Improving Students' Ability Through Mathematical PBL Model at Junior High School

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Abstract - **The study investigated the junior high school students' learning experiences to develop their metacognitive factors; logical, critical, creativity, consistency, and self-esteem within solving mathematical equation problematics. The study introduces Problem Based-Learning (PBL) to enhance students' metacognitive factors as characteristic building consistency to self-sustainable personal. The model signified humanized humanity feature of Khalifa pedagogic experiences in early layer, junior high school. It reformed the very concept of pedagogic metacognitive to solve problems. The study described about the students' achievement in PBL for mathematics subject. The samples are the seventh-grade students of SMP N 1 Kota Langsa. There are 66 (sixty-six) students who participated and selected through their ability to work in individual, collective, and superiority. The study assessed the students' achievement through validated test. The tests instruments have been validated by the proficient in educational evaluation. The test posted 0, 873 of reliable coefficient ratio. The results analyzed through statistical equations description. The result projected about the students' problem-solving achievement features, i.e. there are 46 students who well-understand in problem-solving category and gave answer completely and correctly, there are 58 students who able to organized in problem-solving category and also gave answer completely and correctly, there are 37 students who settled in fair-understand category in problem-solving and also gave answer completely and correctly, and there are 16 students who settled in sufficient category. In conclusion, the study proved PBL effectivity for students' learning experiences to solve problem within mathematical equation. It is suggested to be applied in science for elementary school subjects as one of teaching pedagogic model.**

Keywords: Problem Based Learning and Problem Solving.

A. INTRODUCTION

Mathematics plays complex roles and challenges of the future. Therefore, it is structured to able to prepare students with resilient for problems solving. Soedjadi (1991: 33-34) argued that math is not enough with equational skills for National Exam (UN) only. Mathematics educates fostering transferable ability in the life of future students. For instance, Mathematics as one of the tools of scientific thinking approaches to develop logical reasoning, systematically and critically in the ability to solve problems. Similarly, for recent practice, mathematics is the basic knowledge necessarily in higher education, even required by everyone in everyday life. Utari (1993) argues that solving mathematical problems is of paramount importance. Thus, becoming the goal of mathematics teaching even as the essence of mathematics, preferring the process rather to results.

Although, not all questions are problems. A question will be a problem only if the question indicates a challenge that cannot be solved by routine procedures already familiar to the student. If it applies mathematical reasoning; knowledge, skills and experience to solve a new or confusing dilemma or situation, then it calls problem solving. To be a good problem solver, students are required opportunities to create, adapt, and solve problems in the field of mathematics and a real-life context. Furthermore, K-13, with scientific approaches exclude problem solving skills within mathematical reasoning equal to problem understanding skill, planning, solving and interpretation of a solution. Yet, the *scaffolding* techniques possibly applied by the teachers for problem-solving within teaching-learning process. Related with it, Evils (2008) stated the actual development of students achieved through or facilitated the presentation of non-routine problems.

Nowadays, K-13 affirms problem solving is a focus in mathematics teaching-learning process as opportunity be initiated with the introduction of a *contextual problem*. Moreover, the problem was settled as a learning trigger. Then, the knowledge and learning experience built their new knowledge through contextual problem solving. On the other hand, it related to Suryadi (2008), a research which have been made, stated to encourage the occurrence of mental action. Hence, the learning process must be started serving the problem that contains a challenge for students to think and communicate. In addition, NCTM (2000) states that the general objectives of mathematics are: (1). learning to communicate

(mathematical communicatory), (2). Learn to reason *(mathematical reasoning),* (3). Learn to solve problems *(mathematical problem solving)* (4). Learning to associate ideas *(mathematical connections),* (5). Formation of positive attitudes toward mathematics *(positive attitudes toward mathematics).* All of these goals are called *mathematical power.*

In daily-life, people are inseparable from problem. So, the problem-solving ability is the main focus in mathematics teaching-learning. Yet, the writer has mentioned about not all questions are a problem. A question will be a problem if only it indicates some challenges that cannot be solved by routine procedures. It is believed that mathematical knowledge solves occurred confusing dilemma or situation. It is ***a problem-based learning model (PBM)***. The model affirms learners approach to the problem of authentic (real) so that learners can compile their own knowledge, cultivate high skills and inquiry, establish students, and increase confidence Trianto, (2009: 92). PBM carried out one of student-centered learning and teacher as a facilitator. The process encompasses real-world problems as a context for students to learn critical thinking and problem-solving skills, and to acquire knowledge and concepts that are essentially from the subject matter. Contextual problems are aimed at motivating students, stimulating student learning, improving students' learning activities, focusing on problem solving so that students are interested in learning, finding concepts that are appropriate to the subject matter, and with the interaction of knowledge sharing between students and students with teachers, as well as students with the environment students are invited to be active in the learning process. In conclusion, the article investigated the level of problem solving ability of student mathematics after implementation of Problem Based Learning model (PBM).

B. RESEARCH METHOD

1. *Subjects*

The subjects in this study were students of grade VII SMPN 1 Kota Langsa. There are 66 students. They are selected based on the consideration of problem-based learning model where independent and autonomous students, students who have high ability, students who want to work individually or in groups, students who are able to see the problems of multi-dimensional, students who are able to think critically, and creatively in science skills (Marzuki, 2012).

2. ***Instrument* Research**

Instrument used in the form of problem-solving test, trial result for problem-solving ability consisting of 5 item is valid valid with test reliability value equal to 0,873 (very high category).

3. **Analisia Mechanical Data**

Sugiyono (2014: 206) **Analysis Descriptive statistics** were: Analysis of data in ways that describe or depict the data that has been collected as without meaning make conclusions or generalizations apply to the public ". Data analysis used in this research use descriptive statistic by using percentage and pay attention to indicator of problem solving ability.

C. RESULT

The problem-solving test by using problem-based learning model followed by 66 students. To know the process of student's answer in developing problem-solving ability can be seen from some aspect of problem solving ability following:

1. Understanding problem; (b) The completion step is incomplete and the answer is correct, (c) The completion step is incomplete and the answer is incorrect.
2. Planning the Settlement; (b) The completion step is incomplete and the answer is correct, (c) The completion step is incomplete and the answer is incorrect.
3. Resolving the Problem; (b) The completion step is incomplete and the answer is correct, (c) The completion step is incomplete and the answer is incorrect.
4. Rechecking; (b) The completion step is incomplete and the answer is correct, (c) The completion step is incomplete and the answer is incorrect.

For more details, the following presents the conclusions of the student's answer process based on the above criteria by using descriptive statistical analysis.

Table 1.1 Student Resolution Process in Developing Problem-Solving Ability.

				Class Problem-Based Learning Model	
Indicator Ability Problem Solving	**Indicator Process Answer Student**	**Interval Values**	**Category Assessment**	**Number of Students**	**Average**
Understanding Problems	Completed completion and correct answer	15 <x ≤ 25	Good	46 (69,69%)	17,62
	Incomplete completion step and correct answer	10 <x ≤ 15	Enough	20 (30,30%)	
	Completion step incomplete and wrong answer	0 <x ≤ 10	Less Good	0 (0%)	
Planning Completion	Complete completion step and correct answer	10 <x ≤ 15	Good	58 (87.87%)	12.93
	Step resolver is not complete and correct answer	5 <x ≤ 10	Self-8	(12.12%)	
	Step resolver is not complete and correct answer	0 ≤ x ≤ 5	Less Good	0 (0%)	
Solving Problems	completion step is complete and correct answer	15 <x ≤ 20	Good	37 (56.06%)	15.89
	Step resolver is not complete and correct answer	10 <x ≤ 15	Self-29	(43.93%)	
	Step resolver incomplete and answers not true	0 <x ≤ 10	Less Good	0 (0%)	
Checking	Completed and correct answer Step	10 <x ≤ 15	Good	16 (24.24%)	8.24
	Step resolve incomplete and correct answer	5 <x ≤ 10	Enough	34 (51,51%)	
	Resolver incomplete and incorrect answer	0 ≤ x ≤ 5	Poorly	16 (24.24%)	

Based on Tebel 1.1 above, it can be seen that the ability to understand the problem with the good category as many as 46 students answered completely and correctly, plan the completion of good category 58 students answer completely and correctly, solve the problem with good category 37 students answered completely and correctly, and re-checking only 16 students with enough category. Based on the average

score, the level of resolution problem solving process using PBM model is in either category.

D. DISCUSSION OF RESEARCH RESULTS

Discussion of the results of the following study will describe the description and interpretation of the ability to solve mathematical problems, active student activities and the process of completion of student answers in solving problems given to problem-based learning.

Factors involved in the research are the factors of learning and factors of students' mathematical ability.

1. **Learning Factors**.

   Looking at the results of the research that has been stated above, it projected that the problem-based learning model is significantly better in improving problem solving skills and mathematical communication of students compared with direct learning model. The results of this study confirmed the findings Suhendra (2005) in his research found that students who get problem-based learning in small study groups significantly have better math problem solving skills compared with students who get conventional learning. Likewise, the discovery of Rohman (2009) shows that the problem-solving skills of math learners who are taught with problem-based learning is better than problem-solving skills taught by direct learning. If we look at the learning characteristics of the two approaches it is a natural thing for such differences to occur. Theoretically the problem-

based learning model has several advantages when compared with the direct learning model which if these advantages are maximized in the implementation in the classroom enables the learning process to be better. These advantages can be seen through different views on the characteristics of learning include:

2. **Teaching Materials Teaching**

   The materials developed are packaged in the context of contextual issues that include teacher books, student books, LAS. From student and LAS book Students are encouraged to actively seek answers based on the process of the problem-based model of problems, circumstances or situations encountered and draw conclusions through critical, logical and systematic scientific thinking processes.

3. **Teachers**

   Applying the problem as context, the teacher's role in learning is authentic as a facilitator and organizer, which is to organize how students should learn and provide direction so that the material being studied is understood and understood by the students. Constraints faced by teachers in facilitating and accommodating students learning from problems are the heterogeneity of students' math skills in the classroom. Because the intelligence of students in the classroom is relatively varied, then the level of difficulty faced by students in solving problems also vary. Teachers' difficulties in teaching students with heterogeneous intelligence can be minimized by means of students working together in groups of four to five. They interact cooperatively to solve problems, namely sharing ideas / opinions through question and answer and trial, Form of teacher intervention when students work together by teachers indirectly, that is by using techniques *scaffolding* and *clue*. In scaffolding techniques teachers are required to be skilled at using questioning techniques, among which the most important is to break complex questions for students into more simple questions that are affordable to the minds of students at the time. Questions asked by the teacher in the form of directional questions. The role of teachers as organizers in group learning is not simple. Teachers are not enough just to group students and let them work together, but teachers should be able to encourage each student to participate fully in group activities. In order to avoid being active in group work with only certain students, the teacher should provide clear instructions, assure that each student is responsible for the work of each group, and stimulate the students to be motivated to think optimally according to their potential.

4. **Active Roles of Students**

   In problem-based learning, students' discussion groups are formed, each student is given a student worksheet (LAS) containing the problems. The focus of learning activities is entirely on the students are thinking of finding a solution of a problem and automatically activate physical and mental activities is a process to understand the concepts and procedures contained in mathematics problems. In this case, the problems faced by students have triggered cognitive conflicts. In situations of cognitive conflict, students utilize their cognitive abilities in seeking justification, confirmation and verification of their opinions. Through this mental activity, the cognitive abilities of the students get the opportunity to be empowered, refreshed and strengthened when the student continues to work, he will try to exploit his memory, his understanding of mathematical concepts or his experience to end the conflict. This means the student has made maximum effort using all his cognitive abilities. In other words, it has reached its maximum level of actual development. However, it does not mean that to end the cognitive conflict is entirely the responsibility of the students themselves. In this learning activity the students have the opportunity to interact with their community, in this case their friends and teachers, so that he gets a clue.

5. **Interaction**

   Interaction in problem-based learning activities are multi-direction ie learning process by maximizing inter-class community. Multi-way interaction can foster a dynamic, democratic and sense of math learning. Interaction between students can help low and moderate students in constructing and finding models from mathematical concepts. With different ideas so that problem solving will vary, even one student can give more than one idea in solving the problem. Students will share ideas for solving both within the group and presenting the final result in the classroom. Thus, the students can easily find errors on the solution of the problem created. While for high-ability students have the opportunity to practice conveying ideas and ideas to others and appreciate the opinions of others so it is possible to increase their knowledge. Therefore, in the process of learning-based problem of interaction becomes very important. While in direct teaching interaction is one way that is done between student with teacher and vice versa.

E. CONCLUSIONS AND SUGGESTIONS

Based on descriptive statistical analysis indication, the writer concluded that students' mathematical problem solving ability using problem-based learning model in junior high school in the ability to understand the problem with good category as many as 46 students answered completely and correctly, plan the completion of good category 58 students complete and correct answer, complete problems with both categories of 37 students answered completely and correctly, and re-checking only 16 students with sufficient category. Based on the average score, the level of resolution problem solving process using PBM model is in either category. Moreover, the above conclusions suggested that: (1) in this research has been developed a rectangular learning tool based on the principles of problem-based learning model the *author suggests that it* would be more useful if teachers modify and adjust the learning design with the condition of each school. For example, the difficulty of the problem solved ratio to the characteristics of students, the time available, and learning facilities. (2) In this study the variables studied is the problem-solving ability, it *is suggested for further research* are expected to develop other variables such as the ability to think creatively, critically, reason and others, and (3) if the learning is based on the problems that the actual *author suggests that there* is cooperation with other teachers in the field of study because the problem-solving ability can be divided by the integration of several disciplines.

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