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Analysis of Mathematical Problem Solving Abilities in Terms of Students' Motivation and Learning Styles

Wafiq Nurul Huda[1]✉, Hardi Suyitno[2] & Wiyanto[2]

[1] Program of Primary Education, Postgraduate, Universitas Negeri Semarang, Indonesia
[2] Faculty of Mathematics and Natural Science, Universitas Negeri Semarang, Indonesia

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Abstract

The purpose of this research is: (1) obtain a picture of the quality of implementation of the model PBL on the ability of solving mathematical problem for the material volume cubes and blocks as well as the surface area of cubes and blocks in class V SD N Karangwotan 02 Pucakwangi Pati, (2) identify the mathematical problem solving ability of students in class V SD N Karangwotan 02 Pucakwangi Pati terms of learning motivation after the application of PBL models, and (3) identify the mathematical problem solving ability of students in class V SD N Karangwotan 02 Pucakwangi Pati terms of learning style after the application of PBL models.This research is a qualitative descriptive study. Analysis of the quality of the learning process judged from phase: (1) planning, (2) implementation, and (3) assessment. While data analysis is done through data reduction, data presentation, and drawing conclusions. The results showed that: (1) the quality of learning by using the model PBL Scientific approach to the achievement of an increase in mathematical problem solving ability of students in class V SD N Karangwotan 02 in both categories, (2) students with learning motivation high, medium, and low have the same pattern differ in resolving mathematical problem solving Polya steps, and (3) the student's learning style visual, auditory, and kinesthetic also both have different patterns in solving a mathematical problem solving with Polya steps.

✉ Address correspondence:
Jetak RT.02/RW.01 Pucakwangi Pati, Jawa Tengah (59183)
E-mail: wafiq.nurulhuda@umk.ac.id

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INTRODUCTION

Problem solving is an essential component of the Mathematics Curriculum and it contains the essence of Mathematics activities, so that problem-solving skills need to be a concern in the learning process. According to Freitas (2008), with strong problem-solving skills students can engage themselves in other people's situations and improve them for the good of everyone.

Someone who wants to solve a problem should be a good problem solver. According to Polya (1973), someone who has problem-solving ability to be a problem solver when someone can understand the problems faced, can design the problem-solving plan, then carry out the problem-solving as planned, and reflect on the solution of the problem. However, there are still many people who can not be good problem solver because when the school the person does not get a learning that leads to solve the problem in accordance with the understanding that has the ability to solve the problem is very low. This is evident from the results of TIMSS (Balitbang, 2011), in 1999 Indonesia ranked 34th out of 38 participants with a score of 403 (average international score = 487), in 2003 Indonesia was ranked 35th out of 46 participants with a score of 411 (mean international score = 467), in 2007 Indonesia was ranked 36th out of 49 participants with a score of 397 (average international score = 500). In 2011 Indonesia ranks 36th out of 40 participants with a score of 386 and an average international score of 500 (TIMSS & PIRLS International Study Center of Lynch School of Education, 2011).

Some previous studies say that the difficulties of elementary school students learning Mathematics in general is in the matter of problem solving. Hudojo (2003) states that the questions related to numbers are not so difficult for students, but the problems that use the sentence is very difficult for students who have less ability. The difficulties faced by the students are not due to not being able to do the calculation but the students do not understand the problem. Sajadi, Amiripour, & Malkhalifeh (2013) explain that students are unable to define mathematical problems because they do not have enough experience in solving word problems and in choosing the right solutions immediately. In line with previous research statements, Loc & Phuong (2015) research finds that "students often have a lot of difficulty finding out strategies to solve stories and they often make mistakes in the problem-solving process".

Problems also occur in SD N Karangwotan 02 Pucakwangi Districts Pati Regency. It is shown from the average repeat grade Mathematics of Grade V students of semester I. Average grade of repetition Mathematics of Grade V students of semester I is presented in Table 1.

Table 1. Average Values of Mathematics Student Elementary Grade V Semester I SD N Karangwotan 02

No.	Name	Value	No.	Name	Value	No.	Name	Value
1	DPA	60	11	FDRP	62	21	PAS	80
2	MAR	60	12	IK	62	22	RSM	65
3	MF	61	13	IRAN	62	23	RDR	66
4	NMTS	65	14	KFAF	72	24	SAR	84
5	ARW	80	15	LF	61	25	SW	62
6	ATA	70	16	MC	85	26	TAS	70
7	ANW	63	17	MAS	62	27	ZRA	62
8	AKP	65	18	MKMR	61	28	TAP	62
9	AKN	60	19	NEA	65			
10	BAS	75	20	NTA	62			
Average				66.57				

The data shows that the achievement of learning mathematics in class V SD N Karangwotan 02 low. There are only 8 out of 28 students in the class with a score of ≥ 70. The average class is also low at 66,57.

Based on the results of interviews with teachers in class V found that one of the material that is often a scourge is a material geometry. It will be a bigger problem for the students if the presentation is presented in the form of problem solving questions. Many students have difficulties in understanding the problems so they can not find solutions to the problems presented.

In addition, it is also disclosed that the students' learning achievement is low because students tend to be lazy in learning Mathematics, learning motivation is less and each student has a different level of motivation to learn. The low motivation to learn tends to be caused by the character of Mathematics that is still considered to be abstract for the students in elementary school. The difference in student achievement in class V is also caused by different ways of learning of students in responding and understanding something known as learning style.

In line with the above statement, Hosnan (2014) stated that teacher learning behavior that less encourage the attention and motivation of students tend to be less fun and boring, so that directly or indirectly affect the less satisfactory learning achievement. In addition, differences in learning styles have a great impact on how children learn (Pitadjeng, 2015). Learning styles of VAK also have a positive relationship with problem solving (Gholami & Bagheri, 2013). In Fayombo's research (2015) it was found that both teaching strategies and learning styles were important in achieving academic achievement and student learning outcomes. Therefore, teachers should be able to motivate and understand the different styles of students so that learning can determine the appropriate learning for each student.

In accordance with Permendikbud No. 103 of 2014 on learning in primary and secondary education that the implementation of learning should pay attention to individual differences and student-centered. Learning should take into account differences in early ability, intellectual level, interest, learning motivation, talent, potential, social skills, emotions, learning styles, special needs, learning speed, cultural background, norms, values, and / or the environment of learners. On the basis of that conducted a review of learning in terms of motivation and learning styles of students.

Based on the guidance of the implementation of Curriculum 2013 in Permendikbud No. 103 of 2014 that learning approaches have to use the scientific approach with four model offerings, namely Problem Based Learning, Project Based Learning, Discovery Learning, and Inquiry, the model of Problem Based Learning is chosen because the model is perceived to fit the objectives problem-solving learning. This is in line with Etherington's (2011) statement that Mathematics learning with Problem Based Learning model can build and improve student's motivation in solving real-life problems. In addition, Saragih & Habeahan (2014) also found that students taught by PBL (Problem Based Learning) models have higher mathematical problem-solving abilities than students taught with conventional learning.

The main objectives of this research are: (1) to obtain a description of the quality of PBL model application on mathematical problem solving ability for cube and beam volume and surface area of cube and beam in class V SD N Karangwotan 02 Pucakwangi Pati, (2) to identify students' mathematical problem solving abilities in class V SD N Karangwotan 02 Pucakwangi Pati observed from learning motivation after application of PBL model for cube and beam volume material and cube and beam surface area, and (3) to identify mathematical problem solving ability of class V SD N Karangwotan 02 Pucakwangi Pati in terms of learning style after application of the PBL model for the cube and beam volume material as well as the cube and beam surface area.

METHODS

The approach in this research is qualitative approach with qualitative descriptive research

type. The main instrument is the researcher while the auxiliary instruments used in this study include: (1) validation sheet of the research instrument to obtain data on the opinions of the experts (validator) on the learning device as a guide in revising the learning device, (2) learning tools (syllabus, lesson plans, teaching materials, and LKS), (3) learning activity observation sheets used to obtain data on teachers' ability to apply learning scenarios, (4) student response questionnaire, used to obtain student response data during learning process and on learning device, (5) questionnaire motivation to learn given before learning to get data about student learning motivation class V SD N Karangwotan 02, 6) questionnaire of learning style given before learning to obtain data about the learning style of students in grade V SD N Karangwotan 02, (7) TKPM (Test of Problem Solving Ability) with the type of test is the test description with the implementation of the test done at the end of the learning after using the Scientific approach with Problem Based Learning model that aims to measure students' mathematical problem solving abilities, and (8) interview guidelines on research subjects to obtain in-depth information about students' mathematical problem solving abilities in terms of motivation and learning styles.

RESULTS AND DISCUSSION

Quality of Learning

The quality of learning is measured based on three aspects as disclosed by Gregor namely planning/preparation, implementation, and assessment.

1. Preparatory stage

At this stage prepared learning tools include syllabus (available), RPP, teaching materials (available), LKS, and TKPM. Devices that have been created are then validated by an expert validator. Validators validating learning tools are 2 lecturers from the Unnes Postgraduate Program. The following assessment results of each validator against learning tools can be seen in Table 2.

Table 2. Validator Values Results on Learning Devices

Device	Average Validator Score		Average	Category
	Validator 1	Validator 2		
RPP	4,7	3,9	4,3	Very good
LKS	4,7	3,7	4,2	Good
TKPM	4,4	3,8	4,1	Good

Based on the results of validator assessment of RPP, LKS, and TKPM obtained the result that the learning device is in the category of at least good. Thus, it is concluded that learning tools are suitable for research.

2. Implementation stage

Measuring the quality of the implementation of learning seen from the sheet implementation of learning. The results of the assessment of the implementation of learning can be seen in Table 3.

Table 3. Observation Result of the Implementation of Learning

Implementation	Average	Category
Observation 1	3,68	Good
Observation 2	3,76	Good
Observation 3	3,64	Good
Observation 4	4,00	Good
Observation 5	4,12	Good

Based on predetermined criteria, the 5 scores get a good category average. Thus, it can be concluded that teachers have good skills in the preparation and manage of learning so that learning is done well.

3. Assessment stage

Assessment of learning is done by providing a questionnaire of student responses to the learning that has been done. Questionnaire student responses were filled by 28 students after obtaining learning by using Scientific approach using PBL model to improve students' mathematical problem solving abilities. Details of student response questionnaire can be seen in Table 4.

Table 4. Student Response to Mathematical Learning with Approach Scientific Using the PBL Model

Responded aspect	The number of students		Percentage (%)	
Are you happy about the following learning components?	Pleasant	Unpleasant	Pleasant	Unpleasant
a. Teaching materials	20	8	71,43	28,57
b. TKPM	24	4	85,71	14,29
c. How to teach teachers	25	3	89,28	10,72
d. The atmosphere teaches in the classroom	23	5	82,14	17,86
Is this learning component new to you?	Modern	Ancient	Modern	Ancient
a. Teaching materials	18	10	64,28	35,72
b. LKS	26	2	92,86	7,14
c. TKPM	24	4	85,71	14,29
d. How to teach teachers and the atmosphere of teaching in the classroom	25	3	89,28	10,72
Are you interested in following the next lesson in the way you just followed?	23	5	82,14	17,86
Are you clear and understand the language used in learning?	Un-ambiguous	Ambiguous	Un-ambiguous	Ambiguous
a. Teaching materials	21	7	75	25
b. TKPM	23	5	82,14	17,86
c. LKS	25	3	89,28	10,72
Are you interested in the appearance of writing, illustrations / drawings, and the location of images contained in:	Interested	Not interested	Interested	Not interested
a. Teaching materials	23	5	82,14	17,86
b. LKS	28	0	100	0
c. TKPM	24	4	85,71	14,29
What can you get after today's Mathematics lesson and after working on problem solving questions?	22	6	78,57	21,43

Table 4 shows that students respond positively to all aspects whose numbers are above half the number of students in the study subjects. This means every aspect responded positively by students more than 50%. From the positive response of students who more than half the number of students it can be concluded that the quality of learning based on the positive response of students is categorized well.

Mathematical Problem Solving Ability Judging from Student Motivation

1. High Learning Motivation

The following summarizes the characteristics of problem solving steps of students who are at high motivation level can be seen in Table 5.

Table 5. Summary of Characteristics of Student Problem Solving Steps on High Learning Motivation

Stages polya	Information	High learning motivation
0	Not able to understand the problem	-
I	Understand the problem	-
II	Make plans	2
III	Implement the plan	2
IV	Check results again	13
The number of students		17

Based on Table 5, it is found that from 17 students who have high learning motivation, there are 2 students reaching stage II Polya, 2 students reach stage III Polya, and 13 students reach stage IV Polya. Students who have high learning motivation achieve different stages in solving mathematical problems with Polya step. Thus, it can be concluded that students who have high learning motivation does not have the same pattern in solving mathematical problems with Polya step.

2. Medium Learning Motivation

The following summarizes the characteristics of problem solving steps of students who are at moderate motivation level can be seen in Table 6.

Table 6. Summary of Characteristics of Problem Solving Step Students on Medium Learning Motivation

Stages polya	Information	Medium learning motivation
0	Not able to understand the problem	1
I	Understand the problem	1
II	Make plans	1
III	Implement the plan	2
IV	Check results again	3
The number of students		8

Based on Table 6, it is found that from 8 students who have moderate learning motivation, 1 student reaches stage 0 (unable to understand the problem), 1 student reaches stage I Polya, 1 student reaches stage II Polya, 2 students reach stage III Polya, and 3 students reached stage IV Polya. Students who have the motivation to learn are reaching different stages in solving mathematical problems with Polya step. Thus, it can be concluded that students who have motivation to learn is not having the same pattern in solving mathematical problems with Polya step.

3. Low Learning Motivation

The following summarizes the characteristics of problem solving steps of students who are at low motivation level can be seen in Table 7.

Table 7. Summary of Characteristics of Student Problem Solving Steps on Low Learning Motivation

Stages polya	Information	Medium learning motivation
0	Not able to understand the problem	1
I	Understand the problem	-
II	Make plans	1
III	Implement the plan	-
IV	Check results again	1
The number of students		3

Based on Table 7, it is found that from 3 students with low learning motivation, 1 student reaches stage 0 (unable to understand the problem), 1 student reaches stage II Polya, and 1 student reaches stage IV Polya. Students who have low learning motivation reach different stages in solving mathematical problems with Polya step. Thus, it can be concluded that students who have low learning motivation does not have the same pattern in solving mathematical problems with Polya step.

Mathematical Problem Solving Ability Viewed from Student Learning Styles

1. Visual Learning Style

The following summarizes the features of student problem-solving steps that reside in visual learning styles can be seen in Table 8.

Table 8. Summary of Characteristics of Student Problem Solving Steps on Visual Learning Style

Stages polya	Information	Visual learning style
0	Not able to understand the problem	-
I	Understand the problem	1
II	Make plans	1
III	Implement the plan	2
IV	Check results again	5
The number of students		9

Based on Table 8, it is found that from 9 students who have visual learning style, 1 student reaches stage I, 1 student reaches stage II, 2 students reaches stage III, and 5 students reaches stage IV Polya. Students who have a visual learning style reach different stages in solving mathematical problems with Polya step. Thus, it can be concluded that students who have a visual learning style does not have the same pattern in solving mathematical problems with Polya step.

2. Auditorial Learning Styles

The following summarizes the features of the student problem-solving steps in the auditorial learning style can be seen in Table 9.

Table 9. Summary of Characteristics of Student Problem Solving Steps on Auditorial Learning Styles

Stages polya	Information	Auditorial learning styles
0	Not able to understand the problem	-
I	Understand the problem	-
II	Make plans	3
III	Implement the plan	1
IV	Check results again	7
The number of students		11

Based on Table 9, it is found that from 11 students who have auditorial learning style, there are 3 students reaching stage II, 1 student reaches stage III, and 7 students reach stage IV Polya. Students who have an auditorial learning style reach different stages in solving mathematical problems with Polya step. Thus, it can be concluded that students who have an auditorial learning style do not have the same pattern in solving mathematical problems with Polya step.

3. Kinesthetic Learning Styles

The following summarizes the features of student problem-solving steps that are in the kinesthetic learning style can be seen in Table 10.

Table 10. Summary of Characteristics of Student Problem Solving Steps on Kinesthetic Learning Styles

Stages polya	Information	Kinesthetic learning styles
0	Not able to understand the problem	2
I	Understand the problem	-
II	Make plans	-
III	Implement the plan	1
IV	Check results again	5
The number of students		8

Based on Table 10, it is found that from 8 students who have kinesthetic learning style, there are 2 students who reach stage 0 (unable to understand the problem), 1 student reaches stage III Polya, and 5 students reaches stage IV Polya. Students who have a kinesthetic learning style reach different stages in solving mathematical problems with Polya step. Thus, it can be

concluded that students who have kinesthetic learning styles do not have the same pattern in solving mathematical problems with Polya step.

CONCLUSION

The quality of learning by using Scientific approach using PBL model on the achievement of students' mathematical problem solving abilities of grade V SD N Karangwotan 02 in good category. This is shown as follows:
(1) The result of validation of learning tools of mathematics that approach Scientific using PBL model to improve students' mathematical problem solving ability obtained by valid device.
(2) The average score of observations on the implementation of learning from the first to the fifth observations included in good category.
(3) The result of questionnaire of student response to learning with scientific approach using PBL model shows that more than 50% of students respond positively to every aspect. From the positive response of students who number more than half the number of students it can be concluded that the quality of learning based on positive responses of students categorized well.

The distribution of mathematical problem solving ability of grade V SD N Karangwotan 02 students in high learning motivation is from 17 students, there are 2 students reaching stage II Polya, 2 students reach stage III Polya, and 13 students reach stage IV Polya. Students who have high learning motivation do not have the same pattern in solving mathematical problems with Polya stage. Meanwhile, the distribution of mathematical problem solving ability of grade V students of SD N Karangwotan 02 on moderate learning motivation is from 8 students, there is 1 student reaching stage 0, that is students unable to understand the problem, 1 student reaches stage I Polya, 1 student reaches stage II Polya, 2 students reached stage III Polya, and 3 students reached stage IV Polya. Students who have the motivation to learn are not having the same pattern in solving mathematical problems with Polya stage. And the distribution of mathematical problem solving ability of grade V SD N Karangwotan 02 students in low learning motivation is from 3 students, there is 1 student reaching stage 0, that is students unable to understand the problem, 1 student reaches stage II Polya, and 1 student reaches stage IV Polya. Students who have low learning motivation do not have the same pattern in solving mathematical problems with Polya stage.

The distribution of students' mathematical problem solving ability in grade V SD N Karangwotan 02 on visual learning style is from 9 students, there is 1 student reaching stage I Polya, 1 student reaches stage II Polya, 2 students reach stage III Polya, and 5 students reach stage IV Polya. Students who have visual learning styles do not have the same pattern in solving mathematical problems with the Polya stage. Meanwhile, the distribution of mathematical problem solving ability of grade V SD N Karangwotan 02 students in auditorial learning style is from 11 students, there are 3 students reaching stage II Polya, 1 student reaches stage III Polya, and 7 students reach stage IV Polya. Students who have an auditorial learning style do not have the same pattern in solving mathematical problems with the Polya stage. Also, the distribution of mathematical problem solving ability of grade V SD N Karangwotan 02 students in kinesthetic learning style is from 8 students, there are 2 students reaching stage 0, that is students unable to understand the problem, 1 student reaches stage III Polya, and 5 students reach stage IV Polya. Students who have kinesthetic learning styles do not have the same pattern in solving mathematical problems with the Polya stage.

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