The Effectiveness of the PBL Model on Mathematics Problem-Solving Ability in Elementary School

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Abstract. The background of the research is because of the low problem-solving ability of students in mathematics. This research aims to describe the positive effect and significance of PBL for problem-solving ability of students in SDN Tado Kembo. This research is quantitative. The technique of data collection is a descriptive test. The population of this research is all the students of SDN Tado Kembo. The sample of this research is Students from class V with 40 students divided into 20 control groups and 20 experimental groups. The test result showed that the average learning outcome of the group using PBL was 7,400 while the average learning outcome using the conventional model was 4,650. Furthermore, the researcher did a t-test and the result T_{ob} = 7,481 while T_{cv} was 1,685. The calculation above showed that $T_{ob} > T_{cv}$, then Ho is rejected, and Ha is accepted. This research concludes that PBL can positively and significantly affect the math problem-solving ability of students of SDN Tado Kembo.

Keywords: mathematic, problem solving ability

1. Introduction

Learning mathematics has to be noticed and taught in schools, from elementary to college. There are so many kinds the purpose for mathematics learning. The other one is to improve student problem-solving capabilities. Problem-solving is the implementation of various methods to complete the problem based on a mathematical model until getting the result [1]. In this case, students can use various strategies to solve the problem. The steps in problem-solving are (1) identifying the various information contained in the problem; (2) The problems formulation and development model of mathematics; (3) implementing the way of problem-solving; (4) reviewing again the result they got [2]. In order to apply the steps, students must understand the questions given to them.

Increasing their mathematical problem-solving ability can help students think highly ordinary [3]. However, Indonesian students' problem-solving ability needs to improve nowadays [4]. It is also seen in the results of TIMMS and PISA. The results of TIMSS in 2003rd and 2007th indicate that it ranked Indonesian Students deeply below other countries [5]. Furthermore, 2015th TIMMSS results show that Indonesian students' abilities are below level because they can only complete the simple mathematic test [6].

The study result from PISSA proves that 2003rd and 2007^{th,} where they did every three years, established the rank of Indonesian Students deep below compared to other countries [7]. The same result happened in 2018th [8]. Indonesian Students do not yet have the ability of high think so they cannot complete the non-routine problem in math.

Student ability on SDN Tado Kembo, Manggarai Regency, to complete the math problem is still below. Most students at SDN Tado Kembo need to be more competent in

ICEHHA 2022, October 21-22, Ruteng, Indonesia

DOI 10.4108/eai.21-10-2022.2329665

identifying the information from the questions, cannot choose relevant data and information, and are incompetent in selecting the correct procedure. This is because students still need clarification to complete the test. Not only that, in learning, students need to be more creative because teachers still use conventional learning. Conventional learning, which until now is still dominantly implemented in mathematics learning in schools, evidently has yet to succeed in making students understand well what they are learning [9]. In conventional learning, students cannot provide an active and optimal response [10-11]. This is because students are forced to accept knowledge from the teacher without knowing the meaning of the knowledge they get. Hence, students only memorise formulas or concepts without understanding their meaning and cannot apply them in everyday life. This also leads to a need for more discussion and collaboration activities. That fact requires teachers' attention and creativity to develop correct learning tools that can be captured by students and create learning that makes students more active, creative and effective and can improve students' problem-solving skills on building materials [12]. Therefore, we need a learning model that can be used to solve the problem, namely, PBL.

Learning using PBL can be done by analysing the problem and allowing students to check the answer they get [13]. Furthermore, Bilgin et al. [14] said that in applying PBL, teachers have to give problems related to the student's daily life and demand high logic. The PBL model can stimulate students to identify information from the question, plan for complications and apply the way to complete until they correct answers [15]. From the explanation above, the researcher concludes that PBL can help students solve problems. Therefore, this research aims to describe the positive effect and significance of PBL for problem-solving ability students SDN Tado Kembo. The research results can also be used as a guide for SDN Tado Kembo teachers to apply the PBL model in learning mathematics.

2. Method and Materials

The approach of this research is quantitative with experimental methods. The experimental method aims to prove the successful implementation of PBL. Thus, the research student variables consist of the independent variable, namely the PBL model and the dependent variable, namely the ability to solve mathematical problems. This research design is a pretest-posttest control design, as shown in the table below.

Table 1. Research Design

Class	PretestPretest	Treatment	Posttest
Experiment	O_1	X	O_2
Control	O_1		O_2

Based on table 1, the subjects of this research consist of two groups, namely the experimental group and the control group. The control group intended a comparison of the experimental group. Learning activities on the experimental group using PBL, but on the control group using conventional learning.

Class V SDN Tado Kembo is a sample of this research that was determined with the use of purposive sampling, with consideration that the ability of problem-solving of math students is still low—furthermore, using a random technique to determine the control group and experiment group. The data collection was used to test, so the description test is an instrument for this research. Furthermore, to analyse data by SPSS 16.

3. Results and Discussion

Pretest and posttest were done to get data on this research. A description of the data can be seen in the table below.

Table 2 Description of posttest data for experimental and control classes

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Post Test Experiment	20	5.0	9.0	7.400	1.2312
Post Test Control	20	3.0	7.0	4.650	1.0894
Valid N (list-wise)	20				

The table above is a descriptive statistical table with minimum, maximum, mean and standard deviation values. That table was obtained from the posttest scores of experimental and control classes. The data in the table above shows that the average value of the experimental class is higher than the average value of the control class, which is 7,400 > 4,650. The minimum and maximum values were also higher in the experimental class than in the control class, namely 5.0 > 3.0 and 9.0 > 7.0.

Furthermore, the first is normality and homogeneity tests before testing the hypothesis. Results of the test show that the data is usually distributed and homogeneous. Moreover, after that, I did T-test. The result of the test can see in the table below.

Table 3 Hypothesis Testing Data Using t-test

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	T	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Result of student's problem-solving ability	Equal variances assumed	0.65	0.425	7.481	38	0	2.75	0.368	2.006	3.494
	Equal variances are not assumed.			7.481	37.45	0	2.75	0.368	2.006	3.495

Based on table 3, Tob = 7.481 and Tcv = 1.685 at a significant level of a = 0.05 and degrees df (20+20-2=38) because T_{ob} = 7.481 > T_{cv} = 1.685, then the decision has a significant difference. There is a significant difference between classes that apply PBL and classes that do not apply PBL.

Analysis results of table 3 show that the class using the PBL model is higher than the class using the conventional model. Students who joined learning with PBL are also more active. This result is the same as the opinion of previous researchers [16]. Apply PBL focuses on the student's learning process and enables students to rediscover concepts, reflect, abstract, formalise, problem-solving, communication and application. In addition, in learning by applying the PBL model at SDN Tado Kembo, the opportunity was given to Students to solve mathematic problems in groups—the formation of groups in PBL to improve the understanding of students [17]. Furthermore, in table 3, the results of the calculation of a significance value of more than 0.05 mean that applying PBL can affect students' problem-solving abilities. The thing is the same with research [18] which shows that applying the PBL significantly affects elementary school's problem-solving abilities.

4. Conclusion

Based on the results of the research that has been done, the researcher concluded that the mathematical problem-solving ability of students who use the PBL is higher than the conventional learning in the control class. This is evidenced by the value of T_{ob} = 7.481 > T_{cv} = 1.685 at a significant level of 5% or 0.05 and degrees of freedom (20+20) - 2 = 38. In addition, it is also proven by the difference in the average value of the two classes. In the experimental class using PBL, it was higher, namely, 7,400, while in the control class using the conventional method, the average value was 4,650. Thus, there is a positive and significant effect of the PBL on the mathematic problem-solving abilities of class V students at SDN Tado Kembo.

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