Description of Students Mathematical Understanding Ability Obtained by Problem Based Learning (PBL) and Inquiry Based Learning (IBL) Models

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Abstract. This research aims to obtain a comprehensive picture of students' acquisition of Mathematical Understanding Ability using the PBL and IBL models. The method in this research is a mixed method The sample in this research was 16 students in class IV at SDN 1 Girimukti and 12 students in class IV at SDN 2 Girimukti. The results of the research based on SPSS calculations show that descriptively the average gain in mathematical understanding ability of students who studied with PBL was 77.81, higher than the average gain in mathematical understanding ability of students who studied with IBL which was 63.33. Distribution of scores for the acquisition of mathematical understanding ability of students who learning with PBL is more spread out compared to the scores for gaining mathematical understanding abilities of students who study with IBL, as can be seen from the standard deviation scores in both classes, where the PBL class is 8.2 and the IBL is 7.8. The conclusion shows that the description of the mathematical understanding abilities of students who obtain the PBL model is higher than the mathematical understanding abilities of students with the IBL model seen from the mean and standard deviation.
Keywords: Mathematical understanding ability, PBL, IBL

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INTRODUCTION

This statement is in line with current conditions where technology and digitalization have made mathematics have a special place where most calculations are taught to students at primary to secondary school levels (Gravemeijer er al, 2017). Therefore, good Mathematical skills will not only determine success and obtain a good job in the context of this modern world, but will also have an impact on a good quality of life (PISA, 2016).

Several research study results state that mastery of mathematical abilities has a positive correlation for students in other educational fields outside mathematics, such as science, technology and engineering. For example, according to Uhden et al (2012), mathematics and physics have a deep interrelationship. Therefore, considering the importance of mathematics for students in everyday life and the future, good mastery of mathematical skills is an important thing to emphasize in mathematics learning.

Abilities that are really needed to face various challenges in the 21st century or often called "21st century skills" such as critical thinking, problem solving, communication and creativity (Battelle for kids, 2019). Meanwhile, in the field of mathematics education, there are standards of mathematical ability that need to be developed in mathematics learning, in NCTM (2000) there is one additional component, namely strategic competence. These competencies are not separate things, but are interrelated and influence each other (Philipp & Siegfred, 2015). These overall competencies do not only look at cognitive development which refers to the ability to understand mathematics, but also pay attention to the level of student motivation to learn.

Mathematics learning that emphasizes mastering students' mathematical understanding abilities has become a priority and main focus in various countries, one of which is Indonesia (NCTM, 2000; NRC, 2001; ACARA, 2018; Ministry of Education and Culture, 2018). As one example we take is the American education curriculum. Then, in the context of the education curriculum in Indonesia, states that mastery of knowledge competencies in mathematics learning is obtained by understanding factual knowledge by observing (listening, seeing, reading) and asking questions (Ministry of Education and Culture, 2018).

Research conducted by previous researchers focused on conceptual understanding in mathematics learning (Fatimah, Wahyudin & Prabawanto, 2019). When students learn a procedural to solve mathematical problems, what is desired is not only that students can solve the mathematical problem correctly, but also that students can understand how the procedure can work correctly (Fyfe, Mcneil & Borjas, 2015). We can interpret this statement to mean that what is expected when students learn mathematics is not only that they are able to memorize and apply mathematical procedures, but also understand why the procedures they learn can be applied and are able to solve mathematical problems.

The ability to understand mathematics is one of the important goals in learning mathematics, providing an understanding that the material taught to students is not just memorization, but more than that, with understanding students can understand the concepts of the mathematics subject matter itself.

Indicators of understanding mathematical concepts include the ability to restore concepts that have been studied, the ability to classify objects based on whether or not the conditions that form the concept are met, the ability to apply concepts algorithmically, the ability to provide examples and counter examples of concepts that have been studied, the ability to present concepts in a variety of ways. form of mathematical representation (Kilpatrick et all, 2001).

In connection with this opinion, improving understanding skills is something that is very necessary in learning mathematics, because learning without good understanding will affect the way of thinking about how these concepts are formed correctly and how to communicate this to other people. Alfeld in Nasution (2013:7) states that a student is said to have the ability to understand mathematics if he is able to learn simpler things. Next, students can carry out their interactions. Apart from that, students can also recognize the relationship between new concepts and previously understood concepts, and finally, students can identify existing principles in mathematics. If these four things can be mastered well then he is said to have good mathematical understanding abilities. Furthermore, Anderson, et.all (2001:70) stated that students are said to have understanding abilities if the students are able to construct meaning from teaching messages such as oral, written and graphic communication.

Another factor that influences students' ability to learn mathematics is students' initial knowledge of mathematics regarding mathematics learning. Initial knowledge of mathematics is the ability or skills that students have before students take the subjects given by the teacher (Dick & Lou, 2005). With this ability students can learn the material that will be taught by the teacher and conversely without this ability students will have difficulty learning the next material. At the beginning of the teaching and learning process, teachers should first examine students' initial mathematics knowledge. From the results of this ability, the teaching and learning process should be organized in such a way that the expected learning outcomes can be achieved.

Some schools do not provide opportunities for teachers to develop innovations in the learning process and assessment for mathematics. This innovation is in the learning process through Problem Based Learning and Inquiry Based Learning. With this innovation, it is hoped that there will be changes made by teachers in the quality of teaching and the abilities of their students. Changes in a competency can be seen from the results of improvements before and after implementing the innovation.

Tan (2003) explained that through PBL, students are motivated to learn more, develop higher order thinking skills, and teamwork and communication skills. So Tan's opinion regarding Problem Based Learning assumes that it can increase students' enthusiasm/motivation in learning which is in the mathematical disposition indicator and high level thinking skills which are in the mathematical understanding indicator.

From these two statements, the problem solving based learning model is an alternative model that can be applied in an effort to improve the ability to understand mathematical concepts, this is because students are required to construct their own knowledge by being able to creatively produce something new from the results. discoveries that are in accordance with what he has obtained.

Inquiry Based Learning is learning in which one obtains knowledge through an inquiry process (Hebrank, 2000). Inquiry according to Budnitz (2003) says that inquiry means asking questions that can be answered through justification and verification. In Bruner's theory, inquiry learning emphasizes material structure and active learning. From this statement, I can conclude that Inquiry Based Learning is learning that involves all students' abilities to search, investigate, analyze systematically and logically the problems posed so that students can find their own knowledge and formulate it with full confidence.

Realizing the importance of learning, the two learning models, namely the Problem Based Learning and Inquiry Based Learning models, can see a picture of students' mathematical understanding abilities. Based on the problems and explanation above, it is necessary to conduct research regarding the description of Mathematical Understanding Ability (KPM) using the Problem Based Learning and Inquiry Based Learning models of elementary school students.

METHOD

Then, the method in this research is a mixed method with an explanatory factory design with the first research sequence being quantitative with types related to experiments and qualitative with a case study design with a growing theory perspective. Quasi-experimental research design type factorial design. Then the procedures for carrying out the research are as follows:

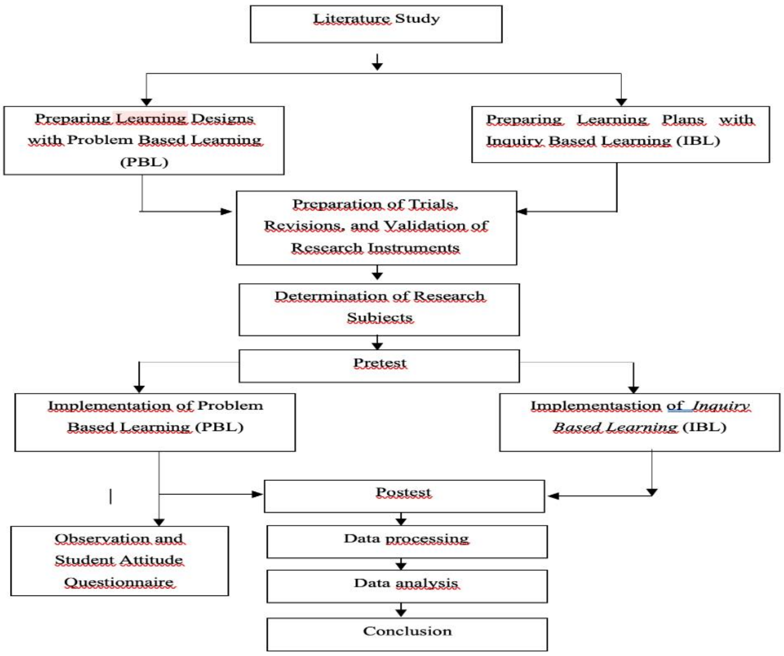

Figure 1. Procedure Research

The location of this research was in 2 schools, namely SDN 1 Girimukti and SDN 2 Girimukti with a sample of 16 class V students at SDN 1 Girimukti and 12 class V students at SDN 2 Girimukti. The instruments used in this research were pretest-posttest questions on spatial construction materials and questionnaires. Pretest questions are given before learning begins, both in the experimental class and the control class. The test given is a test of students mathematical understanding ability in terms of students' learning motivation. Next, the second class was given problem-based learning and inquiry-based learning in class V.

Then the next instrument is a questionnaire that uses an attitude scale. This questionnaire is given to measure the level of student motivation to learn. Next, the second class was given problem-based learning and inquiry-based learning in class V. There are several steps that can be implemented in the instrument development process, while several steps in the instrument development process in this research are as follows:

Testing an instrument is called valid if the instrument can measure what it is supposed to measure Ruseffendi (2006). In the analysis of testing the validity of the tests in this research, factor analysis was carried out, namely correlating between item scores and total scores using Pearson Product Moment (Arikunto, 2001:72)

The scores from the test results of the mathematical understanding ability and disposition test were calculated by the correlation coefficient. The results of calculating the correlation coefficient rxy are compared with the critical value r table (correlation value in table r). Each test item is said to be valid if it meets the rxy > r table. Apart from that, you can also use a p-value of 0.05, that is, if the 2 tailed sig value is less than the alpha value of 0.05 then the question can be said to be valid.

Test reliability is the level of consistency of a test, namely the extent to which the test can be trusted to produce a steady or consistent score. An instrument is said to be reliable if the measurement results with that instrument are the same as if the measurements were carried out on the same person at different times or on the same group of people. The score in the score is 0 to 4 so for the reliability test the alpha formula is used.

To test the hypotheses above, the pretest and posttest data were processed statistically using the following steps: Descriptive statistical data analysis technique that measures pretest and posttest. This analysis technique is in the form of means (average), standard deviation (standard deviation), and range (range). Inferential statistical data analysis techniques used to test research hypotheses. This analysis technique is in the form of hypothesis testing using the t-test, Mann-Whitney U test, one-way ANOVA test, two-way ANOVA test, and Kruskal-Wallis post hoc test.

As for qualitative data analysis in this research, it refers to the steps used by Miles and Huberman (2007, p. 20) which consist of three activity flows that occur simultaneously, namely: data reduction, data presentation, and drawing conclusions.

Data reduction is a selection process, focusing on simplifying, abstracting and transforming "rough" data that emerges from written notes in the field. The amount of data obtained in the field is quite large, requiring careful and detailed recording. Data Presentation, the researcher presents the data in the form of descriptions based on the aspects studied according to the research formulation. Conclusions are drawn in stages, starting with making temporary conclusions. However, with increasing data, data verification is then carried out, namely by re-studying the existing data (reduced or presented). To strengthen the decisions made, the researcher also asked for consideration from parties related to this research. Once this is done, the researcher makes the final decision.

RESULTS

The research results related to the description of the acquisition of Mathematical Understanding Ability (KPM) of students who received the Problem Based Learning (PBL) and Inquiry Based Learning (IBL) models can be seen from the results of the acquisition and improvement of the mathematical understanding abilities of students who studied with the PBL and IBL models which are presented in the table below this.

Table 1. Pretest, Posttest, and N-gain Mathematical Understanding Ability scores based on learning

Model PBL					Model IBL				
No	Siswa	Pretest	Posttest	N-Gain	No	Siswa	Pretest	Posttest	N-Gain
1	S1	50	60	0,20	1	S1	40	80	0,43
2	S2	30	70	0,57	2	S2	25	65	0,20
3	S3	60	80	0,50	3	S3	35	65	0,00
4	S4	30	70	0,57	4	S4	10	50	0,43
5	S5	40	75	0,58	5	S5	35	65	0,29

Model PBL				
6	S6	30	75	0,64
7	S7	50	75	0,50
8	S8	60	70	0,25
9	S9	70	80	0,33
10	S10	40	75	0,58
11	S11	30	85	0,79
12	S12	80	90	0,50
13	S13	60	90	0,75
14	S14	60	85	0,63
15	S15	70	80	0,33
16	S16	60	85	0,63

Model IBL				
6	S6	10	45	0,20
7	S7	30	55	0,25
8	S8	40	70	0,20
9	S9	55	90	0,25
10	S10	30	75	0,60
11	S11	30	60	0,40
12	S12	30	70	0,20

Then, to answer the acquisition of mathematical understanding abilities from each output, descriptive statistics are used using SPSS software results as in the Table 2.

Descriptives

	pembelajaran			Statistic	Std. Error
postes	PBL	Mean		77.81	2.040
		95% Confidence Interval for Mean	Lower Bound	73.47	
			Upper Bound	82.16	
		5% Trimmed Mean		78.13	
		Median		77.50	
		Variance		66.563	
		Std. Deviation		8.159	
		Minimum		60	
		Maximum		90	
		Range		30	
		Interquartile Range		14	
		Skewness		-.337	.564
		Kurtosis		-.014	1.091
	IBL	Mean		63.33	2.247
		95% Confidence Interval for Mean	Lower Bound	58.39	
			Upper Bound	68.28	
		5% Trimmed Mean		63.15	
		Median		60.00	
		Variance		60.606	
		Std. Deviation		7.785	
		Minimum		50	
		Maximum		80	
		Range		30	
		Interquartile Range		10	
		Skewness		.668	.637
		Kurtosis		.924	1.232

Table 2. Results of Descriptive Analysis of students Mathematical Understanding Ability acquisition based on learning

DISCUSSION

Based on the research results table, the mean score, standard deviation and skewness (slope) in the output shown in Table descriptively showed that the average gain in mathematical understanding ability of students who studied with PBl was 77.81. This result is higher than the average gain in mathematical understanding abilities of students who study with IBL (posttest mean = 63.33). The distribution of scores for the acquisition of mathematical understanding abilities of students who study with PBL is more spread out compared to the scores for the acquisition of mathematical understanding abilities of students who study with IBL. These results are based on the standard deviation scores in both classes, where the standard deviation score in the PBL class is 8.2 and the standard deviation score in the IBL class is 7.8. Meanwhile, based on the skewness value, the PBL class obtained a score of -0.337.

These results show that the score graph for the acquisition of mathematical understanding abilities for those studying with PBL tends to be negatively skewed, which means that the scores for the acquisition of mathematical understanding abilities tend to converge on large scores. The skewness value in the PBL class is -0.32. These results show that the score graph for the acquisition of mathematical understanding abilities for those studying with IBL is 0.67, which means that the scores for the acquisition of mathematical understanding abilities tend to converge on small scores.

The questionnaire instrument for measuring student learning motivation consists of 20 statement items with an ordinal scale of 1 to 4. Based on the calculation results in the table, it can be seen that of the 16 students who received the Problem Based Learning (PBL) model, 6 people (37.5%) have the high motivation category, 8 people (50.0%) have the medium motivation category and 2 people (12.5%) have the low motivation category. Then of the 12 students who received the Inquiry Based Learning (IBL) model, 3 people (25.0%) had the high motivation category, 4 people (33.3%) had the medium motivation category and 5 people (41.7%) has a low motivation category.

CONCLUSION

Based on the research results, it can be seen from the results that the gain in mathematical understanding ability with the problem-based learning model was 77.81, while the gain in mathematical understanding ability for students who studied with the inquiry learning model was 63.33. Then the scores for the acquisition of mathematical understanding abilities of students who learn using the problem-based learning model are more spread out compared to the scores for the acquisition of mathematical understanding abilities of students who use the inquiry learning model. So the standard deviation value in the PBL class is 8.2 and the standard deviation value in the IBL class is 7.8. So, the conclusion is that the description of the acquisition of mathematical understanding abilities in terms of the average posttest results obtained is that students who learn using the problem-based learning model are higher than those who use the inquiry-based learning model.

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