

CHAPTER I INTRODUCTION

1.1. Background

Education is as process of educating or teaching. Education is further defined as to develop the knowledge, skill and character of students. Ayn Rand (in Judith Lloyd Yero, 2002) stated that the only purpose of education is to teach students how to life his live by developing his mind and equipping him to deal the reality. He has to be taught to think, to understand, to integrate, to prove and to solve the problem for daily life. According to Professor Shulman (in Oon-Seng-Tan, 2003) of Stanford:

Education is a process of helping people develop capacities to learn how to connect their troubles with useful puzzle to form problems. Educator fail most miserably when they fail; to see that the only justification for learning to do puzzle is when they relate to troubles. When the puzzles take on a life of their own problem sets employing mindless algorithms, lists of names ... definitions – they cease to represent education. The puzzles become disconnected from troubles and remain mere puzzles. We may refer to them as problems, but that is a form of word magic, for they are not real problem.

One of the subjects that reflect the goal is mathematics. Mathematics is one of the most important subject in education which we must learn since we were child although we haven't been in school. Mathematics have important role to development knowledge and technology because the knowledge of mathematics are applied in development of technology to produce the newest invention such as HP, computer and other technology which make our life easier. Certainly we have asked why we must learn mathematics since we were elementary, junior high school and senior high school. More over when we are in university, mathematics is also learned and it becomes obligation subject. Many students asked what the purpose of learning mathematics is, what the relationship of learning mathematics for daily life is, why we must learn about integral, differential, function, counting volume, exponent etc and what mathematics influence for our life is. Mathematics is not only about calculation but from learning mathematics we can change our

mindset systematically and arranged. By learning mathematics our brain is accustomed to solve problem systematically so that if we have problem in our daily life, we can solve our problem easily. Mathematics teach us to become careful people and accurate for doing something. It is proven when we do mathematics problem where we must careful to count the result, how many nol digit behind the comma and the measure of thing such as geometry. If we are not careful, it will cause our answer is wrong.

Learning mathematic also learn us become patient people facing everything which we face. It is proven when we must solve the most difficult mathematics problem which it needs long and difficult calculation. It needs much patient and we must struggle to solve it but when it is solved and the answer is right, how happy it is. For daily life mathematics have important role, for example to counting bank interest, profit or lose out, determining sound, the magnitude of earthquake etc. In addition the learning objectives of mathematics according to Abdurrahman (2012) suggested that:

Lima alasan perlunya belajar matematika karena matematika merupakan (1) sarana berpikir yang jelas dan logis, (2) sarana untuk memecahkan masalah kehidupan sehari-hari, (3) sarana mengenal pola-pola hubungan dan generalisasi pengalaman, (4) sarana untuk mengembangkan kreativitas, dan (5) sarana untuk meningkatkan kesadaran terhadap perkembangan budaya.

One of important aspect in mathematics is mathematics problem solving. There is a competence that can be developed during and after the learning process of mathematics, as revealed by National Council Teacher of Mathematics (2000) in Principles and Standards for School Mathematics that there are five standard that describes the relationship mathematical understanding and mathematical competencies that teachers and students should know and can be done. Understanding, knowledge and skills that students need to be held covered in the standard process which includes: problem solving, reasoning, communication, connection and representation.

From the explanation above it is meant that mathematical problem solving ability is a component of the process standard that trains high order of students' thinking ability. Mathematical problem solving ability is an effort made by an individual or group to find the solution of a problem with the knowledge, understanding and skills that people possess. In students' mathematical problems solving, it is trained to determine what is known, what is asked in the problem and how to use what are wore. Because in completing math problems do not just want to get the answer or outcome measures but rather on how students solve the mathematical problem.

Oon-Tan Seng (2009) said that problem can trigger curiosity, inquiry, and thinking in meaningful and powerful ways. Education needs a new perspective of searching for problem and looking at problems that will achieve the aim of helping students construct their own knowledge.

Mathematics experts stated that problem is the question that must be answered or responded. However, not all questions is a problem. As said by Hudojo (2005) that a question would be a problem only if a person has no certain rule or law can be used to find answers to these questions as soon as possible.

To solve the problems is needed some strategies are named problem solving. *National Council of Teachers of Mathematics* (NCTM, 2000) mentioned that problem solving was not only as a mathematics learning target, but also was as main tools to do the learning. Because of that, problem solving ability is as mathematics learning focus in all level, from elementary school until university. By learning problem solving in mathematics, the students will get thinking ability, accustomed to be diligent, and curiosity, and also self confident in unusual situation, as situation that will them face out of mathematics class. In daily life and the work world, become a good problem solver can give big benefit.

Mathematical problem solving is a process which involves the method solution is unknown in advance, to find the solution students should mapping their knowledge, and through this process they often develop new knowledge about mathematics. Based on Downey (in Joyce, 2000) said that the core of good

thinking is the ability to problem solving. The essence of problem solving is the ability to learn in puzzling situation. Indicator which can show what a student has problem solving ability based on *National Council of Teacher of Mathematics* (NCTM, 2003) was: (1) Applying and adapting some approach and strategy to problem solving, (2) Solving the problem that occur in mathematics or in other context related mathematics, (3) Creating new mathematics knowledge toward problem solving, and (4) Monitoring and reflection in mathematics problem solving process. There are four important phase to solve mathematics problem. In this research problem solving ability will be measured through students' ability to complete a problem by using problem solving steps as follows:

1. Understanding the problem

In this step, students should be able to point out the principal parts of the problem include the unknown and the data.

2. Devising a plan

In second steps, there are some alternatives to do include students can find the connection between the data and the unknown.

3. Carrying out the plan

Students be able to implementing problem solving strategies based on plan and operate of integers correct.

4. Looking back

Student be able to derive the result differently and use method for some other problem (Polya, 2004).

Based on survey data of Trends in International Mathematics and Sciences Study (TIMSS) (in La Arul, 2009) under the International Association for the Evaluation of Educational Achievement (IEA) is the average score of students below the international average score. Indonesia is in the position 34 for field of mathematics and in position 36 for field of science of 45 countries surveyed. This suggests that Indonesian students are included in low category, which means students in Indonesia have a little basic knowledge. Students have not able to formulate and solve non-routine problems. So the goal of learning

mathematics for solving problems is not achieved in Indonesia. It is not achieved the goal of learning mathematics, especially mathematical problem solving. The problem also occurs in SMP Negeri 1 Tanjung Morawa. Low mathematical problem solving ability is found in the eighth grade through interview and diagnostic tests.

Based on the interview (December 11th, 2015) of researcher with mathematics teacher grade VIII of SMP Negeri 1 Tanjung Morawa, Mrs. Murti, S.pd said that students' mathematical problem solving was low. Students are difficult to make the step of mathematics problem solving. They can understand the concept and the formula but they were difficult to use the concepts if find problem in real life which relate with concept have. Teacher also use conventional model in learning activity where the teacher is as the center of learning process.

Then from the result of survey that was conducted by researcher (December 14th, 2015) by giving problem solving diagnostic test to students of grade VIII - 5 at SMP Negeri 1 Tanjung Morawa in the topic of Pythagorean. The problem was tested by the student was: "*Known is cube of ABCD.EFGH with the length $AB = 15$ cm. Determine space diagonal length of AG?*"

The answers were as following:

1. Understanding the problem

Students can't understand the problem. It can be seen in Figure 1.1.

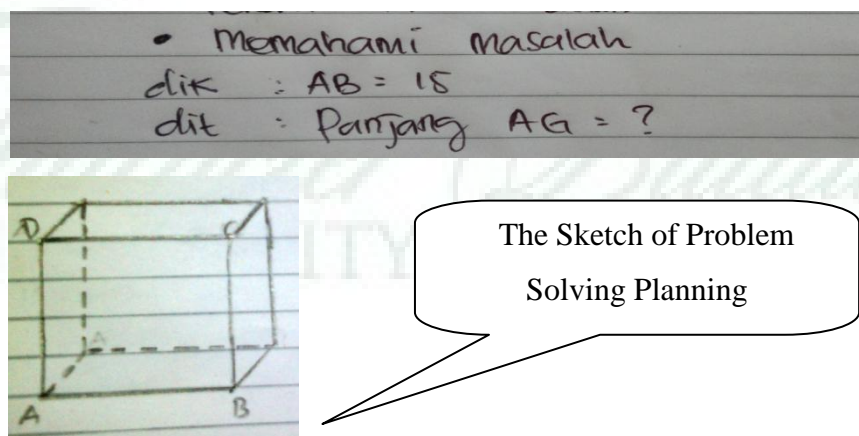
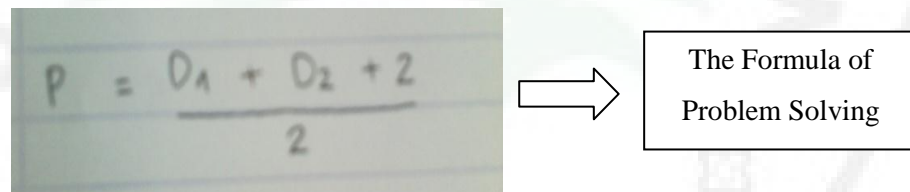


Figure 1.1. Student's sheet in understanding the problem step

From the answer above, students can't understand the problem solving step well. Students were less able to identify what asked was and identify what known was. It should be the students must clearly explain that known was length AB of cube $ABCD.EFGH = 15 \text{ cm}$ and for asked was not too defined well because the question asked was length of space diagonal of AG. Then some students can draw the sketch but it did not complete and some students don't draw the figure at all. The students should draw the cube $ABCD.EFGH$ and draw outline based on known length $AB = 15 \text{ cm}$ and determine space diagonal of AG but in fact some students didn't make it at all. They couldn't determine the question was needed. This indicates that students have not been able understand the problems. There were only 9 of 38 or 23.68% of students understand about the problem well.

2. Devising the Planning



$$P = \frac{D_1 + D_2 + 2}{2}$$

The Formula of
Problem Solving

Figure 1.2. Student's sheet in planning the problem step

From the Figure 1.2 above, we can see that students' devising a plan were still bad. The students' can't find formula that could be useful for the problem. The students' can't introduce some auxiliary element to help solving the problem. For planning the problem there were 6 of 38 students or 15.78 % can make good planning.

3. Carrying Out The Plan

The students can't implement problem solving strategies well. Students can not find an appropriate strategy to solve the problem. The students can't determine the suitable formula to solving the problem. Students' can't check each step clearly was correct. There were 2 or 5.26% of students can implement problem solving strategy. Student's ability in carrying out the plan was shown in Figure 1.3.

$$P = \frac{D_1 + D_2 + 2}{2}$$

$$= \frac{15 + 15 + 2}{2}$$

$$= \frac{32}{2} = 16$$

Jadi panjangnya 16 cm

Figure 1.3. Student's sheet in carrying out the plan

4. Looking Back

Student's answer in looking back step is shown in Figure 1.4.

$$P^2 = AB^2 + AB^2$$

$$= 15^2 + 15^2$$

$$= 225 + 225$$

$$= 450$$

$$= \sqrt{450}$$

$$= 21\sqrt{9}$$

$$= 21,3$$

Figure 1.4. Student's sheet in looking back step

Based on Figure 1.4 above, there was no or 0 % of students can derive the result differently and use other formula or step solving to determine the diagonal length of AG. Students' problem solving ability result above can be shown in Table 1.1.

Table 1.1. Students' Problem Solving Ability Result of Diagnostic Test

| Problem Solving Step | Total of Students | Percentage |
|------------------------------|-------------------|------------|
| 1. Understanding the problem | 9 | 23.68 % |
| 2. Devising a plan | 6 | 15.78% |
| 3. Carrying out the plan | 2 | 5.26 % |
| 4. Looking Back | 0 | 0 % |

From students' answer, it was indicated that students didn't know what they solved. Students can't implement problem solving strategies. Students can not find an appropriate strategy to solve the problem. From all figure above, we can see that the student can't do the completion based on the plan has been made. Almost all students can't implement problem solving strategies well.

Diagnostic test result is also shown that there were not students who completed to solve problem. From some of description above, it can be seen that many of students just remind the concepts and not able to use the concepts if find problem in real life which relate with concept had. For further, students were not able to determine the problem and formulate it. Almost all students were not able to relate between what they learned with how the knowledge will be used or applied in the new situation.

According to Arends (1997) that it is strange that we expect students to learn yet seldom teach then about learning, we expect student to solve problems yet seldom teach then about problem solving. That means that in learning, teacher always demand students to study and solve the problem but seldom teach how should the students solve the problem. It makes learning process is meaningless to students that cause low ability of students' mathematics problem solving ability.

To achieve objectives learning election methods, strategies and approaches in a classroom situation is concerned very important. Therefore, learning in the classroom should be converted into student-centered. One model of learning that makes students active and interested in learning mathematics is problem-based learning model. Problem based learning (PBL) process essentially consists of the following stages: (1) meeting the problem; (2) problem analysis and generation of learning issues; (3) discovery and reporting; (4) solution presentation and reflection; and (5) overview, integration, and evaluation, with self directed learning bridging one stage and the next (Tan, 2003).

In PBL, the problem is cast in realistic context that the students might encounter in future. Although creative individuals tends to work alone, students in

PBL classes work in groups brainstorming issues pertaining to understanding of the problem and defining it by group consensus. They then work independently on their own to search for more information related to the problem before generating hypotheses and possible explanation to the problem. While this stage may be similar to some of stage involved in creative problem solving.

In problem-based learning, teacher provide to students mathematics problem until students interested to solve the problem. Problem cannot be solved using procedure routine so students perceive the problem as a challenge. Mathematics teachers have a duty to help students to improve student's problem solving ability. Teachers should strive to enable students to solve problems was given of problem based learning model. Problem-based learning model believed can enhance students' problem solving ability that require students to seek their own solution problem independently that will give a concrete experience, the experience can be used also to solve the similar problem will give meaning itself for the learners. Students solve mathematics problem until students' mathematical problem solving ability increased. So, problem-based learning provides the opportunity for students to solve mathematics problem and increase students' mathematics problem solving.

Based on above background, the researcher interested in conducting research entitled : "**The Implementation of Problem-Based Learning Model to Increase Students' Mathematical Problem Solving Ability At SMP Negeri I Tanjung Morawa.**"

1.2. Problem Identification

Based on the background of the issues that have been mentioned above, some problems can be identified as follows:

1. Students' mathematical problem solving ability is low.
2. Student has difficulty to solve mathematical problems.
3. Learning process is dominated by the teacher so the students only receive without have learning experience

4. Implementation of PBL is an effort to increase students' mathematical problem solving ability

1.3. Problem Limitation

Because the extent of the problem and limited ability, time and costs so the researchers need to make a Limitation Problem in this research. As for the Limitation Problem in this research are:

1. Research subject is the eighth grade students of SMP Negeri 1 Tanjung Morawa in academic year 2015/2016.
2. Model of learning used is Problem Based Learning Model.
3. Problem solving ability the eighth grade students of SMP Negeri 1 Tanjung Morawa in academic year 2015/2016.

1.4. Problem Formulation

In accordance with the extent of the problem described above, the research question in this study:

1. Does the implementation of Problem Based Learning Model increase students' mathematical problem solving ability in grade VIII at SMP Negeri 1 Tanjung Morawa?
2. How does Problem Based Learning Model increase students' mathematical problem solving ability in grade VIII at SMP Negeri 1 Tanjung Morawa?
3. Do students' activities increase after the implementation of Problem Based Learning Model in grade VIII at SMP Negeri 1 Tanjung Morawa?

1.5. Research Objectives

Based on the problem formulation, then objectives of this research is:

1. Knowing whether students' problem solving ability increase after the implementation of problem-based learning model.
2. Improving students' Mathematical Problem Solving ability through problem based learning in grade VIII at SMP Negeri 1 Tanjung Morawa .

3. Knowing the increasing of students' activities after the implementation of Problem Based Learning Model in grade VIII at SMP Negeri 1 Tanjung Morawa.

1.6. Benefits of Research

After conducting this research study is expected to provide significant benefits, namely:

1. For student, instil a high order thinking skills in problem solving, formulating problems, and ability to cooperate to solve the problem.
2. For teachers, it can use problem based learning model for improving students' mathematical problem solving ability in learning activities.
3. For researchers, as information for students who are conducting research using Problem Based Learning to improve students' mathematical problem solving ability in learning activities.

1.7. Operational Definition

To avoid the occurrence differences in interpretation of the terms contained in the formulation of the problem in this research, the operational definition be stated as follows:

a. Problem-Based Learning

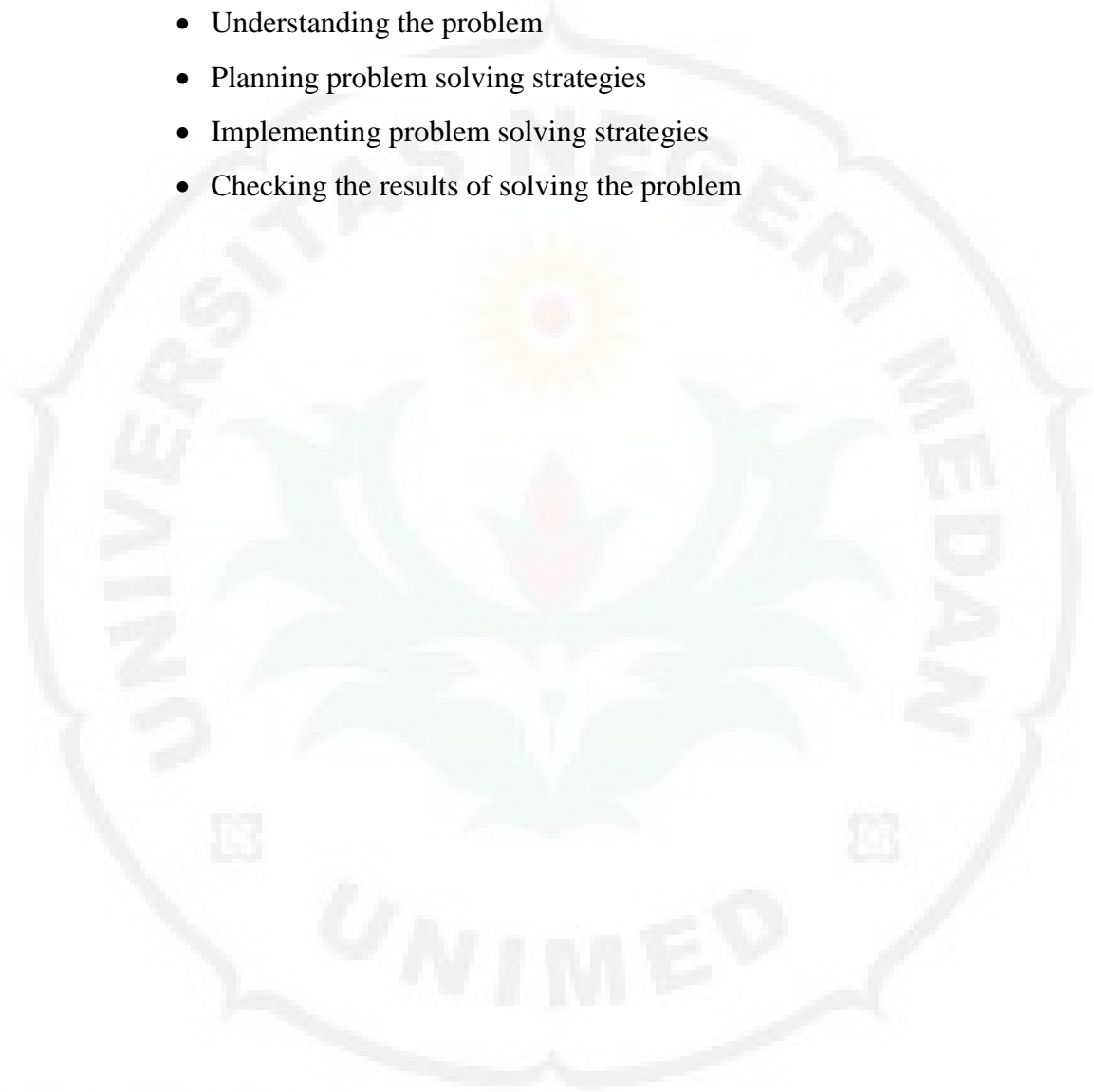
Problem-based learning is a learning model that applies to the process stages:

- Orient student to the problem,
- Organize students for study,
- Assist individual and group investigation,
- Develop and present artifacts and exhibits,
- Analyze and evaluate the problem solving process.

b. Problem Solving Ability

Problem solving is the students' ability in solving mathematical problems based on the stages of problem solving, namely:

- Understanding the problem
- Planning problem solving strategies
- Implementing problem solving strategies
- Checking the results of solving the problem



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