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PROBLEM-BASED LEARNING (PBL) MODEL BASED ON LESSON STUDY FOR LEARNING COMMUNITY (LSLC) TO IMPROVE STUDENTS' MATHEMATICAL COMMUNICATION

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ABSTRACT

The Problem-Based Learning model is a strategy in implementing learning related to real problems in everyday life, the solution will be maximized if combined with Lesson Study for Learning Community (LSLC). The objectives of this study are: 1) to know the application of the Problem Based Learning (PBL) model based on Lesson Study for Learning Community (LSLC) to improve students' mathematical communication. 2) to know the result of the application of the Problem Based Learning (PBL) model based on Lesson Study for Learning Community (LSLC) to improve students' mathematical communication. This research is a type of Classroom Action Research (PTK) consisting of 2 cycles, each cycle consists of four stages, namely: planning, implementation, observation and reflection. The population in this study were all students of class VIIIA MTsN Karangasem totalling 32 students and the sample was taken 3 students based on the results of observations and test results, namely students with high, medium and low abilities. The instruments used in the research were observation, tests, interviews and documentation. Data analysis was carried out through three stages, namely, Data Reduction, Data Presentation, and Conclusing Drawing. The results of this study can be seen with the acquisition of the percentage of student activity and test questions increasing every cycle. In activity I cycle I increased 21.56% from 61.77% to 83.33% in cycle II, in activity II cycle I increased 19.10% from 69.10% to 88.20% in cycle II, in activity III cycle I increased 12.15% from 69.10% to 81.25% in cycle II. Likewise with the test results, in the first cycle test questions increased by 12.50% from 81.25% to 93.75% with an average value of the first cycle increasing by 6.28 from 78.75 to 85.03.

Keywords: problem-based learning; lesson study for learning community; mathematics communication skill

1. Introduction

Education is the process of maturing a person intellectually so that a person becomes an independent personality. Without education, one cannot live forward, develop, and be in line with what one aspires to, as well as advance their life, so education becomes the main means for an educator who is managed effectively, systematically, and consistently (Djuwairiyah 2018). In education, there must be a learning process, as well as learning that supports student competence in the independent curriculum, namely contextual learning, namely learning mathematics.

Mathematics is a science that must be learned by every student which functions as a means of communication between teachers and students and students with other students. In mathematics, communication contains the process of conveying ideas or ideas conveyed orally and in writing. Communication in mathematics consists of two things. 1) Written communication can be in the form of using words, tables, symbols, mathematical equations, and so on that describe the student's thinking process to solve a problem. 2) Oral communication can be in the form of interactions between students, for example in learning with the discussion method (Widyaningsih 2019). With these discussion activities, it is very helpful for students to exchange ideas with their friends and as a means of communicating between students and other students. There are several factors that cause

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students' weak mathematical communication, namely 1) many students are still not active in group discussions and questions and answers. 2) The lecture method applied by the school also makes students less active in learning, because there is no place for students to do oral communication such as group discussions.

The Problem-Based Learning (PBL) model is a learning model that uses real-world problems as a context for students to learn calm ways of thinking and problem-solving skills, as well as to gain essential knowledge and concepts from learning materials (Utami in Maryati 2018). The purpose of the Problem-Based Learning (PBL) model is to increase students' mathematical communication skills critically, as well as help students solve problems systematically and make students learn to be independent and responsible people. The stages that must be carried out by the teacher in applying the PBL learning model are: 1) Explaining the orientation of the problem to students, 2) Organize students in learning 3) Providing guidance to individuals and groups 4) Developing and presenting student work 5) Analyze and evaluate the problem-solving process.

One way to implement the Problem-Based Learning (PBL) model well is for teachers to form a community and collaborate by preparing for teaching or during the learning process. The communication in question is by implementing Lesson Study for Learning Community (LSLC) or can be known as LSLC. LSLC is a place for educators to design and strategize together with other educators, and evaluate the learning process for improvement. LSLC is a collaboration between fellow teachers to study the content and learning instructions taught and discuss them, with the aim of increasing student learning activities, so that they can work together in the form of collaboration and collegiality (Saiful et al 2019). By applying LSLC, it becomes an alternative in solving problems during the learning process. The stages in LSLC are Plan (planning), do (implementation) and see (reflection). At the Plan stage the teacher formulates the problem by making a Learning Implementation Plan (RPP) and Student Worksheets (LKS), at the do stage the teacher conducts an open class activity in which students are given a Problem Based Learning (PBL) learning model with the steps described above, and at the see stage the model teacher with other observers reflects on the learning process during the open class with the observer reporting the results of his observations, while observations about how the teacher teaches and mastery of learning materials will be given a very small percentage (Hobri et al 2018).

The Problem Based Learning (PBL) model based on Lesson Study for Learning Community (LSLC) encourages students to be able to express ideas or ideas that students have through oral or written and makes students more active in learning. Because after the educator teaches the learning activities are always evaluated and improved, it will find deficiencies in students. Finally, the level of students' mathematical communication skills. Many researchers have proven that there is a significant difference in the mathematical communication skills of students who follow learning with the PBL model and students who follow learning with a direct strategy.

2. Research Methods

This research uses Classroom Action Research (PTK) which consists of 2 cycles, in general, the classroom action research (PTK) procedure used in this research is the Kurt Lewin Design. It consists of several cycles or repetitions of cycles. Each cycle consists of four steps/phases: (1) Planning, (2) Implementation, (3) Reflection, and (4) Observation. The four phases are elements that form a cycle, a series of sequential activities. Therefore, the form of classroom action research is never a one-time activity, but a series of activities that return to the original form, namely the cycle (Arikunto et al., 2021; Guru et al., 2007; Nanda et al., 2021; Wijaya & Syahrum, 2013).

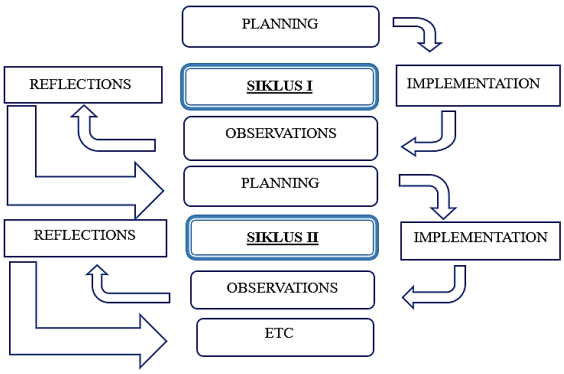

Figure 1. Lewis Theory (Kemmis and Tanggart)

This research was conducted at MTsN Karangasem, located in Subagan Village, Karangasem District, Karangasem Regency, Bali. This research was conducted in the even semester of the 2023/2024 academic year, what was studied

was the mathematical communication ability of class VIIIA students in statistics subjects. The subject of this research is consideration and observation through interviews with mathematics teachers at MTsN Karangasem. The population studied was class VIIIA students with a total of 32 students and a sample of 3 students was taken based on the results of observations and test results, namely students with high, medium and low abilities. Data collection techniques using observation, tests, interviews and documentation. Data analysis is done by collecting data (Data Collection), Data Reduction (Data Reduction), Presentation of data (Data Display), and Conclusing Drawing.

3. Results and Discussion

Pre-Cycle

Before the research took action in the form of cycles both cycle I and cycle II, researchers collected data in the form of observations first from the initial condition of the class to be given action. Researchers entered the VIIIA classroom as the teaching and learning process activities as usual. The data information obtained is described as follows:

a. The model used by mathematics teachers at MTsN Karangasem still uses a lecture model which causes students to be less active in the teaching and learning process.
b. Students' mathematical communication is also very low, this can be seen from the weakness of students in conveying information known by students through dialogue talks or a writing and the low ability of students in solving mathematical problems related to everyday life in mathematics learning.

Cycle 1

In cycle I there are four stages, namely the planning stage, the implementation stage, observation and reflection. In the planning stage, namely: 1) Making Learning Implementation Plans (RPP) and Student Worksheets (LKS). 2) Invite other teachers as observers to make observations during the learning process. 3) Explaining to the observer the learning that will be used during open class activities. 4) Teachers prepare the materials and tools used. 5) Teachers prepare student learning process observation sheets that will be used by observers during the implementation of learning. At the implementation stage the researcher improves the situation, at this stage the observer also makes observations during the learning process with the instrument sheet that has been provided. At the observation stage, the researcher makes observations for data collection on the implementation of actions that have been carried out by the math subject teacher in the class, starting from the plan to the process and learning outcomes are collected along with the research instrument tools. In the reflection stage, the researcher conducts activities to look critically at the changes that occur in students, the classroom atmosphere and the teacher. researchers can see things that are felt to have gone well or have not implemented the learning process well. In this phase also analyzed the activities of students. Therefore, this phase is used as a consideration in designing the next learning activity (cycle).

Based on the results of Open Class observations, student activity observations and student learning outcomes in cycle I can be seen in the following table:

Table 1. Results of *Open Class* Observation in cycle I

Observer	Introduction		Core		Conclusion	
	Yes	Result	Yes	Result	Yes	Result
1	3	10,34%	3	75,86%	3	13,79%
2	22	10,34%	22	75,86%	22	13,79%
3	4	10,34%	4	75,86%	4	13,79%
Average	10,34%		75,86%		13,79%	

Based on table 1 above, it shows that in cycle I, learning using the Problem Based Learning (PBL) model based on Lesson Study for Learning Community (LSLC) has all been implemented. However, there are notes that must be improved. The observer hopes that the model teacher in delivering the material needs to be slow so that it can encourage students to understand the learning material clearly.

Below the researcher will present the student test results in cycle I in the form of a graph.

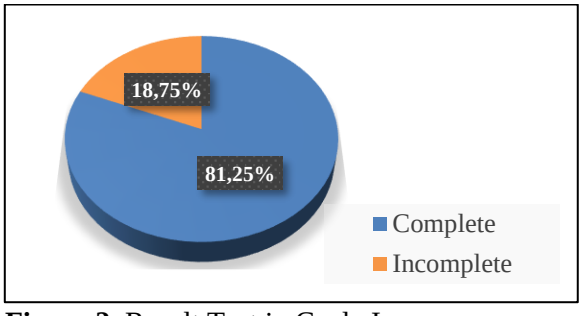

Figure 2. Result Test in Cycle I

Based on Figure 2 above, it is clear that the student test results in cycle I were completed by 26 students with a percentage of (81.25%) and 6 students with a percentage of (18.75%). Students are said to pass or complete when the score that students get has reached the KKM, which is 75. In this cycle I, the average class result obtained in the question test is (78.75) and has met the classical completeness of 75.

Student activities were also observed by several observers by paying attention to activities carried out by students, including: 1) student activity in analyzing mean, median, and mode in statistics material, 2) student activity in discussion activities between groups, and 3) student activity in presenting and responding to group work results. The following table shows the results of observations of student activity.

Table 2. Student activity observation results in cycle I

Activities	Observer 1	Observer 2	Observer 3	Average
1	61,46%	62,50%	59,37%	61,77%
2	69,79%	62,50%	75%	69,10%
3	72,92%	64,58%	69,79%	69,10%

In table 3 above, the results obtained clearly show that student activity in cycle I learning with the Problem Based Learning (PBL) model based on Lesson Study for Learning Community (LSLC) is still not optimal. Because there are some students who are still confused in applying mathematical concepts in the form of problem solving story problems. In addition, students' mathematical communication is still lacking, this can be seen when students have difficulty working on problems, they are still awkward to ask what students do not understand to the teacher or their group friends.

Table 3. Results of Score Range and Student Activity Observation Categories

No	Score Range (%)	Categories
1	0 - 69	Less Active
2	70 - 89	Aktive
3	90 - 100	Very Active

Based on the results of student activity observations in cycle I, the number and average of student activity observations were 61.77% in activity I, 69.10% in activity II and 69.10% in activity III. So it cannot be said that it meets the standard value of MTsN Karangasem. Meanwhile, based on table 4, it can be seen that the average ≤ 70 is categorized as less active. After reflection, there are several factors that become obstacles in learning carried out in cycle I including: 1) Some students were still confused by the material explained due to the speed of the teacher in explaining the learning material. 2) Some students are still shy to ask questions if there is an explanation that is still not understood. 3) The limited time available so that some students have not completed answering the questions. 4) The improvement of students' mathematical communication skills has not yet reached the target because it only fulfills the stages of written text and drawing. Therefore, there needs to be some improvements so that researchers decide to continue learning to cycle II.

Cycle 2

In cycle II, the stages in this cycle are the same as those carried out in cycle I, which consists of planning, implementation, observation, and reflection. Based on the results of Open Class observations, student activity observations and student learning outcomes in cycle II can be seen in the following table:

Table 3. Results of *Open Class* Observation in cycle 2

Observer	Introduction		Core		Conclusion	
	Yes	Result	Yes	Result	Yes	Result
1	3	10,34%	3	75,86%	3	13,79%
2	22	10,34%	22	75,86%	22	13,79%
3	4	10,34%	4	75,86%	4	13,79%
Average	10,34%		75,86%		13,79%	

Based on table 3 above, it shows that in cycle II, learning using the Problem Based Learning (PBL) model based on Lesson Study for Learning Community (LSLC) has all been implemented.

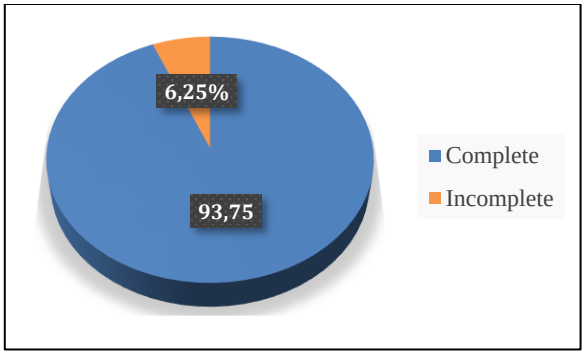

Figure 2. Result Test in Cycle II

Based on table 5 and figure 4 of cycle II test results, it can be seen that there is an increase from the previous cycle. In cycle II, there were 30 complete students with a percentage (93.75%) and 2 incomplete students with a percentage (6.25%). Similar to cycle I, students are said to be complete if they have reached the KKM score and classical completeness. From the data above, it can be seen that the class average in cycle II was 85.03.

Student activities were also observed by several observers by paying attention to activities carried out by students, including: 1) student activity in analyzing mean, median, and mode in statistics material, 2) student activity in discussion activities between groups, and 3) student activity in presenting and responding to group work results. The following table shows the results of observations of student activity.

Table 4. Student activity observation results in cycle I

Activities	Observer 1	Observer 2	Observer 3	Average
1	80,21%	89,58%	80,21%	83,22%
2	87,50%	85,42%	90,62%	88,20%
3	80,21%	79,17%	84,38%	81,25%

From the results of student activity observation data in cycle II, it is very visible that there is an increase from cycle I. Many students are already active in participating in math learning. Students have also been able to analyze the mean, median and mode in mathematics learning, cooperation between groups has also improved, in responding to discussion and presentation results, students are better able to provide input or ideas during learning. So it is very visible that students' mathematical communication is better and the atmosphere in the classroom looks more fun.

Comparison

	N	Minimum	Maximum		Mean	
	Statistic	Statistic	Statistic	Sum	Statistic	Std. Error
Cycle 1	32	60.00	90.00	2520.0	78.7500	7.37913
Cycle 2	32	65.00	100.00	2724.0	85.1250	9.23790

Based on the table above, it is known that the average learning outcomes of 32 students in cycle I are 78.7500, with minimum data 60, maximum data 90, total 2520.00, standard error 0.809, standard deviation 7.37913, and variance 54.452. Then the average learning outcomes of 32 students in cycle 2 were 85.1250, with a minimum data of 65, maximum data of 100, total 2724.00, standard error 0.809, standard deviation 9.23790, and variance 85.339. Judging from the data, it is known that there is an increase in the average score with the average value of cycle I to cycle II increasing by 6.28 from 78.75 to 85.03.

Judging from the data, it is known that there is an increase in the average value in the test results from cycle I to cycle II. In the test questions, cycle I to cycle II increased by 12.50% from 81.25% to 93.75% with the average value of cycle I to cycle II increasing by 6.28 from 78.75 to 85.03.

Table 5. Variance Homogeneity Test

Variance Homogeneity Test

		Levene Statistic	df1	df2	Sig.
Student Learning Outcomes	Based on Mean	2.493	1	62	.119
	Based on Median	2.618	1	62	.111
	Based on Median and with adjusted df	2.618	1	61.964	.111
	Based on trimmed mean	2.720	1	62	.104

Based on the result of the analysis it is known that based on the statistical levene average is 2.493 with a sig value $0{,}119 > 0{,}005$. From these results it can be concluded that the data on student test result in cycle I and cycle II are homogeneous. In other words, they have the same variance.

Table 6. Comparison of Cycle I and II Result Using SPSS 26

Comparison of Cycle I and II Result Using SPSS 26

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	Siklus I – Siklus II	-6.37500	4.17944	.73883	-7.88185	-4.86815	-8.629	31	.000

From the result of the analysis using SPSS 26, it is known that the difference in the average value in cycle II and cycle I is -6.37500, with a standard deviation of 4.17944, and standard error of 0.73883. then it is also known that the t value for the significance test of the comparison of the average value in cycle I and cycle II is -8.629,

with a calculated significance value of 0.000, the number of samples is 32 the degree of freedom is 31.

In the 95% confidence level test and alpha 5% of 0.05, it can be concluded that the t value is greater than the t table value of 2.039 (sig. 2-tailed). In addition, it can also be compared with the calculated t significance value of 0.000 which is smaller than alpha 0.05. in this case, based on theses two criteria, it can be concluded that the average difference between cycle I and II is significant. In other word, the result of this study can be generalized to the population and not only to the research sample.

The results showed that the *Problem Based Learning* (PBL) learning model based on *Lesson Study for Learning Community* (LSLC) can improve students' mathematical communication at MTsN Karangasem. Because learning using PBL based on LSLC can improve students' mathematical communication, students are able to develop thinking skills and skills in solving problems, learn as adults and become independent personalities. This is in accordance with what was found in Trianto research that PBL is also students in improving thinking skills and problem-solving skills of learners and helping learners in understanding the role of authentic adults and becoming independent learners (Trianto, 2019). This research is relevant to that conducted by Sri Wahyuni that learning with the *Problem Based Learning* (PBL) model is good, this can be seen from the average post test score obtained by students, namely 74.178 with a variance of 98.82 and a standard deviation of 9.839 (Sri Wahyuni, 2018). In addition, research conducted by Devi Yuniar that learning with *Lesson Study for Learning Community* (LSLC) can improve students' creative thinking skills, this can be seen from the increase in observation results and test results in cycle I and cycle II (Devi Yuniar, 2020).

Based on the reflection carried out in cycle II, the researcher compares the result obtained from cycle I and cycle II both from the result from the result of observing the activities of students and the average results of the test questions. All components have increased the observation result of activity I students reached 80.21% (active), the result of activity II students 88.54% (active) while activity III students 80.21% (active) and the average score of students 93.75% which means it has reached the performance indicator. So, the researcher made the decision that research only reached cycle II. So that this model is deemed appropriate to be applied in every math lesson.

4. Conclusions

The results of this study show that the application of Problem Based Learning (PBL) based on Lesson study for Learning Community (LSLC) is proven to improve students' mathematical communication at MTsN Karangasem. The material taught in class VIIIA is focused on statistics. The improvement of students' mathematical communication can be seen from the students' test results and observation of students' activities from cycle I to cycle II. Student test results showed that cycle I to cycle II increased 12.50% from 81.25% to 93.75% with the average value of cycle I to cycle II increased 6.28 from 78.75 to 85.03. While the results of student activity observations in activity I cycle I increased 21.56% from 61.77% to 83.33% in cycle II, in activity II cycle I increased 19.10% from 69.10% to 88.20% in cycle II, in activity III cycle I increased 12.15% from 69.10% to 81.25% in cycle II.

5. Acknowledgments

The researcher would like to thank the supervisor and mathematics teacher of MTsN Karangasem for helping the researcher in completing this scientific work, as well as support and guidance during writing, and to all those who were many in carrying out learning and during research data collection. The LSLC-based PBL model must be applied in collaboration between fellow teachers or researchers in order to better understand the shortcomings during the learning process.

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