

# Training Model of Troubleshooting Mathematics Materials of LCM And GCD Through PBL

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**Abstract**—The purpose of this research is to investigate the 4<sup>th</sup> grade of elementary school students in term of solving their skill of LCM and GCD in math in the form of problem solving through model problem based learning (PBL). To support the research, the research procedure used a classroom action research procedure with two cycles. In the first cycle, the students who involved the class were 15 students from 21 students (71.42%) while in the cycle II, there were 19 students from 21 students (90.47%). The result showed that by implementing problem-based learning model on LCM and GCD materials, students was trained in term of mathematical problem solving skills. The implementation was also to train teachers' skills in learning mathematics using problem-based learning model.

**Keywords**—PBL; problem-solving skills; Least Common Multiple (LCM); Greatest Common Divisor (GCD)

## I. INTRODUCTION

Effort to train the skills of elementary students on LCM and GCD materials in the form of problem solving problems was used the concept of problems in the process of learning mathematic. Problems are the conditions encountered by a person or group that encourages solving them but one still doesn't know the clear rules for immediate use in resolving the situation or problem. This is because if the problem is presented to a person or group to be resolved and they immediately resolve it correctly, it can be ascertained if the problem is not a problem [1].

To help solve problems that exceed the level of students' ability, the teachers need to provide scaffolding and assistance to students to solve them. The problem in the form of question is a matter that surpasses student's current level of ability [2]. Scaffolding here can also build students' new knowledge to continue the problem-solving process that goes beyond the level of their ability.

Improving students' numeracy skills is not the only goal of mathematics learning in primary schools, but there are other capabilities to be improved as well, namely problem-solving skills. The issue is in accordance with [3], stating that by solving a problem, students will gain new experience in implementing the basic knowledge and skills they already have when solving problems.

In order for students to gain new experience when solving problems, students must have a stock of problem solving skills.

This is in accordance with [4] who states that students must be equipped with problem solving skills. With the provision of these skills, the students will be having the basic skills that can be utilized in various areas of daily life problems. The basic skills are problem solving skills. It is called as "problem solving" because the solution requires a process that contains the correct and logical steps [5]. According to [3] students are categorized to have problem-solving skills when they can solve math problems through a process while trying to find answers according to the steps in solving the problem.

Correct and logical problem-solving steps follows the 4 troubleshooting steps proposed by [6] which consists of: (1) understanding the problem, requiring students to think hard to know the background of the problems they face and how to solve them; (2) making a plan of completion, i.e. the students collect the knowledge they have to be used in solving the problem; (3) completing the settlement plan, i.e. the students use their knowledge to solve the problem; and (4) re-examining the settlement, i.e. the students re-check the answer to find out the correct answer to the completed problem.

Based on the explanations that have been described, it is necessary to train students to use problem-solving skills, especially in solving problems related to their life. Efforts to train students' problem solving skills, among others, can be performed by a means of utilizing learning models that can train problem-solving skills.

One of the choices of learning models use to train students to be skilled at solving problems is PBL (Problem Based Learning) learning model. This is in line with [7] who explains the definition of problem-based learning model. It is said that PBL is a set of teaching models that make problematic problems as a target of learning so that there is better development in solving a problem, understanding the content of the lesson, and self-regulation.

The feature of problem-based learning model can be seen from its characteristics [8] including: (1) Solving problematic problem that is the focus of the lesson, (2) The student is the one who responsible for solving problem, and (3) The teacher support students in the process of working on the problem. On the other hand, [9] also identified five characteristics of problem-based learning consisting: (1) problem or problem solving, (2) interdisciplinary focus, (3) authentic investigation, (4) produce and present artefacts (production of artefacts and exhibits), and (5) collaboration.

A learning model should have a syntax that is used as guidance in an activity. The syntax of a learning model contains the steps of learning. There are five steps in problem-based learning, which begins with the teacher's activities presenting the problem to be solved by the students. It is then closed by presenting and analyzing the work during learning by students. In detail, these five steps can be seen in Table I.

Based on these steps, it can be seen that the teacher's role in PBL learning is to propose authentic problems to the students, to guide the investigation, to facilitate dialogue, and to provide support [10].

Daily test result of problem solving ability of math material of LCM and GCD in the form of story in the even semester in fourth grade of SD Negeri Kepuhanyar of academic year 2017/2018, Wednesday 17<sup>th</sup> January 2018 followed by 21 students obtained various value. Students who have excellent problem solving ability level was 0 (0%), good level was 1 (4.76%), good enough level was 7 (33.33%), poor level was 11 (52.38%), and very less was 2 (9, 52%).

From the above data, it can be interpreted that students' problem solving skills are low, so they have difficulties to understand the problems, formulate the things that are known from the problem, have no direction in planning the settlement, and the process of completion is not true. It is also because the teacher did not use a learning model that can train students to solve skills in the learning process so that students do not have problem solving skills.

TABLE I. PROBLEM-BASED SYNTAX LEARNING

Step	Teacher' Behavior
Step 1: Student orientation on the problem	Teacher explains the purpose of the lesson, explains what is needed, presents a phenomenon or demonstration or story to raise the problem, motivates the student to get involved in solving the selected problem.
Step 2: Organize students to learn	Teacher helps students to be able to determine what is known about the problem and organize learning tasks related to the problem.
Step 3: Guide individual and group investigations	Teacher encourages students to have appropriate information, then students carry out investigation activities with the aim of obtaining explanations and problem solving.
Step 4: Develop and present the work	Teachers help students to create designs and make preparations that produce appropriate work such as reports, videos, and models and help them to share their work with their friends.
Step 5: Analyze and evaluate the problem-solving process	Teacher provides students help to reflect or assess the investigations they have undertaken and the processes they use.

(Source: Ibrahim & Nur)

## II. METHOD

This study used a classroom action research type (CAR). Classroom action research is the research done by teachers in the classroom with the aim to improve their ability, their own work experience. Moreover, it is implemented systematically, planned, and with introspection.

The subjects in this study were students of SDN Kepuhanyar academic year 2017-2018 class IVA consisting 21

students. The location of this research is SDN Kepuhanyar, Mojoanyar District, Mojokerto Regency. Data collection techniques were in the form of observation and questionnaires. This research was conducted in two stages: preliminary and action research. Introduction includes initial observation on the subject of the study. The action research stage consists of several cycles, each cycle is done through 4 stages namely planning, action, observation, and reflective [11].

This classroom action research is successful if it meets the following criteria: 1). the data of teacher achievement in applying the steps of Problem Based Learning model can reach the percentage of  $\geq 75\%$  ". 2) Students' achievement data in problem solving skills can reach a percentage between 75% - 91% with classification of 'good' category [12].

The indicators for the implementation of the Problem Based Learning can be seen in Table II below:

TABLE II. TEACHER'S ACTIVITY OBSERVATION SHEET

No.	Descriptor	Yes	No
1	Teacher explains Problem Based Learning consisting of standards competence, basic competencies, achievement indicators of competence, and learning objectives.		
2	Teacher informs the essential equipment needed in the learning process, motivates, and directs the student to engage in problem-solving activities		
3	Teacher organizes common language into sub narrow subjects and helps students in group formation		
4	Teacher presents general, less structured, and actual issues		
5	Teacher guides students to define and organize learning tasks related to the given problem		
6	Teacher provides provocative questions to improve high-level skills		
7	Teacher gives students the opportunity to work together in groups		
8	Teacher ensures students that they are independent in finding sources / information to solve problems even though working in groups		
9	Teacher guides the student in analyzing the information according to the problem solved.		
10	Teacher guides students in planning and preparing reports on problem solving outcomes.		
11	Teacher assigns each group a report on the results of their problem solving in class discussion		
12	Teacher evaluates and reflects on the learning process that has been done.		

Data application of the steps of learning in Problem Based Learning was analyzed descriptively based on the achievement of the action done by the teacher. This is shown by the number of check marks ( $\surd$ ) in the "yes" column in the presentation observation sheet of the teacher's achievement with (1).

$$\frac{\text{The number of signs } (\surd) \text{ in the "yes" column}}{\text{Total number of signs } (\surd)} \times 100\% \quad (1)$$

The achievement of teacher' action in cycle I was measured from percentage achieved in cycle I. "The action is said to be achieved if the percentage has reached  $\geq 75\%$ " [12], while the achievement of teacher action in cycle II was determined based on reflection cycle I. From here, it can be seen whether there is an increase between cycle I and cycle II.

The student's problem solving skill indicators are listed in Table III. The problem solving skill indicators were analyzed descriptively based on the percentage of problem solving skills accomplishment with the assessment guidance by (2) and (3).

$$\text{Student Score Percentage} = \frac{\text{Score obtained}}{\text{Score obtained}} \times 100\% \quad (2)$$

TABLE III. STUDENT'S PROBLEM SOLVING SKILL INDICATORS

Score	Understand the problem	Create a settlement plan	Implement the settlement plan	Check again
0	Misinterpret / false at all	No plans, make irrelevant plans	Dont do calculations	No solutions or no other information
1	Misinterpret some of the questions, ignore the problem condition	Create a non-executed solving plan	Carry out the correct procedures where many produce are correct answers but miscalculations is happened	There is an examination but not complete
2	Understand the full problem	Making the right plan but wrong in the results / no results	Do the calculation process correctly and get the correct result	Inspection is done to see the truth of the process
3		Make the right plan, is not complete		
4		Make plans according to the procedure and lead to the correct solution		
	Score max 2	Score max 4	Score max 2	Score max 2

$$\text{Percentage Average Score of Students} = \frac{\text{the percentage score of all students}}{\text{the number of students}} \times 100\% \quad (3)$$

TABLE IV. PERCENTAGE OF STUDENT'S PROBLEM SOLVING SKILL CRITERIA

No	Percentage	Classification
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1	92%-100%	Very well
2	75%-91%	Good
3	50%-74%	Pretty good
4	25%-49%	Not good
5	0%-24%	Bad

TABLE V. CRITERIA OF STUDENT QUESTIONNAIRE ON PROBLEM BASED LEARNING

Percentage criteria	Category
67%-100%	Agree / positive
34%-66%	Neutral / in doubt
0%-33%	Disagree / negative

As a guideline in taking the decision / conclusions from the results of data analysis it was used such percentage (%) that define classification which also refers to the opinion of [11] as in table IV.

The response data were analyzed descriptively based on the result of the questionnaire that has been answered and collected by the students. It is supported also from result of the interview with some student after action had finished. Questionnaires that have been filled waere then processed to take a decision formula as shown at (4) and criteria are showed by Table V.

$$P = \frac{F}{N} \times 100 \quad (4)$$

P = Percentage of answered option  
 F = Number of respondents who answered the option  
 N = Number of respondents

### III. RESULTS AND DISCUSSION

#### A. Pre-Cycle Findings

In the Pre Cycle, it was obtained the value of the problem-solving test from 21 students as many as 61.90% while in the complete stage, there are 4 students or 19.04%. Students are also less active in the learning process.

TABLE VI. PROBLEM-SOLVING TESTS OF LCM AND GCD THROUGH PROBLEM BASED LEARNING CYCLE I

No	Va	No	Va	No	Va	No	Va
1	65%	7	50%	12	80%	17	80%
2	90%	8	65%	13	80%	18	45%
3	80%	9	70%	14	90%	19	75%
4	70%	10	70%	15	70%	20	85%
5	80%	11	50%	16	70%	21	75%
6	45%						

TABLE VII. CLASSIFICATION OF PROBLEM SOLVING SKILLS IN CYCLE I

Scor	Classification	The Number of Students	Percentage
92% - 100%	Very Well	0	0
75% - 91%	good	10	47,61%
50% - 74%	Good enough	9	42,85%
25% - 49%	Not good	2	9,52%
0% - 24%	Bad	0	0

**B. Cycle I Findings**

In the cycle I, it was obtained the value of problem-solving test as in in table VI. The average value is 71, 67%. Based on the data of problem solving skills in cycle I, it can be seen that the students' lowest score is 45% while the highest score is 90%.

From the table VII, students who complete the learning were  $\geq 75$  or as many as 10 students of the percentage reached 71.42%. In the result of skill classification in solving the problem of cycle I, student reached 71, 67%. The things that were found in the implementation of class actions in cycle I are: (a) In general, students still do not understand how to solve problem-solving problems in terms of making the completion plan and check the results, (b) the teacher did not maximally use the problem-based learning model in terms of granting scaffolding to individuals or groups who really need help at the stage of guiding individual or group investigations. Alternative actions about things that were found in cycle 1 are (a) providing continuous problem solving exercises, (b) using the complete learning model.

**C. Cycle II Findings**

In the second cycle, it was obtained value of problem-solving test as shown in table VIII. Based on the data of students' solving skills in cycle II, it can be seen that the students' lowest score is 50% and the highest is 100% so that the average score of 79.876% was obtained.

TABLE VIII. PROBLEM-SOLVING TESTS OF LCM AND GCD THROUGH PROBLEM BASED LEARNING CYCLE II

No	V	No	V	No	V	No	V
1	75%	6	70%	11	95%	16	80%
2	100%	7	75%	12	80%	17	75%
3	90%	8	75%	13	100%	18	80%
4	80%	9	80%	14	80%	19	90%
5	90%	10	60%	15	70%	20	80%
						21	50%

TABLE VIII. CLASSIFICATION OF PROBLEM SOLVING SKILLS IN CYCLE II

Score	Classification	The number of students	percentage
92% - 100%	Very well	2	9,52%
75% - 91%	Good	15	71,42%
50% - 74%	Good enough	4	19,04%
25% - 49%	Not good	0	0
0% - 24%	Bad	0	0

The results of the data prove that the problem solving skills of students is increasing. This can be seen in the table IX. Students who have completed learning were as many as 19 students or in percentage, it is 90.47%. There is an increase of 19, 05% from cycle I. Result of classification in cycle II showed that problem solving skill reached 79, 87% experience increase by 8,2% from cycle I that is equal to 71,67% and 79.87%. The things that are found in the implementation of class actions in cycle II are: (a) there are 2 students from 21 students who do not understand how to solve problem-solving problems at the stage of carrying out the completion plan and checking the results. (b) The teacher has used a problem-based learning model better than cycle I. Alternative actions about things found in cycle II: (a) provide continuous exercise of problem solving to students and (b) keep using the learning model of problem-based learning. From the results obtained, there has been an increase in learning outcomes of problem-solving tests [13].

From the research data of the class action, it appears that all the elements are precise. The test value of the final problem-solving cycle and the observation of the implementation of problem-based learning are improved resulting as the longer the better from cycle I to cycle II. It shows that learning model of problem based learning can improve problem solving skill. From the 2<sup>nd</sup> cycle result, there is no need for another action because the total number of students reaches 90.47%, while the performance indicator in this research was 80% reaching KKM.

Based on the observation of Problem Based Learning in cycle I, it is obtained the percentage of success of learning which is equal to 71, 42%. In the learning, the teacher did not maximally used the problem-based learning model in terms of providing scaffolding for individuals or groups who really need assistance at the stage of guiding individual or group investigations. Based on the reflection of learning actions with teachers and 1 observer, teachers can increase the percentage of learning achievement of the next cycle. The teacher has done all indicators of Problem Based Learning so that the percentage of achievement is 90.47%. There is an increase of 19.05% from cycle I. This is in line with the purpose of Problem Based Learning that is to help developing students' problem-solving skills and critical thinking skills, intellectual skills. Moreover, it functions to introduce students to learn about the various roles of adults through their involvement in real-life experiences or simulations and become autonomous learners and independent [14].

TABLE X. PERCENTAGE OF STUDENTS RESPONSE QUESTION SCORE ON PROBLEM BASED MODEL LEARNING

No.	Statement	Number of students who answered the option			
		SA	A	D	SD
1	Model Problem Based Learning (MPBL) on the subject matter of LCM and GCD in the form of problem solving story problem can achieve the purpose of learning	9,52	90,48	0	0
2	MPBL is very appropriate to solve the problems on LCM and GCD material in the form of problem solving stories	19,05	80,95	0	0

3	MPBL motivates me to learn actively and creatively	23,8 1	71, 43	4,7 6	0
4	MPBL really helps me to work with other students in solving problems	38,1 0	61, 90	0	0
5	MPBL can improve my learning responsibilities in groups	33,3 3	66, 67	0	0
6	MPBL encourages each member of the group to give input in solving the problem	28,5 7	71, 43	0	0
7	MPBL helps me expressing my opinions in the classroom	23,8 1	42, 86	28, 57	0
8	MPBL encourages me to interact with other group members	19,0 5	61, 90	19, 05	0
9	MPBL can increase my participation in teaching and learning activities	42,8 6	47, 62	9,5 2	0
10	MPBL can improve my understanding of LCM and GCD material in the form of problem solving stories	28,5 7	71, 43	0	0
11	MPBL can guide me in a structured and gradual learning	0	80, 95	19, 04	0
12	MPBL encourages me to enjoy the material of LCM and GCD in the form of problem solving story	9,52	66, 67	19, 04	0
13	MPBL can be continued to be applied in mathematics subjects on other materials	0	76, 19	23, 81	0
14	I follow the material of LCM and GCD in the form of problem solving story with pleasure	23,8 1	76, 19	0	0
15	The atmosphere of the classroom is fun and conducive	9,52	90, 47	0	0

#### IV. CONCLUSION

From the results of classroom action research conducted by researchers, it can be seen that: (1) students' problem-solving skills has increased after having basic skills to solve problems by often practicing problem-solving and (2) teachers have the ability to manage learning to train students' problem solving skills after using one of the learning models that can train students' solving skills. The model chosen by teacher is problem based learning model.

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