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The ability of mathematical problem solving reviewed from goal orientation to learning model of problem based learning assisted by problem card

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Abstract

The aims of this study are to prove the problem solving abilities of students in the application of Problem based learning (PBL) models assisted by problem cards to achieve classical completeness. The research used mixed method. The sample in this study were students of class VII D and VII E. Quantitative data was done by simple random sampling technique. Quantitative data was obtained using tests. Qualitative data analysis is the analysis of interview data. The results showed that (1) problem solving ability of 7th grade students achieving classical completeness; (2) problem solving abilities of students with PBL models assisted by problem cards reach the Minimum Completeness Criteria; (3) the proportion test results of students' in experimental class is better than students in control class. (4) the average test results of students in experimental class are better than the average results of students in control clas; (5) students in the mastery goal group meet the indicators of problem solving abilities while the students in the performance goal group have not met the indicators of problem solving abilities.

1. Introduction

Learning mathematics has an important role in life. According to Puspitasari, et al (2015) Mathematics needs to be taught to students because (1) it is always used in all aspects of life; (2) all fields of study require appropriate mathematical skills; (3) it is a powerful; short and solid means of communication; (4) it can be used to present information in various ways; (5) it improves the ability of logical thinking, accuracy and spatial awareness; (6) giving satisfaction to efforts in solving challenging problems.

One of the objectives of learning Mathematics is to develop the problem solving skills. According to National Council of Teacher of Mathematics (2000: 52), it is emphasized on the importance of problem solving because problem solving is an integral part of Mathematics learning, so that it cannot be separated from Mathematics learning. Problem solving skills are not only needed to solve problems in mathematics, but also needed in everyday life.

In addition to problem solving skills, the goals to be achieved in learning by students are also very necessary in improving problem solving skills by students, because the goals possessed by students in learning can serves as the booster of student achievement. As stated by experts, the goal orientation relates to the goals or objectives to be achieved by individuals in a task. Ames and Archer (1988) stated that the characteristics of a goal orientation, namely mastery goals and performance goals. Mastery goals are a motivational orientation that an individual has, which emphasizes the acquisition of new skills or mastery of the material. effective strategies, preferred challenging tasks, had a more positive attitude toward the class, and had a stronger belief that success follows from one's effort. While the performance goal is the orientation of students to get good results. With a performance goal orientation, there is a concern with being judged able, and one shows evidence of ability by being

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successful, by outperforming others, or by achieving success with little effort. Differences in goal orientation that students have can lead to different businesses. Students with mastery goals stop learning if they feel mastered the subject matter well, while students with performance goals stop learning if they feel the value is good.

Based on the results of observations, information was obtained that Curriculum 2013 had been applied mathematics learning activities in 7th grade students in one of Junior High School in Ungaran. As the implementation of the 2013 Curriculum on mathematics learning in the classroom, the teacher applies the learning method with the scientific approach even though the use of learning models suggested by Curriculum 2013 such as Discovery Learning, Problem Based Learning, and Project Based Learning is not optimal. The teacher assesses that learning with these models requires more time and the teacher also considers the situation and conditions of students in the class. This certainly affects the value obtained by students. It is known that the Minimum Completion Criteria set at Ungaran 2 Public Middle School is 70 with 75% classical completeness. Even though based on the results of the final of the first semester assessment test, it was found that students who achieved the Minimum Completion Criteria were only 60%. This shows that the value obtained by students is still far from the Minimum Completion Criteria.

From the description of the problems above it can be said that the students’ problem solving abilities of Junior High School 2 Ungaran are still not optimal, so that mathematics learning with models recommended by the 2013 Curriculum needs to be developed in order to improve students' problem solving abilities.

There are various models and learning approaches that can be used by teachers to improve students' problem solving skills, one of which is the Problem Based Learning (PBL) model. Problem Based Learning is learning that uses problems as a basis for students in the learning process. Based on research conducted by Padmavathy and Mareesh.K. (2013), problem based learning models can improve the ability to think critically, think creatively and solve students' problems. Problem based learning can also increase the activity of students in learning, motivation and interest in learning.

In addition to the learning model, learning media can also help the learning process, one of the learning media is the problem card. Problem cards are learning media or equipment that are included in graphic or visual media. Mathematical ideas can be learned by students through instructions, questions and exercises written on problem cards. Through problem cards, students will absorb concepts and solve problems and communicate them. The role of problem cards in this study is as a medium or tool to help students learn.

Based on the background described, the formulation of the problem to be studied in this study are as follows: (1) whether the problem solving abilities of students with PBL models assisted by problem cards can achieve classical completeness; (2) whether the problem solving abilities of students with PBL models assisted by problem cards can achieve Minimum Completion Criteria; (3) is the proportion of completeness test results of problem solving abilities of students with PBL model learning assisted by problem cards better than students with PBL learning models (4) whether the average results of the problem solving ability tests of students who get learning using PBL models assisted by problem cards is better than the average test results of students' problem solving abilities with PBL learning models; and (5) how the mathematical problem solving abilities of students in PBL assisted by problem cards are viewed from the goal orientation.

2. Method

The method used in this study is mixed methods. The model used is a concurrent embedded model, which is a research method that combines qualitative and quantitative research methods by mixing the two methods out of balance (Sugiyono, 2016: 537).

Data collection methods used in this study are scale, written test, interview and documentation. The population in this study was 7th grade students in one of Junior High School in Ungaran in the academic year of 2017/2018 as many as 288 students. The sample in this study were 2 classes from class VII D as many as 32 students as the control class and class VII E as many as 31 students as the experimental class. The experimental class received treatment for learning mathematics with PBL models assisted by problem cards. While the control class used the PBL model.

In quantitative research, the sample was selected using a simple random sampling technique. Quantitative methods are used to determine the achievement of completeness of problem solving abilities in the experimental class and the control class. In qualitative research, purposive sampling is used, namely the technique of taking subjects with certain considerations. Qualitative methods are used to describe students' problem solving abilities in terms of goal orientation in the mastery goal group and performance goals.

The research was conducted at one of Junior High School in Ungaran 2, Semarang. The subjects used as data sources were experimental group students consisting of 2 students with mastery goals and 2 students with *performance goal* based on the results of the goal orientation scale and strengthened by interviews with the consideration of being able to communicate well and considerations from the seventh grade mathematics teachers. Qualitative data analysis includes analysis of interview data. Data analysis in qualitative research includes data reduction, data presentation, and conclusion drawing. Analysis of students' problem solving abilities in this study is based on the results of the problem solving ability test and also the results of interviews in which there are indicators for Polya's problem solving abilities which include the ability to understand problems, the ability to plan solutions, the ability to implement a settlement plan and the ability to re-examine. The results of the interview analysis will be used as a triangulation to identify students' problem solving abilities in terms of the goal orientation in selected students.

3. Result & Discussion

The study was conducted using two classes, namely class VII E as the experimental class and class VII D as the control class. Research data collection took place at Junior High School 2 Ungaran. The learning model applied to the experimental class is learning that uses PBL models assisted by problem cards while for the control class uses the PBL model. Learning is done in four meetings for each class.

The results of the descriptive analysis test the mathematical problem solving abilities of students in the experimental class and control class can be seen in the following table.

Table 1. Summary of Experimental and Control Class Problem Solving Ability Test Results

No	Descriptive Statistics	Experimental Class Test Results	Control Class Test Results
1	Maximum score	98,86	86,36
2	Minimum score	43,18	30,68
3	Range	55,68	55,68
4	Average	82,70	63,42
5	Standard deviation	13,35	15,48

Whereas for taking goal orientation data through scale. The goal orientation scale is to group students into the goal orientation category of students. Grouping is divided into 2 namely the mastery goal group and the performance goal group. Mastery goal group students focus on learning material and mastery of tasks, while performance goal groups measure their abilities and performance by comparing their abilities with those of others. The results of data processing on the goal orientation scale of the experimental group students can be seen in the following table.

Table 2. Results of Grouping Goal Orientation Learners

No.	Group	Number of students
1	Mastery goal	8
2	Performance goal	8
3	Cannot be distinguished	15

Based on the goal orientation grouping, 4 students were selected who were then interviewed to find out the goal orientation of students more deeply. Students selected in the mastery goal category are coded MG-1 and MG-2, for the performance goal category coded PG-1 and PG-2. Selected research subjects for analysis of problem solving abilities can be seen in Table 3 below.

Table 3. Table 3. Selected Research Subjects

No	Student Code	Category	Subject Code
1	E-21	Mastery Goal	MG-1
2	E-27	Mastery Goal	MG-2
3	E-14	Performance Goal	PG-1
4	E-32	Performance Goal	PG-2

Based on the research that has been done and the results of the research hypotheses obtained: (1) The results of data analysis results of the problem solving ability test of experimental class students in the triangle and quadrilateral chapters, especially the material of flat rectangular, square, and square lines is known at least 75% from the test participants achieving a Minimum 70 Completion Criteria, that is as many as 29 out of 31 (93.5%) students have reached the Minimum Completion Criteria with an average problem-solving ability test result is 82.70. Based on the calculation results obtained by z_{count} in the class with problem-assisted problem-based learning problem, namely 1.95. At a significance level of 5% it was obtained z-table which is 1.64 so $z_{count} > z_{table}$ which means H_0 is rejected and H_1 is accepted, meaning that the proportion of students who complete individually on mathematical problem solving skills with Problem-Based Learning assisted by problem cards is more than 75% of the total students in class; (2) From the results of the study it was found that the number of students who received a score of ≥70 as many as 29 students from the total number were 31 students. Based on the results of the average test of one part, that is, the right is obtained t_{count} is 5,29 In the class with assisted Problem-Based Learning Problem Card is At the significance level of 5%, it was obtained t_{table}which is 1.70 so that $t_{count} > t_{table}$ which means H_0 is rejected and 1 is accepted, meaning that the results of the students' problem solving ability tests with Problem-Based Learning reach Minimum Completion Criteria; (3) Based on the results of the proportion test obtained z_{count} in the class with problem-assisted problem-based learning problems which is 3.25. At a significance level of 5% it was obtained z_{table} that is 1.64 so that $z_{count} > z_{table}$ which means that H_0 was rejected and H_1 accepted, meaning the proportion of class completeness that obtained subject matter with Problem-Based Learning model assisted by problem cards was more than the proportion of students who learned a learning model PBL; (4) Based on the results of the problem-solving ability test and the two-mean difference test obtained t_{count} in the class with problem-assisted Problem-Based Learning problem which is 5,280. At a significance level of 5% it was obtained t_{table} is 1.669 so that $t_{count} > t_{table}$ means that H_0 is rejected and 1 accepted, meaning that the results of the problem solving ability test of students in PBL model assisted by problem cards are more than the average test results of students' problem solving abilities. PBL learning; (5) Based on the results of the analysis, students' problem solving abilities viewed from the Goal Orientation after the implementation of Problem-Based Learning assisted by problem cards in solving problem solving problems are presented in Table 4 and Table 5.

Table 4. Ability to Solve Student Problems in Review of the Goal Orientation After Card-assisted Problem-Based Learning Implementation Problems with MG-1 and MG-2 Subjects

No.	Polya Problem Solving Indicator	*Goal Orientation*	
		MG-1	MG-2
1.	Understanding the problem	Student writes down what is known and asked of the problem effectively and correctly.	Student writes down what is known and asked of the problem effectively and correctly.
2.	Planning a strategy	Student can write a problem solving plan, complete and correct.	Student can write a problem solving plan but have not been able to determine the formula completely and correctly.
3.	Implement the strategy	Student can implement and solve problem solving problems in accordance	Student can implement and solve problem solving problems correctly but

		with the completion plan.	are less coherent
4.	Re-examine	Students re-examine the answers that have been done.	Students re-examine the answers that have been done.

Table 5. Students' Problem Solving Ability in terms of Goal Orientation After Card-Assisted Problem-Based Learning Implementation Problems of PG-1 and PG-2 Subjects

No.	Polya Problem Solving Indicator	*Goal Orientation*	
		PG-1	PG-2
1.	Understanding the problem	Student writes down what is known and asked of the problem, but it is incomplete and inaccurate.	Student writes down what is known and asked of the problem, but it is incomplete and inaccurate.
2.	Planning a strategy	Student is not optimal in writing completion plans	Student 2 writes a settlement plan but it is not clear.
3.	Implement the strategy	Student still often make mistakes in carrying out problem solving.	Student only write a solution without information that can be understood.
4.	Re-Examine	Student does not check the answers that have been done	Student writes simple and inappropriate conclusions.

Based on the results of the analysis in table 1, table 4, and table 5, it is known that these results are in line with the research conducted by Mattern (2005) showing students with high mastery goals have a higher level of ability than other goal orientation students (performance goals alone and combined) mastery goal-performance goal).

4. Conclusion

Based on the results of the research and discussion of the problem solving abilities of students in terms of the Goal Orientation on Problem-Based Learning assisted by problem cards in 7th grade students of Junior High School 2 Ungaran on quadrilateral material, conclusions can be obtained as follows. (1) Problem solving ability of 7th grade students in terms of goal orientation in problem-based learning assisted by problem cards has achieved classical completeness; (2) The problem solving abilities of students with PBL models assisted by problem cards can achieve Minimal Completion Criteria; (3) The proportion of the completeness of the test results of problem solving abilities of students with PBL models assisted by problem cards is better than those of students with PBL model learning; (4) The average test results of problem solving abilities of students who get learning using PBL models assisted by problem cards are better than the average results of tests of problem solving abilities of students with PBL models; (5) Students in the mastery goal group can meet the indicators of problem solving abilities while students in the performance goal group have not met the indicators of problem solving abilities.

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