Analysis of Junior High School Students' Problem-solving Ability Reviewed from Self-regulated Learning

A S Bayuningsih[1,a)], B Usodo[1,b)], and S Subanti[1,c)]

[1] Mathematics Education Department, Sebelas Maret University
Jl. Ir. Sutami No. 36A, Jebres, Surakarta, Jawa Tengah 57126, Indonesia

E-mail:
[a)]anisasepti415@gmail.com
[b)]budi_usodo@yahoo.com
[c)]subanti@mipa.uns.ac.id

Abstract. Problem-solving ability in mathematics is a primary means to understand a problem and develop the students ' ability in solving a problem. Step in solving problems are categorized to understanding the problem, devising a plan, carrying out the plan and reflection. This research used a descriptive method aimed to identify the problem-solving ability among junior high school students and review from students self-regulated learning (SRL).The subjects of the research were taken by one student in each SRL category (high, medium, and low) which then given the problem-solving test and the result was triangulated by interview. Based on the research, it can be stated that the students with high self-regulation can solve a mathematical problem by applying first indicator, the second indicator, third indicator, but they cannot apply the fourth indicator. The students with medium self-regulation can apply the first indicator and second indicator while they are still having the problem in third indicator and fourth indicator. The students with low category self-regulation cannot apply all of those in solving the mathematical problem.

1. Introduction

The main purpose of the learning of mathematics is to enable students to solve problems in daily life. Unfortunately, according to the results of the latest national test of mathematics, grades according to the Department of Education standards in Indonesia (2015, 2016) the changes of the 56.28 in 2015 has dropped to 50.24 in 2016. [1] This has become an indicator that the overall performance in mathematics is considered low. This also reflects that students have difficulty in understanding the mathematical problem that affects the process of problem-solving.

Problem-solving is a universally acknowledged that a resolution forms the basis for successful mathematics education. Solve the problem by carefully selected help to develop, improve and foster creativity One of the science that is closely related to problem-solving is mathematics. According to National Council of Teachers of Mathematics (NCTM) states that solving the problem is not only a goal of learning mathematics and a key tool for successful learning. If students do not have a problem-solving ability, then these students will not be able to resolve the problems to be faced. [2] Through problem-solving, students can develop the capacity to think. Students will be able to understand the problems well and can develop the ability to solve a problem.

So, problem-solving ability in learning mathematics is a primary means to understand a problem and develop the students ' ability in solving a problem.

The implementation of problem-solving needs one to think critically and creatively and it is a systematic process.[3] It is a very important activity either for the present or future condition so that a pattern is necessary in order to be able to solve problems. A creative product must be preceded by the construction of a creative idea produced through a thinking process involving cognitive activities called a creative thinking process. This creative thinking is a process of creativity and refers to any individual efforts to produce creative products.[4] The ability of mathematical creative thinking is the capability to find out a solution to a mathematic problem easily and flexibly, while creativity may be viewed from the process of solving the problem.[5] From the description above, it is shown that in the process of problem-solving, critical thinking is necessary, so that after students understand the problems, they make plans to solve them and in such planning, bright ideas are needed in order to be able to find the solutions effectively and accurately. The bright ideas may be obtained if critical thinking is always employed in viewing every problem, where creative thinking is gained through thinking. Successful thinking through creative thinking is a principle in solving any problems.

According to Polya steps in solving problems are categorized to understanding the problem, devising a plan, carrying out the plan and reflection. [6] The first step in the Polya model is to understand the problem. As simple as that sounds, this is often the most overlooked step in the problem-solving process. This may seem like an obvious step that doesn't need mentioning, but in order for a problem-solver to find a solution, they must first understand what they are being asked to find out. According to Polya suggested that teachers should ask students questions similar to the ones listed below: Do you understand all the words used in stating the problem? What are you asked to find or show? Can you restate the problem in your own words? Can you think of a picture or a diagram that might help you understand the problem? Is there enough information to enable you to find a solution? Those questions are useful to identify the level of mathematical problem-solving ability among students. Based on the interview with mathematics teacher in junior high school, the difficulty in resolving problem mainly focus on carrying out the plan. This was marked by a student who still faces the difficulty of identifying a problem based on a given story by the teacher. Based on the results of observation which was conducted in concerning the process of learning and teaching, it was discovered that the problems were encountered during mathematics learning. The problem faced is the difficulty experienced by students in solving a math problem that was given by the teacher. This can be seen when the students were given a problem or a question, the student's difficulties in symbolizes a problem in mathematical form, students' difficulty formulating a resolution to be used in resolving problems, students' difficulty in planning the student's completion, and the difficulty in interpreting a conclusion obtained. Students' difficulties in problem-solving might occur at any phases. Generally, the majority of the students did not acquire this skill utterly.[7] Cognitive abilities in learning such as the

ability to recall, memorize and perceive influence the efficiency of problem-solving. The result revealed that students do not like to read lengthy problem . [8] When students do not understand a problem, then guessing without having any mathematical thinking process occurs. This result is in accordance with the studies that state the level of reading skill is a significant indicator to solving mathematical problems.[9][10]

Problem-solving abilities that belong to someone is also influenced by how to organize yourself or self-regulation called self-regulated learning (SRL). Factors affecting the ability of problem-solving is the mental attitude of the individual, personal situation against attachment, stress and frustration.[11] In addition, Metacognition ever affects an individual or individuals in resolving the problem. Problems that often arise among students is self-regulation. One such self-regulation is done to improve the acquisition of academic values and problem-solving are academic self-regulation in learning (self-regulated learning).[12]SRL will be carried out if the student can control himself in solving a problem, and then evaluate and plan something more in the process of teaching and learning. SRL efforts made students in the learning process to obtain results that correspond to specific objectives in this regard are complete math problems so as to obtain success in the field of mathematics. Related to the problem-solving ability is the ability that depends on from how students in organizing it self to obtain the success so that the need for research on problem-solving ability analysis of self-regulated learning.

2. Experimental Method

This study used grounded theory, which is a suitable to analyze large quantities of unstructured or semi-structured data is qualitative [13]. To purpose of this research is to analyze students problem-solving ability reviewed from self-regulated learning. Subjects were taken based on the result of the SRL questionnaire which consisted of 30 items which then taken the subjects HSRL, MSRL, and LSRL representing each level of SRL. The three subjects are then given a problem-solving test consisting of two questions and the results are analyzed based on the problem-solving categorize. To check the validity of the result of the analysis, a triangular method was conducted by interviewing each subject.

3. Result and Discussion

Question
1. The floor of a room measuring 16 m x 10 m, it will be installed square-shaped ceramics. the side of the ceramic is 40 cm. If the price of each ceramic Rp 5000, then calculate the amount of money needed.
2. a trapezoid-shaped paper with parallel side size is 12 cm and 24 cm. whilst the other side 10 cm. If each cm paper price is 500 rupiah, then compute the trapezoidal paper prices

The instrument used to determine the selection of the subject based on SRL students is now SRL. The results of analysis of the question form are used to classify the subject

with SRL high, medium, and low. The subject chose three students to be given a test of problem-solving. As for the third subject is HSRL, MSRL, and LSRL. The results of the analysis indicate that the subject satisfies the HSRL three stages of problem-solving were understanding the problem, devising a plan, carrying out the plan. SRLS are able to meet the stage of problem solvers that is understanding the problem, devising a plan and at the third stage has not been perfect, SRLR was only able to reach understanding the problem or can be said to have not mastered the ability of problem-solving.

3.1. Subjects with High SRL (HSRL)

The subject of high SRL (HSRL) can apply indicator of problem-solving were understanding the problem, devising a plan, carrying out the plan. For more details, look at Figure 1 or 2 and Figure 3 or 4.
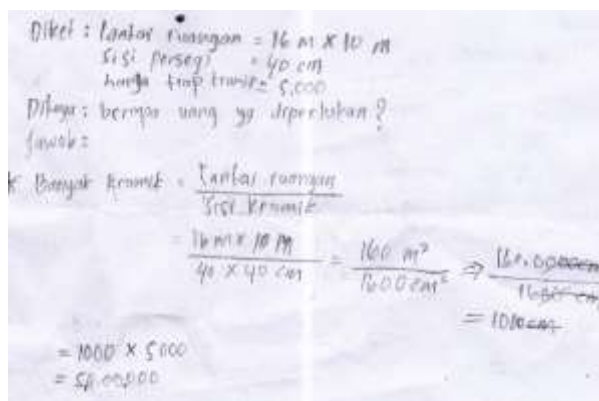
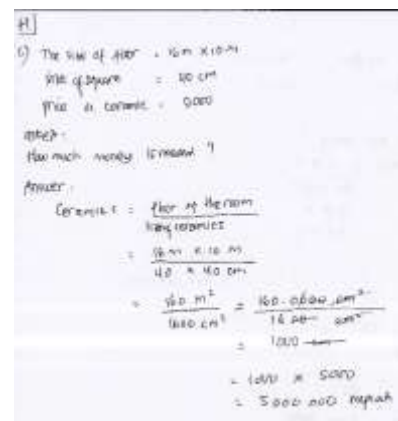**Figure 1.** HSRL subject's answer for number 1 (Indonesia)

Figure 2. HSRL subject's answer for number 1 (English)
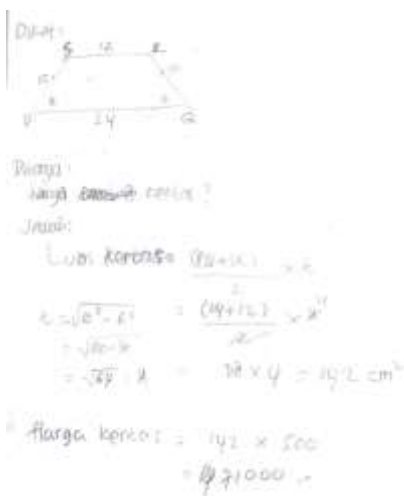

Figure 3. HSRL subject's answer for
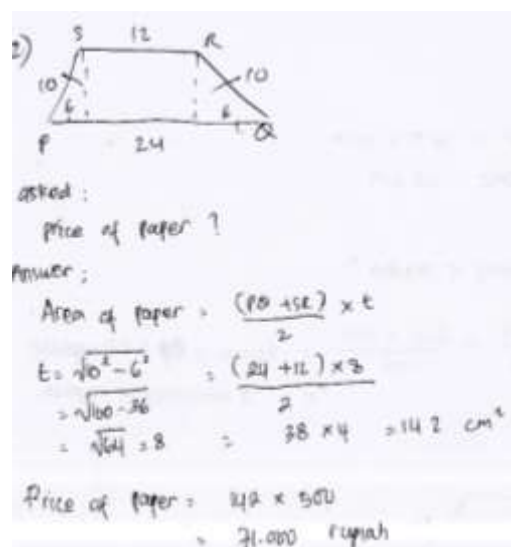

Figure 4. HSRL subject's answer for number 2

number 2 (Indonesia)   (English)

In Figure 1 or 2, it is seen that the subject HSRL can write down what is known and ask in a matter and the intent of the question based on the given problem. This means the subject can understand the intent of a given problem. The subject of the HSRL do the first stage of the problem-solving that is understanding the problem solved. Next, on the second stage of the planned settlement, HSRL planned completion by determining what formula would be used as a settlement. In the picture, it looks that the initial steps of knowing the HSRL was finding the area of a room and ceramics, then both the wide divide each other resulting in a large number of ceramic many need. The next step carries out calculation according to plan, HSRL can link calculations to find the number of ceramics with equating unit area. After the ceramics obtained, then the HSRL can deduce the amount of money required. The last step is a reflection, HSRL didn't do it. HSRL based on results of interviews doesn't do reflection when you're done working on.So the HSRL for indicators of problem-solving question number 1 only until the third stage. In Figure 3 or 4 it looks that the HSRL's been able to reach the second stage, on the thirdstage of carrying out a plan HSRL do miscalculations so that the results obtained are wrong. This occurs because the HSRL after working on not doing reflection terhadapa the results of the work that is marked by drawing conclusions the results obtained. Based on the results of the analysis and interviews obtained that HSRL capable of achieving the third indicator of the ability of problem-solving, which is able to solve the problem based on planning done and what is known problem but are not doing so likely reflection phases can make mistakes.

3.2.   Subject with Medium SRL (MSRL)

The subject of medium SRL (HSRL) can apply the first indicator (understanding the problem) and second indicator (devising a plan) while they are still having problem in third indicator (carrying out the plan) and fourth indicator (reflection). For more details, look at Figure 5 or 6 and figure 7 or 8
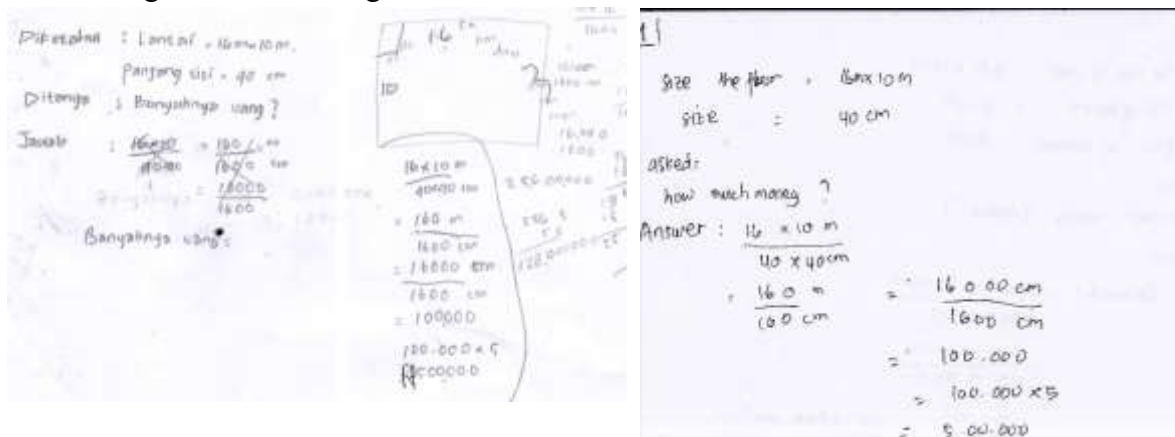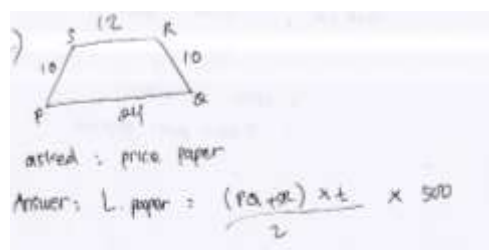

Figure 6. MSRL subject's answer for number 1 (English)
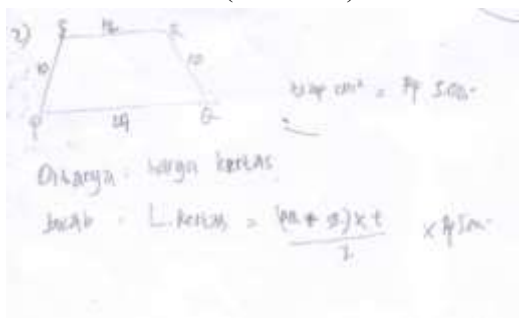
Figure 5. MSRL subject's answer for number 1
(Indonesia)

Figure 7. MSRL subject's answer for number 2   **Figure 8.** MSRL subject's answer for number
(Indonesia)   2 (English)

In Figure 5 or 6, it is clear that the subject of the MSRL can write down what is known and apply the problem and question is based on a given issue. This means the subject can understand the meaning of a particular problem. Thus, the subject of the MSRL do the first stage of the solving is understanding this problem solved. Next on the second stage of devising a plan, the completion of the plan by determining the MSRL formula what will be used as a settlement. Based on the photos and interviews obtained that MSRL not sure of plans will be made in resolving the problem. MSRL know that to find the money needed must know the number of tiles first. However, in the third stage of the MSRL don't perform perfectly, there is a mistake in the calculation and precision work. The number one question MSRL only until on the second phase in Figure 7 or 8 visible that the MSRL has done the first stage with a sketch drawing based on known issues, so MSRL can understand the problem. The next step MSLR do devising a plan. MSRL knowing that to determine the price of the entire paper is seeking a broad and multiply by price per cm2. But the MSRL don't know looking for the height of the trapezoid. So only until the second stage of the MSRL has not been perfect. Based on the results of the analysis and interviews obtained that MSRL capable of achieving second and third on the indicator MSRL do it not right, where students can find out what the meaning of the problem and planning will be done but can not do the third step is to implement the plan. So the MSRL can not solve the problem.

3.3. Subject with Low SE (LSE)

The students with low category self-regulation cannot apply all of those in solving mathematical problem. For more details, look at Figure 9 or 10 and Figure 11 or 12.
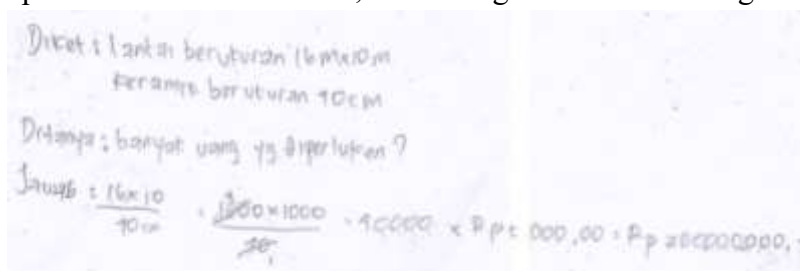
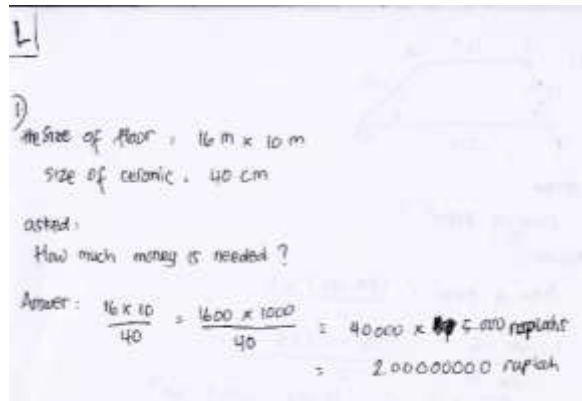**Figure 9.** LSRL subject's answer for number 1 (Indonesia)

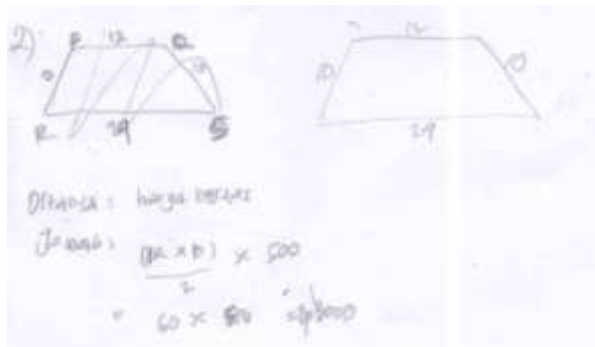**Figure 10.** LSRL subject's answer for number 1
(English)

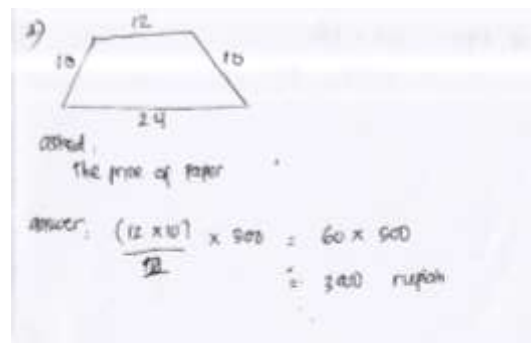**Figure 11.** LSRL subject's answer for number 2
(Indonesia)

Figure 12. LSRL subject's answer for
number 2 (English)

In Figure 9 or 10, it is seen that the subject LSRL can write down what is known and asked in a matter and the intent of the question based on the given problem. This means, the subject can understand the intent of a given problem. Thus, subject of the LSRL do the first stage of the problem-solving that is understanding the problem solved. Next on the second stage of devising a plan, LSRL planned completion by determining what formula would be used as a settlement. LSRL know that to find the amount of money that is necessary is to calculate results for a wide room with ceramic tile. However LSRL did not understand the units used in the process of the calculation. LSRL therefore cannot make devising a plan, because it is not able to connect between the known problem with what formula will be used. The results obtained LSRL is wrong. So for the next stage is carrying out a plan and reflection is not implemented correctly.

In Figure 11 or 12, LSRL subject do sketches as a sign he represents what is known problem and asked. But from the sketches retrieved, LSRL cannot be declared with the correct layout of the letter as a sign of the point angles of a trapezoid. Next on stage of devising a plan, LSRL did not know the formula of the wide trapezoid but actually he learns to solve the problem is to find a breadth first and then multiplying with the price of each unit area. Based on the results of the analysis and interviews, it can be

concluded that LSRL only up to the stage of understanding the problem or can be said to have not mastered the ability of problem-solving.

4. Conclusion

Based on the purpose of the research and data analysis, that has been done by researchers about the problem-solving ability of junior high school students in material rectangular. The information showed that although students understand the problems to solve, they have less understanding to the problems.The concluded that the students with high self-regulation can solve mathematical problem by applying first indicator, second indicator, third indicator, but they cannot apply the fourth indicator. The students with medium self-regulation can apply the first indicator and second indicator while they are still having problem in third indicator and fourth indicator. The students with low category self-regulation cannot apply all of those in solving mathematical problem.

Acknowledgements

References

[1]   Indonesia. Department of education standards. (2015-2016). Data Hasil Ujian Nasional PAMER UN 2010-2012. Jakarta

[2]   National Council of Teachers of Mathematics. (2000). *Principles and Standards for School Mathematics*.United State: Nasional Council of Teachers of Mathematics, Inc

[3]   Yahaya, A., Yahasa, N., & Zakariyya, Z. (2005). *Psikologi Kognitif*. Johor Baharu: Penerbit Universiti Teknologi Malaysia.

[4]   McGregor, D. (2007). *Developing Thinking Developing Learning*. Poland: Open University Press.

[5]   Inam, A. (2014). The Implementation of the Polya Method in solving Euclidean Geometry Problems. *International Education Studies,* 7 (7), 149-158.

[6]   Polya, G. (1973). *How To Solve It*. Princeton, New Jersey: Princeton University Press

[7]   Intaros, P., Inprasitha, M., & Srisawadi, N. (2014). Students' Problem-solving Strategies in Problem-solving-mathematics Classroom. *Procedia - Social and Behavioral Sciences*, *116*(0), 119–123.

[8]   Phonapichat, P., Wongwanich, S., & Sujiva, S. (2014). An analysis of elementary school students' difficulties in mathematical problem-solving. *Procedia -Social and Behavioral Sciences*,

[9]   Lamb, J. H. (2010). Reading gread levels and mathematics assessment: an analysis of Texas mathematics assessment items and their reading difficulty. The mathematics Educator, 20(1), 22-34

[10] Jiban, C. L., & Deno, S. L. (2007). Using math and reading curriculum-based measurements to predicts state mathematics test performance: Are simple one-minute measures technically adequate?. Assessment of Effective Intervention, 32(2), 78-89.

[11] Kluytmans, F. (2006). *Perilaku Manusia*. Bandung : Refika Aditama

[12] Cahyono, T.R. Iriani, N dan Lestari, S.S. (2002). "Kecenderungan Somatisasi Ditinjau dari Sanse Of Humor dan Kemampuan Menyelesaikan Masalah". *Jurnal Ilmiah Berkala Psikologi Indegenous.* Vol. 16. No. 2 159-167.

[13] Lawrence, J, Tar, U. (2014). The use of grounded theory technique as a practical tool for qualitative data collection and analysis. *Journal of Travel & Tourism Marketing*, *31*(3), 417–442.