thinking that ultimately contains the thought becomes more logical.

Problem Based Learning (PBM) is different from ordinary learning. If ordinary learning culminates in problem solving after the presentation of mathematical objects, then PBM begins with a problem for building mathematical knowledge and skills in the relevant context. Therefore, from a pedagogical perspective, PBM rests on the theory of learning constructivism. In PBM the problem is put forward as a learning trigger. At first, every child thinks to recognize, analyze, and formulate the learning needs. This is then followed up by accessing the source and at this moment the process of assimilation and accommodation of cognitive structures takes place. Through the series of activities it can also be expected the character of the independence of learning children grow, knowing that the teacher will be able to design learning better. The problem-based learning step is; 1) Student orientation on the problem; 2) Organize students to learn; 3) Guiding individual and group investigations; 4) Develop and present the work; 4) Analyze and evaluate the problem solving process.

While learning discovery learning is one of the most influential cognitive influential learning approach is model of Jerome bruner which is known as discovery learning. Trianto (Dahar, 1989) Bruner considers, that learning discovery is in accordance with the active search for knowledge by humans, and by itself the best result. Trying to find a solution to the problem and the accompanying knowledge, produce a truly meaningful knowledge. Bruner suggests that students should learn through active participation with concepts and principles, so that they are encouraged to gain experience, and conduct experiments that allow them to discover the principles themselves. So discovery learning is a learning process of discovery, a learning process found by students themselves by the steps: Stimulation, Problem Identification, Data Collection, Data Management, Evidence, and Generalization. In the learning process, children learn from their own experience, construct knowledge and then give meaning to that knowledge. Through a self-taught learning process, self-discovery, in groups such as play, the child becomes excited, thus growing an interest in learning. In this regard, this study attempts to apply the use of problem based learning and discovery learning learning in every learning of Mathematics and improvement of student learning process. The use of varied learning models as an application of learning strategies that are expected to improve students' logical reasoning abilities.

2. Methodology

This type of research is a quasi experimental research (quasi experiment). This study aims to see differences in reasoning ability between students who are given problem-based learning model with discovery learning model. The research design used in this research is Factorial Design described in Table 1.

Table 1. Research Design

Group	Pretest	Learning	Postest
PBM (Eksperimen 1)	T_1	X_1	T_2
Discovery Learning (Eksperimen 2)	T_1	X_2	T_2

Sumber (Arikunto, 2013).

Description:

T_1 = Pretest;

T_2 = Postest;

X_1 = Treatment for learning model PBM;

X_2 = Treatment for learning model *discovery learning*.

The population in this study is all students of class XI SMK Admiral Martadinata Medan, as many as 937 students consisting of 20 classes, class division is not based on achievement or rank so there is no superior class with different student characteristics. Sampling in the research using purposive sampling technique, and elected two classes that class XI PK-1 as experiment class 1 with Problem-Based learning Model (PBM) and class XI PK-3 as experiment class 2 with learning model of Discovery Learning.

Data processing using ANACOVA test. The use of ANACOVA is caused in this study using the concomitant variable (KAM) as the independent variable that is difficult to be controlled but can be measured together with the dependent variable of learning outcomes (thinking ability of students' reasoning).

3. Result Research and Discussion

3.1 The Ability of Students' Reasoning

The reasoning skills test is done twice that is pretest and postest with the equivalent type of problem. The initial and final tests were followed by 48 students. Quantitatively, the results of pretest and postes ability of mathematical depiction can be seen in Table 2, Figure 2 and Table 3, Figure 2 below:

Table 2. Data of Pretest Result of Mathematical Reasoning Competence of Experiment Class I and Experiment II

Indicator	Score	Eksperiment I				Eksperiment II			
	Maks	X_{maks}	X_{Min}	Mean	SD	X_{maks}	X_{Min}	Mean	SD
Analogy	4	4	0	2.063	1.227	4	0	2.417	0.895
Analogy	4	3	0	1.688	1.035	3	1	1.854	0.505
Generalization	4	3	0	1.542	1.110	3	0	1.313	0.803
Conditional	4	3	0	0.896	0.857	3	0	1.063	0.885
Silogism	4	3	0	1.583	1.048	3	0	1.458	0.898
All of Aspect	20	16	1	7.771	4.284	15	2	8.104	2.860

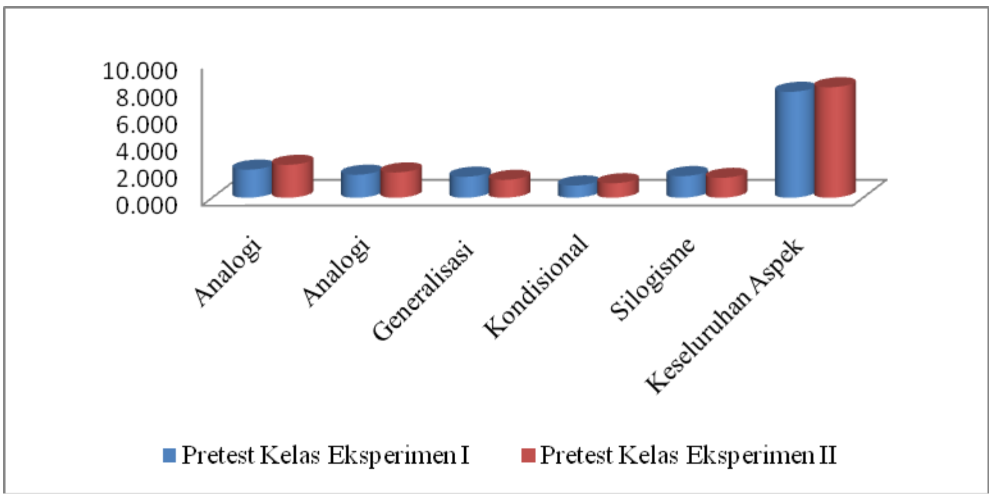

Figure 1. Score Average Pretest Experiment Class I and Experiment II

From Table 2 and Figure 1, it can be seen that the average of pretest students in experiment I and experiment II is different for each indicator of the ability of penalaranya. The average of analogy indicator in experiment class I in sequence is 2,063 and 1,688 then in experiment class II 2,417 and 1,854. The generalization indicator for the experimental class I 1,542 then in the experimental class II 1,333, the conditional indicator for the experimental class I is 0.896 and then in the experimental class II 1,063, the syllogistic indicator for the experimental class I is 1,583 then in the experimental class II 1,458. While the average score of the overall experiment class I is 7,771 while the experimental class II 8,104. This indicates that the average score of the experimental class I and the second experiment does not differ much.

Table 3. Data of Postes Result of Mathematical Reasoning Component of Experiment Class I and Experiment II

Indicator	Score	Class Eksperiment I				Class Eksperiment II			
	Maks	X_{maks}	X_{Min}	Mean	SD	X_{maks}	X_{Min}	Mean	SD
Analogy	4	4	1	2.69	0.75	4	0	2.19	0.92
Analogy	4	3	1	2.13	0.70	3	0	2.10	0.81
Generalization	4	3	0	2.00	0.97	4	0	1.85	1.05
conditional	4	4	0	1.65	0.91	3	0	1.44	0.85
Sylogism	4	3	0	1.79	0.90	3	0	1.54	0.87
All of Aspects	20	16	6	10.25	3.26	16	5	9.08	3.14

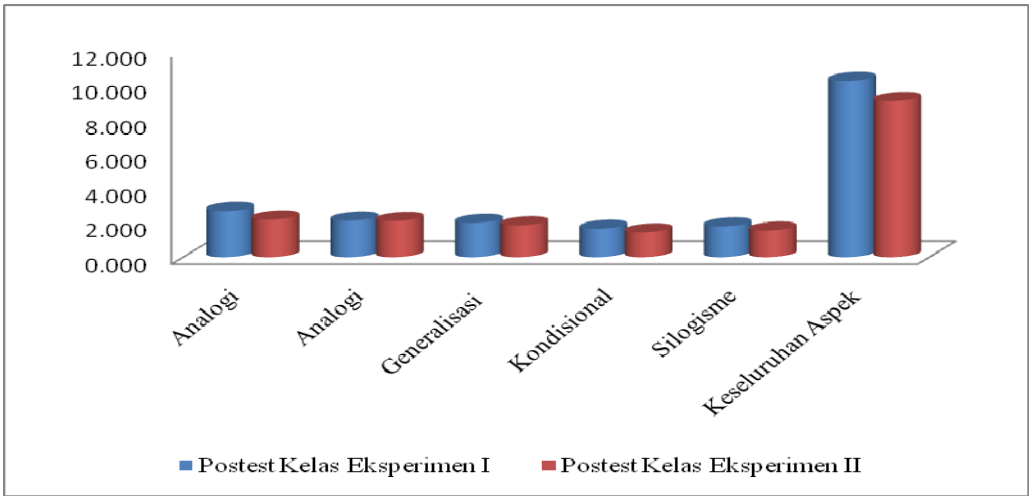

Figure 2. Average Scores Postest Class Experiment I and Experiment II

From Table 3 and Figure 2 it can be seen that the posttest average of students in experiment I and experiment II is different for each indicator of the ability of the penal. The average of analogy indicator in experiment class I in sequence is 2,688 and 2,191 then in experiment class II 2,125 and 2,104. The generalization indicator for the experimental class I 2,000 later in the experimental class II 1,854, the conditional indicator for the experimental class I is 1,646 and then in the experimental class II 1,438, the syllogistic indicator for the experimental class I is 1,792 then in the experimental class II 1,542. In total the average score of the experimental class I is 10,25 while the experimental class II is 9,083. This shows that the average scores obtained by experimental class I and experiment II did not differ much.

From the average pretest score of experiment class I is 7,771 while experimental class II 8,104. While from the score of postes obtained the average of experiment class I is 10,25 while experimental class II 9,083. This shows that PBM learning can improve the achievement of students' mathematical reasoning ability better than discovery learning teaching. It identified that PBM learning was well applied in mathematics learning especially on the subject of opportunity rather than discovery learning teaching.

To know the significant level of difference of the increase is done different test by using anacova, for that firstly done normality and homogeneity test, and test of data linearity as requirement analysis. Using the following SPSS 21 program shows the results of the analysis requirements test.

Table 4. Test Result of Normality of Pretes Mathematical Mathematical Competency of Student of Experiment Class I and Experiment II (SPSS 21)

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	Df	Sig.	Statistic	df	Sig.
Pre_Eks_I	.097	48	.200*	.960	48	.105
Pre_Eks_II	.100	48	.200*	.970	48	.262

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction.

Table 5. The Test Result of Postes Normality Mathematical Reasoning Ability of Experimental Class I and Experiment II (SPSS 21)

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Post_Eks_I	.097	48	.200*	.922	48	.003
Post_Eks_II	.102	48	.200*	.937	48	.013

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction.

From the results of One Sample Kolmogorov-Smirnov test, it was known that for the experimental class the value of significance is $0.2 > 0.05$ and for the experimental class II $0.2 > 0.05$ then the pretest and postes of mathematical reasoning ability in the two classes are normally distributed.

While from homogeneity test it was found that both the pretest and postes of mathematical reasoning ability in experiment class I and experiment class II were homogeneous. Homogeneity calculations for pretest and postes using SPSS 21 were summarized in Table 6 and Table 7 below:

Table 6. Table of Homogeneity Test Results of Pretest Variance Experimental Class I and Experiment Class Experimental Ability II

Test of Homogeneity of Variance					
		Levene Statistic	df1	df2	Sig.
Pre_Ekspeimen	Based on Mean	.293	1	94	.590
	Based on Median	.274	1	94	.602
	Based on Median and with adjusted df	.274	1	92.967	.602
	Based on trimmed mean	.292	1	94	.590

Table 7. Homogeneity Test of Postes Variance Experimental Capability of Experiment Class I and Experiment Class II

Test of Homogeneity of Variance					
		Levene Statistic	df1	df2	Sig.
Post_Ekspeimen	Based on Mean	.065	1	94	.800
	Based on Median	.044	1	94	.834
	Based on Median and with adjusted df	.044	1	93.294	.834
	Based on trimmed mean	.054	1	94	.817

The following test requirements were a linear regression model matching test for mathematical reasoning abilities:

= 8.44 + 0.21 with the hypothesis:

H: The regression model was linear;

H: The regression model was not linear;

To test the above hypothesis was done by analysis of variance by using F-stat with the formula and criteria specified. The results of linearity test analysis in the experimental class I presented in Table 8 follows:

Table 8. Variance Analysis for Linierity Test Regression Experiment Class I Ability Experimentation

Source of Varians	Df	SS	MS	F
Error	48	JK_{reg} =491,37	S^2_{reg} = 10,24	
Lack of Fit	15	343,70	S^2_{TC} = 8,39	1,94
Pure Error	33	354,89	S^2_{E} = 39,43	

Based on the data in Table 8 for the mathematical reasoning ability obtained F = 1.94 and based on Table F, for = 5% diproleh: F = F (0.95, 15, 33) = 2.15. Means F < F (0.95, 15, 33). H accepted or experimental class regression model I is linear. This means that there is a correlation between pretest result with posttest of experiment class I students shown by linear regression model with regression equation: = 8. 44 + 0. 21.

Based on data of pretest result with posttest of second experiment class student for reasoning ability obtained: regression equation ability of mathematical reasoning = 7. 11 + 0.26.

Will be tested suitability of linear regression model for creativity ability in mathematical reasoning = 7. 11 + 0. 26 with hypothesis:

H: The regression model is linear;

H: The regression model is not linear;

To test the above hypothesis is done by analysis of variance by using F-stat with the formula and criteria specified. The results of linearity test analysis in the experimental class are presented in Table 9 below:

Table 9. Analysis of Variance for Linierity Test Regression Experiment Class II Experiment Component II

Source of Varians	Df	SS	MS	F
Error	48	JK_{reg} = 461,73	S^2_{reg} = 9,62	
Lack of Fit	13	259,83	S^2_{TC} = 7,42	2,00
Pure Error	35	268.50	S^2_{E} = 20,65	

Based on the data in Table 9 for the mathematical logic reasoning ability obtained F = 2.00 and based on Table F, for = 5% diproleh: F = = 2. Means F < F. H accepted or experimental class regression model is linear. This means that there is a relationship between pretest results with posttest students experimental class can be shown by linear regression model with regression equation for mathematical reasoning ability = 7.11 + 0.26. In other words, the relationship between the pretest result and the posttest of the experimental class students can be expressed by the linear regression model or the proposed regression model is appropriate. To test the meaning of coefficient of regression equation is formulated hypothesis as follows:

H: = 0 and H: 0.

To test the hypothesis is used variance analysis by using statistic F with formulas and criteria set. The results of indepedence test analysis in the experimental class are presented in Table 10 below:

Table 10. Analysis of Variance for Independence Test of Mathematical Math Competency of Experiment Class II

Source of Varians	Df	SS	MS	F*
Total	48	509,91	10,62	
Regresi (a)	1	3924,03	3924,03	
Regresi (b, a)	1	JK_{reg} =48,17	S^2_{reg} = 48,17	**4,8**
Error	46	JK_{res} = 461,74	S^2_{res} = 9,62	

From the calculation results in Table 10 for the mathematical reasoning ability obtained F = 4.8 and based on Table F, for = 5% obtained: F = = 4.05. Means F. H rejected and accepted H. This means that there is a positive influence (significance) of pretest result of students' mathematical reasoning ability (X) on student posttest result (Y) for experimental class.

Table 11. Analysis of Variance for Independence Test of Second Class Experiment Reasoning

ANOVA[a]

Model		Sum of Squares	Df	Mean Square	F	Sig.
	Regression	48.493	1	48.493	4.800	.034[b]
1	Residual	464.757	46	10.103		
	Total	513.250	47			

a. Dependent Variable: Pre_Reasoning_Eks_II.

b. Predictors: (Constant), Post_Reasoning_Eks_II.

Table 12. Coefficient of Variance Analysis for Independence Test of Second Class Experiment Reasoning

ANOVA[a]

Model		Sum of Squares	Df	Mean Square	F	Sig.
	Regression	48.493	1	48.493	4.800	.034[b]
1	Residual	464.757	46	10.103		
	Total	513.250	47			

a. Dependent Variable: Pre_Reasoning_Eks_II.

b. Predictors: (Constant), Post_Reasoning_Eks_II.

From ANOVA or F test, for students' mathematical reasoning ability, the experimental class obtained F arithmetic is 4.8 with a significance level of 0.034. Since probability (0,000) is much smaller than 0.05, the regression model can be used with regression equation = 7.11 + 0.26.

1) Linearity Test of Experiment Class Regression Equation

Will be tested suitability of linear regression model for creativity ability in reasoning mathematics = 7.11 + 0.26 with hypothesis:

H: The regression model is linear.

H: The regression model is not linear.

To test the above hypothesis was done by analysis of variance by using F-stat with the formula and criteria specified. The results of linearity test analysis in the experimental class are presented in Table 13 below:

Table 13. Analysis of Variance for Linierity Test Regression Experiment Class II

Source of Varians	Df	SS	MS	F
Error	48	$JK_{reg} = 461{,}73$	$S^2_{reg} = 9{,}62$	
Lack of Fit	13	259,83	7,42	2,00
Pure Error	35	268.50	20,65	

Based on the data in Table 13 for the mathematical logical reasoning ability obtained F = 2.00 and based on Table F, for = 5% diproleh: F = = 2. Means F < F. H accepted or experimental class regression model is linear. This means that there is a relationship between pretest results with posttest students experimental class can be shown by linear regression model with regression equation for mathematical reasoning ability = 7.11 + 0.26. In other words, the relationship between the pretest result and the posttest of the experimental class students can be expressed by the linear regression model or the proposed regression model is suitable. Test of Equality of Two Regression Models.

To test the similarity of two experimental model of experiment class I and experiment class II used variance analysis using F statistic. To test the similarity of two models, the hypothesis is formulated as follows:

H: = and = (both regression models are the same).

H: and (both regression models are not the same).

To test the hypothesis is required values in Table 14. The result of similarity test of linear equality of two regression model presented in Table 14 following:

Table 14. Covariance Analysis for Equality Two Regression Models of Mathematical Reasoning Ability

A	B	SSR(R)	SSTO(R)	SSE(R)	SSE(F)	F^*	$F_{(0,95,\ 2,94)}$	H_0
7,69	0,25	68,62	984,24	915,62	332,34	80,73	3,13	Ditolak

From the calculation in Table 14 it was obtained for the mathematical reasoning ability F = 17.06 and based on Table F, for = 5% obtained by F = F (0.95, 2.94) = 3.13. Means F F (0.95, 2.94). H rejected and accepted H. This means that the two linear regression models are not equal or significantly different. While the result of equality test and coefficient of mathematical reasoning ability of experimental class I and experiment class II using SPSS 21 program are summarized as follows:

Table 15. Analysis of Covariance for Equality Two Modeling Regression Modeling Models (SPSS 21)

ANOVA[a]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	68.615	1	68.615	7.044	.009[b]
	Residual	915.625	94	9.741		
	Total	984.240	95			

a. Dependent Variable: Eksperimen_II.

b. Predictors: (Constant), Eksperimen_I.

Table 16. Coefficient of Covariance Analysis for Equality Two Modeling Regression Modeling Models

Coefficients[a]						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	7.689	.821		9.361	.000
	Eksperimen_I	.246	.093	.264	2.654	.009

a. Dependent Variable: Eksperimen_II.

From ANOVA or F test, for the mathematical reasoning ability of experimental class I and experiment class II obtained F count is 7.04 with significance level 0,009. Since probability (0,000) is much smaller than 0.05, it means that the two linear regression models are not equal or significantly different.

3.2 Alignment Test Two Linear Regression Models

If in testing the similarity of two models of regression above H rejected (regression model is not the same), so followed by testing two alignment of the regression model. Testing the alignment of the linear regression model for the experimental group II and the experimental group used covariance analysis using F statistic with the established formula and criteria. The results of the alignment test analysis of two regression models are presented in Table 17 as follows:

Table 17. Analysis of Covariance Ability Reasoning For Alignment Regression Model

	SSTx	SSTy	SPT	SSTx (adj)
Experiment I	631,2	501,48	133,95	473,05
Experiment II	515,68	454,5	134	419,68
Total	1146,9	955,98	267,95	892,73
A	B	F^*	$F_{(0.95,1,96)}$	H_0
892,73	893,38	0,03	3,96	Accepted

From the calculation in Table 18 the ability of mathematical reasoning obtained value F = 0.03 and based on Table F, for = 5% obtained F = F (0.95, 1.96) = 3.96. Means F F (0.95, 1.94) then H is accepted with a significant level of 5%. This means that the two linear regression models for the experimental class I and the experimental class II are parallel. Since the two regression models are not equal (unequal) and parallel, it can be concluded that there is a difference in the experimental results of the experimental group I and the experimental group II.

3.3 Analysis of Covariance with Modified Analysis of Variance

Based on the results of linearity test and alignment regression model is met then to test the difference in students “math reasoning abilities taught by problem-based learning with students” mathematical reasoning abilities taught by discovery learning can be analyzed with anakova as a modification of variance analysis. For this reason, the hypothesis of the analysis was calculated by estimating the distance of both the linear regression line of the experimental group I and the experimental group II of each posttest result score from the average postest score of the experimental group I and the posttest score of the experimental group II. The hypothesis is as follows:

H: =

H: >

To test the hypothesis some of the required values are summarized in the following Table:

Table 18. Analysis of Covariance for Complete Design of Reasoning Abilities

Source of variation	Sums of Squares or Products			DDf
	X	Y	XY	
Treatments	7,59	46,76	18,84	1
Error	1123,06	933,90	257,5	94
Total	*1130,66*	*980,66*	*276,34*	*95*
Source of variation	Adjusted SS	Adjust$$ed Df		
Treatments	38,25	1		38,25
Error	874,86	93		9,41
Total	913,12	95		

From the calculation for reasoning ability in Table 18 obtained F = = and based on Table F, to = 5% obtained F = F (0.95, 1.94) = 3.96. Means F F (0.95, 1.94) so H: r = r = 0 is rejected.

This means that there is a significant difference between students' reasoning abilities subject to problem-based learning and students taught with discovery learning. While the results of the calculation of the mathematical reasoning ability of the experimental class I and the experimental class II using the SPSS 21 program are summarized as follows:

Table 19. Analysis of Covariance for Complete Design of Mathematical Reasoning Ability

Tests of Between-Subjects Effects

Dependent Variable: Postest_Penalaran

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	105.801[a]	2	52.900	5.623	.005
Intercept	912.818	1	912.818	97.036	.000
Pretest_Reasoning	59.041	1	59.041	6.276	.014
Kelas	38.260	1	38.260	4.067	.047
Error	874.855	93	9.407		
Total	10283.000	96			
Corrected Total	980.656	95			

a. R Squared = .108 (Adjusted R Squared = .089).

For the reasoning ability of mathematics obtained Pretes value < 0.05, it can be concluded that at 95% confidence level, postes result is influenced by the ability of student pretest before given problem based learning. Therefore, the error can be corrected by the value of pretes as a covariate/uniform.

The regression model that had been obtained for the mathematical reasoning ability of experimental class I is = 8.44 + 0.21 and experimental class II = 7.11 + 0.26. Furthermore, because both regression for both homogeneous group and the constant of equation of linear regression line for mathematical reasoning experiment group that is 8,44 bigger than equation of equation constant equation of linear regression line experiment group II that is 7,11 then geometrically regression line for experiment class was above Regression line experiment class II.

This indicates that there was a significant difference and in the above hypothesis is the difference in height of the two regression lines that is affected by the regression constant. The regression line height describes the student's learning result, that is when X = 0, the regression equation for creativity ability in mathematical reasoning of problem-based learning class is Y = 8.44 and the learning regression equation discovery Y = 7.11. It can be concluded that the students' mathematical reasoning ability taught by problem-based learning is better than *discovery* learning on the subject of opportunity.

If we look at the characteristics of the two learning models is a reasonable thing the occurrence of such differences. Theoretically, problem-based learning has several advantages when compared with the discovery model where problem-based learning is based on the students' experience and the subject matter associated with the situation around the student so that the students will better understand the material presented. In abstract mathematics learning, students need tools and real events that can clarify what the teacher will convey so that more quickly understood and understood students. Jhonson (2002) states that problem-based learning is a process that helps students understand the subject matter, by making connections of academic material to the context in real life. The context in question is related to the personal, social and environmental life of the student's residence and the objects around the student.

In line with the theory of learning proposed by Bruner (Team MKPBM, 2001) that learning mathematics will be more successful if the teaching process is directed to the concepts and structures made in the subject matter taught, in addition to the related relationship between concepts and structures. By knowing the concept and structure that terbacup in the material being discussed, the child will understand the material to be mastered it. Furthermore Bruner (Team MKPBM, 2001), through his theory, revealed that in the learning process of children should be given the opportunity to manipulate objects (props). Through the props that examined it, the child will see firsthand how the regularity and structure of the structure contained in the object being studied it.

Bruner (MKPBM team, 2001) argues that in the process of learning the involvement of children with objects that for the first time children pass through three stages, such as tinkering, manipulating, composing, etc. that at this enactive stage is still in the stage of trial and error. In the iconic stage, the representation of the child's world of things (which he knows at the enactive stage) is still a static yet operational perception, such as not being able to sort, classify, hypothesize, draw conclusions, and so on. While at the symbolic stage, students are able to perform mental operations in the form of notation without dependence on the object rill. Thus the activity of the child in the learning process looks full. Learning through active participation with concepts and principles is expected to enable them to gain experience, and to experiment so that they discover the principles themselves (Trianto, 2011).

The advantages can be known through different views on the characteristics of learning include: First teaching materials during teaching using problem based learning, the four characteristics that exist in the learning becomes the thing that determines the success of improving the reasoning ability and the effectiveness of students' mathematics learning when the seven characteristics are optimized In teaching and learning process. The process of learning is organized to meet the seven characteristics of problem-based learning can generate student activity for the better and learning directly begins by providing problem-based problems. While the *discovery* model, the teaching materials only with learning activities begins students read the package package prihal material opportunities and then learning is given problem-based problems.

The discovery model also had the advantage of being able to motivate students in groups to help each other. However, in the learning activities, every end of the study done a quiz that sometimes makes students bored and bored and even some who do not follow and do quiz questions because in addition to student quizzes will also be given the exercise. Second Factor Teachers, in the learning is authentic as a facilitator and organizer, which regulate how students should learn and provide direction for the material being studied understood and interpreted students. Constraints faced by teachers in facilitating and accommodating students learn from the problem is the heterogeneity of students' math skills in the classroom. Because the intelligence of students in the classroom is relatively varied, then the level of difficulty faced by students in solving the LAS also varied. Teachers' difficulties in teaching students with heterogeneous intelligence can be minimized by means of students working in groups of four to six. They interact in groups to solve problems in the LAS, which are sharing ideas/opinions through question and answer and try.

The role of teachers as organizers in group learning is not simple. Teachers are not enough just to group students and let them work together, but teachers should be able to encourage each student to participate fully in group activities. To avoid being actively working in groups of only certain students, the teacher should give clear instructions, assure that each student is responsible for the work of each group, and stimulate that students are encouraged to think optimally in accordance with their respective potential. In the discovery model the same thing is also done by the teacher. Teachers as facilitators and motivators so that students can follow the learning as much as possible.

The difference between the two learning models was seen in the learning process, problem-based learning has four characteristics whereas usual have five characteristics, namely convey the subject matter, study group, material presentation, quiz, and award. Problem-based learning and commonly done with the independence and activeness of students in constructing knowledge with teachers as facilitators and organizers, although the characteristics are different. The three Active Roles of Students, in the problem-based learning group formed student discussion groups, each student is given a student worksheet (LAS) that contains problem-based problems. The focus of learning activities is entirely on the students are thinking of finding solutions of a problem and automatically activate the physical and mental activities is a process to understand the concepts and procedures contained in mathematics problems.

Student groups are formed in a heterogeneous group of 5-6 people making students work together and exchange ideas to solve problems. Inter-students can help students with low-ability and moderate understanding of mathematical concepts. A good student can transform the knowledge they have to share with other friends. The results of the settlement of a problem will be accounted for by the larger group, where representatives from several groups present the work of the group, there will be question and answer activity among each group which will become the reflection for the students of the group work that has been made.

Student activity in learning with problem-based and ordinary meet good category, student is very excited to do activity in learning, by involving student directly, student feel that she is more appreciated, student is not sleepy. But student activity in problem based learning is higher than student activity in discovery model. Through this mental activity, the cognitive abilities of students get the opportunity to be empowered, refreshed, and strengthened if the student continues to make use of his memory, his understanding of mathematical concepts or his experience to solve problems in the LAS.

4. Conclusion

Based on the research results obtained conclusion as follows:

1) Overall there was a significant difference to logical reasoning ability among students who were given problem-based learning model with students who were given discovery learning model with students who were given problem based learning show better result.

2) The value of analytic significance of the first problem shows that there was a difference in the ability of the analogy aspect of the students who follow the mathematics learning through problem based learning compared to the students using discovery learning with each average for experiment I 2.69 and experiment II 2.19.

3) The significance value of the analogy ability of the second question shows that there was no difference in the ability of the analogy aspect of the students who follow the mathematics learning through problem based learning compared to the students using discovery learning with each average for experiment I 2.13 and experiment II 2.10.

4) There was a significant difference in the ability of the generalization aspect between students taught through problem-based learning compared to students taught through discovery learning learning with an average of 2.00 and 1.85.

5) There was a significant difference in the conditional aspect ability among students taught through problem-based learning compared to students taught through learning discovery learning with an average of 1.65 and 1.44.

6) There was a significant difference in the ability of the syllogistic aspects among students taught through problem-based learning compared to students taught through learning discovery learning with an

average of 1.79 and 1.54.

Suggestion

The results suggest the following:

1) to the Mathematics Teacher

• Problem-based learning can serve as an alternative to improve the logical reasoning ability of mathematics, especially on the subject matter.

• Learning tools in the form of RPP, LAS students who were designed with problem-based learning can be used as comparisons for teachers in developing learning tools of mathematics on other subjects.

2) to the Related Institution

• Need for socialization in introducing problem-based learning to teachers and students so that the ability of students, especially the ability of logical reasoning can be improved.

• The results of problem based learning research can improve students' ability, especially logical reasoning ability, especially on the generalization and conditional aspects, the subject of opportunity so that it can be used as input for the school to be developed as an effective learning approach for other subjects with attention to the allocation of time, material, and schools.

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