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RESEARCH ARTICLE

AN ANALYSIS OF STUDENTS' METACOGNITION ABILITY THROUGH JUMPING TASK STRATEGY TO SOLVE GEOMETRY PROBLEM.

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Abstract

This research aimed at analyzing students' metacognition ability through *Jumping Task* strategy to solve geometry problem. *Jumping Task* is task-based instruction in which the task is challenging or beyond the standard of the curriculum. This research used descriptive qualitative research method. The samples were, according to the result of the test, 3 students from 32 students, who are high, average, and low achievers. The data was collected by using interview, test, observation and documentation. The result of this research revealed that S1 ability (high achiever) had the most complete metacognition ability rather than those who are average and low achievers. The student with high ability fulfilled all of the aspects as well as predicting, planning, monitoring and evaluating aspects. S2 ability (average achiever) had more complete metacognition ability rather than the low achiever. Average achiever fulfilled only prediction and planning aspects. Whereas, S3 ability (low achiever) fulfilled only prediction aspect, therefore, he had a lack of achieving his metacognitive steps.

Introduction:-

Mathematics has an essential role in education. This is proven by admitting that mathematics exists in every educational step from the elementary up to the higher education. Mathematics is used to give students the ability of logical thinking, management**,** processing information, and cooperation. This means that mathematics is the fundamental knowledge that supports the development of other knowledge which is essential to help interpreting idea and conclusion. Teaching mathematics aims to train students to think, argue, and solve mathematics problem applied in daily life.

One of the mathematics objectives in education is training students ability to think logically to solve problem, this is important because it trains students to develop their ability such as building new mathematics knowledge, solving a mathematics problem in various context, applying the needed strategy. Therefore, students are expected to have metacognition ability to solve both routine and not routine problems.

21st-century education paradigm indicates by some things; *1) core subject, 2) globally aware, 3) creative, 4) innovative, 5) collaborative, 6) communicative, 7) critical thinking, 8) ethnic and humanistic.* In this case, the role of

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the teacher has moved from the main learning source to one of the learning sources, from the guide to the kids' triggers to be a finder and from *"teacher dominated learning"* to the facilitator and *"learning observatory"*. However, learning activities still depends on the teacher control. The main role of the teacher is building learning awareness and concern among the students and elicits students to learn optimally to reach the optimal result. Students' awareness and concern in learning can be seen from thinking process or what so called as metacognition.

Metacognitive terms or what is called metacognition *(metacognition)* appeared in 1976. This term was found by, an education scientist, *Flavell*. Metacognition means more than just a cognitive but one level higher from thinking or what so called as *thinking about thinking*, which means thinking about the process of thinking itself. From this, we can know that metacognition is a human ability to control or monitor thought as well as students' ability to monitor, plan and evaluate a learning process when applied in the education field. Students are expected to be independent finding material or knowledge, be honest to their own ability both their weaknesses and strengths and be brave to try something to get knowledge and develop their ability when applying metacognition theory.

Metacognition in thinking process is students' awareness about their thinking process, checking their process and set their thinking process (Wilson & Clarke, 2004). Metacoginition ability is an ability to control one's thinking process. Thinking process happens during learning activity so the ability is strongly related to the students learning activity. In mathematicss, the role of metacognition is to help students to solve a problem. Schoenfeld (1992) stated that the difficulty in problem solving relates to the students lack observation and control metacognition process. Metacognition is the ability to control one's thinking process. This process happens during the learning activity. This means that metacognition ability relates to the students' learning activity. Latifah (2010) stated that during learning, when students choose a strategy, monitor learning, evaluate fallacy, analyze learning effectiveness, these activities is one that needs metacognition ability.

Livingstone (1997) defined metacognition as *thinking about thinking*. According to his opinion, metacognition is a thinking ability in which the object of the thought is the thinking process itself. Wellman in Mulbar stated that "*metacognition is a form of cognition, a second or higher order thinking process which involves active control over cognitive processes. It can be simply defined as thinking about thinking or as a person's cognition about cognition"*. Meaning that metacognition is the form of cognitive or two-stage thinking process that involves controlling cognitive activity. Thus, metacognition can be called as ones thinking about his thinking or ones' cognition itself.

Metacognition intelligence should be had by students or human because it is self-conscious effort about students' interest and ability. Metacognition intelligence is divided as follows.

1. *Self Assessment* metacognition intelligence, this intelligence inclines to the students' ability in knowing cognitive ability or their independent thinking.
2. *Self-management* metacognition intelligence, this intelligence expects students to manage and set cognition development or their thinking without any help.

Metacognition is students' ability to know their cognition process by controlling and managing their thinking process when they solve a mathematics problem. They have to solve the problem to know what strategy to be applied and conscious of what obstacle they face in solving the problem. McLoughlin and Hollingworth research (2003) showed that an effective problem solving can be gotten by giving a chance to the students to apply their metacognitive strategy while working on the question. This ability should be recognized early, including junior high school students aiming at building and choosing appropriate step to make them careful and wary of what they are doing.

According to some definitions that have been mentioned above, it can be identified that the fundamental definition of metacognition are: 1) metacognition is an ability that is categorized in cognitive field, 2) metacognition is an ability to be aware and knowledgeable about the cognitive process of oneself, 3) metacognition is an ability to direct the cognitive process happen in oneself, 4) metacognition is an ability to learn how learning is done in a way of planning, controlling and evaluating, 5) metacognition is a higher thinking activity because it controls thinking process that happens in oneself.

One of the efforts that can be done is by applying learning strategy *"Jumping Task"*. Jumping task is giving students a task in which the task is a challenging or beyond the standard of the curriculum task. This practice has long been applied in some developed country such as Japan. In Japan, this practice does not call as a model or teaching method

but it has been common practice among teachers especially those who have applied school reformation "Lesson Study". This concept proposed by Manabu Sato and called as classroom reformation focusing on learning activity in the form of creating dialog, interaction and collaboration among students (Sato, 2014:21-34).

According to the notion above, through Jumping Task students are taught to think independently and grow up each other. Through the creative learning process and featuring dialog in learning activity, the school guarantees every students right to learn, develop solid academic skill and lead child to think independently and grow up each other. Child's school, society, and family together lead to make a cheerful, healthy, active, brave, independent learner, hard worker and tenacious child. *Shinsetuna*, kind and cooperative child (Hobri and Susanto, 2015)

According to the rationale above, the researcher conducted a research entitled "An Analysis of Students' Metacognition Ability Through *Jumping Task* Strategy to Solve Geometry Problem". This research aimed at knowing students' thinking process and analyze their metacognitive ability through *Jumping Task* strategy to solve geometry problem in the form of given questions. The benefit of this research was students have the ability to think for themselves, to be confident and responsible in making a decision while working on the test question.

Research Methodology:-

This research was descriptive research with a qualitative approach. The description was about students' metacognition ability in solving a mathematics problem of the eighth-grade students of junior high school 3 Rambipuji. The first step of this research was recognizing classroom characters and materials. In this research, the subject of the research was determined by using *purposive sampling* in which the class that will be the research subject was decided consciously. The second step was arranging research instrument and collect data from mathematics achievement test, interview and students documentation. The collected data was analyzed and draw a conclusion about junior high school students' metacognition process in solving a mathematics problem. The data was analyzed by using validity and reliability test.

The data collection methods of this research were 1) interview to explore students' metacognition process in solving mathematics problems, 2) competence test which was conducted two times a) mathematics competency test was given to the students in class to determine the subject of the research which is high, average, and low achiever, one for each category, b) geometry problem-solving test was given to the research subject to know students' steps while solving problem and while using their metacognition, 3) observation was conducted to get a direct information about students' learning activity, 4) documentation of students' answers, data collection and students score.

The data validity used triangulation method by comparing the result of interview, test, observation, and documentation. This research used the data analysis by Miles and Hubberman (in Sugiyono, 2012:246) with the following steps: 1) data reduction, 2) data presentation and 3) conclusion/ verification. The data reduction was the result of the test and interview that had been done with the students. Then, the data was presented in the form of narrative text. After that, the conclusion about the process of the students' metacognition was drawn.

Discussion:-

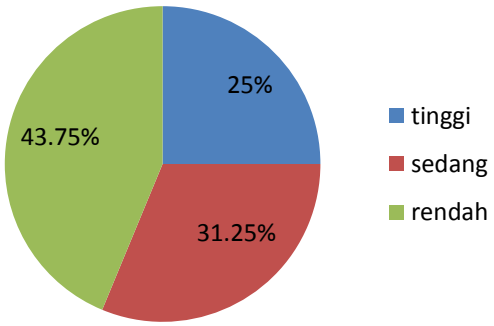
This research was done in the eighth class of junior high school 3 Rambipuji through mathematics competency test was done by 32 students. The result of the test was categorized into high, average and low. The criteria of the category were based on the students' mathematics ability in the following table.

Table 3.1:- Category Classification

Category	Score Average
High	$x > 66,7$
Average	$42,5 < x \leq 66,7$
Low	$x \leq 42,5$

From the classification above, there were 8 students who have a high mathematics ability (25%), 10 students have an average mathematics ability (31,25%), and 14 students have a low mathematics ability (43,75%).

The result is presented in the following chart.



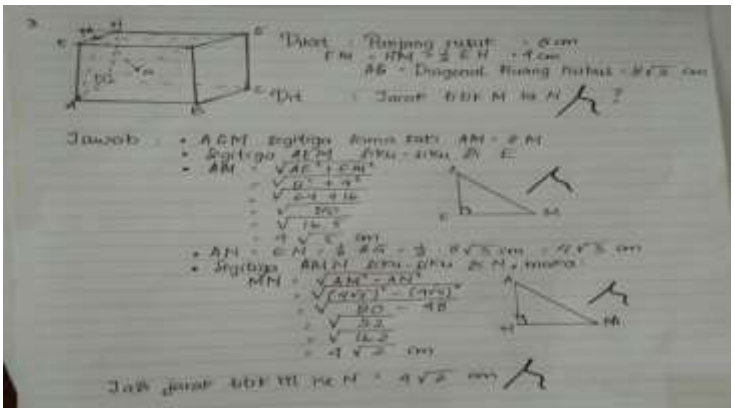
Picture 3.1:- Students' Mathematics Ability

Based on those three categories, the subject of the research with high category : Novita Tri Wulandari (S1) with 90, average category : Danang Nugroho (S2) with 52, low category : Firman Maulana (S3) with 38.

The question to be analyzed based on metacognition is as follows:

A cube ABCD.EFGH has an 8cm edge. M is the center point of EH. The distance of M points to AG is…
The following was the documentation of the result of each category.

1.1 High achiever students' metacognition ability (S1)



Picture 3.2:- S1 Test Result

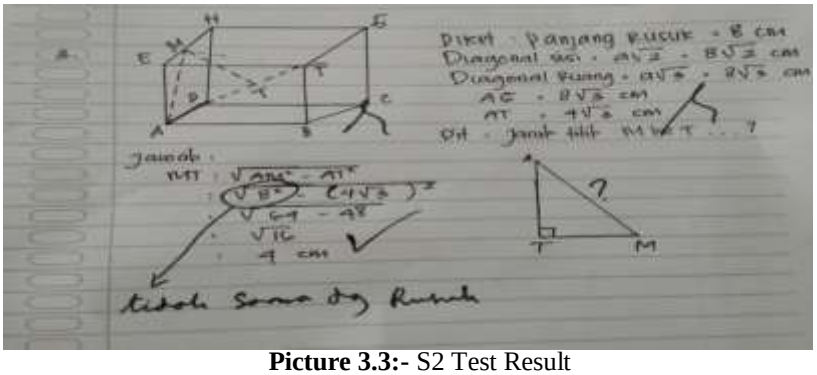
Based on the result above, the prediction aspect had fulfilled the indicator. It means that the students understood the meaning of the question so that he could answer the question accurately. In line with the research conducted by Listya et al. (2015), students with high academic ability could recall their prior knowledge when interpreting the information that has been identified by recalling the prior knowledge to solve the problem and knowing the reason why they used their prior knowledge.

S1 had fulfilled the indicator of planning aspect in which he could transform the question into an image and used the appropriate strategy accurately. The student wrote the steps systematically, this probably because he used to solve the problem by visualizing the question into an image. This statement was supported by Solaikhah et al. (2013) high achiever students could use some information to plan solution and its steps while planning the solution. The monitoring aspect had been well mastered by the student. This can be seen from the result of the test above, the student could apply the formula and concept accurately. Concept comprehension had a positive effect to solve the geometry problem, comprehension about right triangle concept by using Pythagoras theorem and decide the formula to be used. Comparable with the research conducted by Putri et al. (2012), students could use a formula or mathematics sentence as well as geometry problem-solving strategy that had been chosen consistently to decide the solution.

Precise calculation and answer rechecking was the indicator of evaluation aspect. According to the result, S1 had done the calculation correctly and the steps were appropriately the same with the plan. In other words, the students rechecked his answer. This statement was supported by Fitrianti et al. (2016), the subject checked the truth of solving steps, and he asked himself about what made him feel that the question was not appropriate to the work steps he wanted to reach. From the statements above, it can be concluded that evaluation aspect had been fulfilled.

Based on the facts collected by the researcher, it can be concluded that S1 had fulfilled the four aspects of metacognition; that is a prediction, planning, monitoring, and evaluating optimally.

1.2 Average achiever students' metacognition ability (S2)
The following was the result of average mathematics ability student



Picture 3.3:- S2 Test Result

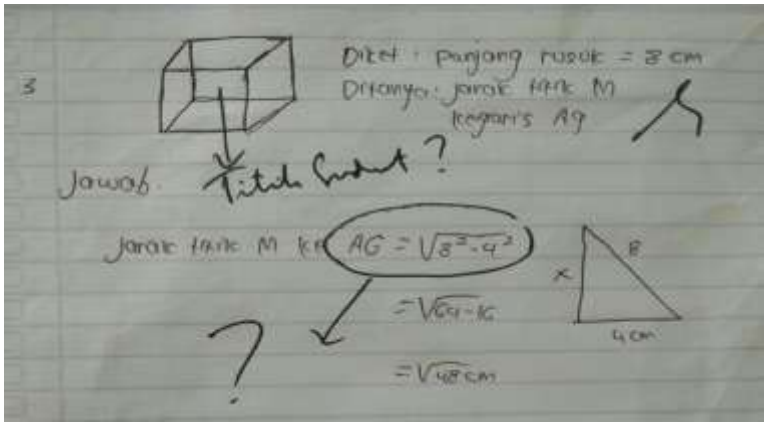
The prediction aspect of metacognition ability was the main study as a student's vehicle to understand the problem. The collected fact, according to the picture above, was the student who has average mathematics ability (S2) could fulfill the prediction aspect. The student had been well understood the problem so that he could show what was known and what was asked from the question. Students' problem comprehension could help them to find information to plan the solving steps accurately. This is in line with Fitrianti et al. (2106) who said that the subject identified everything they know to decide the aim or result of the task. Based on the statement mentioned before, the prediction aspect of S2 had done well.

The picture of the S2 test result above was quite right although there was no right sign drawn on the line segment that shows the distance of the asked point; this means that the student had been well understood the question so that he can transform the question into an image then applied the strategy accurately. The strategy used by the student had been suitable for what had been expected. Therefore, the planning aspect of average mathematics ability student had been fulfilled well. Indicator achievement in monitoring aspect of S2 from the result show that the student had correctly applied the formula but he took the length of the line that was not the length of the lateral but considered to be the same. There should be one more step to be done to find the length of the line segment that lead to what is questioned. Although he was not quite accurate in deciding the length of the line segment, the student applied the concept of diagonal space on the cube well. Comparable to the research conducted by Solaikah et al. (2013), students with average ability could use some provided information to answer the question even the answer was not accurately right.

Evaluating aspect indicator was an accuracy of the calculation process and recheck answer. When monitoring aspect was not correct, the evaluating aspect was so. This means that the students did not calculate correctly and did not recheck his answer so the answer was wrong. This is in line with the research result by Putri et al. (2012), students did not recheck their answer. This can be seen from the result of their calculation which was not same as what the question asked for. This happened because they believed enough that their answer was right so that they did not recheck it.

Based on the facts, the researcher showed that S2 only fulfilled two aspects well; they are predicting and planning. Whereas, monitoring and evaluating aspects had not fulfilled yet.

Low achiever students' metacognition ability (S3:-
The following was the result of low mathematics ability student.



Picture 3.4:- S3 Test Result

Predicting aspect was the main study of students' vehicle to solve the problem. The fact collected by the researcher showed that the students could not understand the problem well, so the student answer was not appropriate with what the question asked for. Yet, the student still showed what was known and what was asked based on the result of the interview. This is in line with the research conducted by Solaikhah et al. (2013) that to understand the question, low achiever students could write what was known and what was asked for, but they could not understand the question well. This means that S3 fulfilled predicting aspect but it was not optimal.

Planning aspect was the second aspect of metacognition skill. The result showed that the students could not transform the questions into an image accurately. It means that the student was not quite careful in reading the question so the image was wrong and it had no corner. The student also could not apply the appropriate strategy accurately, so the answer was not appropriate too.

S3 had not done the indicator of planning aspect that is transforming question into an image well. This might be caused by their habit in which they were not used to solve a complex problem so he did not have any experience to face the problem especially in calculating the distance of a point to a line in the cube. This is the same with the research conducted by Risnanowati (2008) that the less student's experience in solving problem, the harder they monitor the solution effectively. Although they could continue the process yet the strategy was wrong.

The S3 student did not fulfill monitoring aspect. This can be seen from the picture above that the student applied the formula less accurate because the formula was written directly to the number, so this indicator did not fulfill. The second indicator in monitoring aspect was finding out the distance of a line, the result showed that the student understood the concept well but he was less accurate while applying the formula so the final result was wrong.

The calculation accuracy and answer recheck were the indicators of evaluating aspect. The result showed that the student's calculation was wrong and he did not recheck his answer so the final answer was wrong. According to Kriswiyanti (2012), in mathematics problem-solving student did not used to recheck their answer so they did not realize that the answer was wrong. Based on the facts above, the evaluating aspect on S3 metacognition skill had not done properly.

The facts showed that S3 only fulfilled predicting aspect of metacognition while the planning, monitoring, and evaluating aspects were not fulfilled. It can be concluded that students' mathematics ability influence their metacognition process.

Conclusion:-

Students' metacognition ability consists of four aspects; that is predicting, planning, monitoring and evaluating. The result of mathematics ability test of 32 students of the eighth grade was 8 students were high achievers (25%), 10 students were average achievers (31,25%) and 14 students were low achievers (43,75%). One student was chosen

from each category as the subject of the research to solve jumping task strategy question test. Based on the result of the test and interview, it can be concluded that:

1. High achiever student's metacognition ability
2. The student could fulfill all the aspects of metacognition ability optimally. This means that high achiever student could answer the entire problem question correctly.
3. Average achiever student's metacognition ability
4. The student fulfilled the predicting and planning aspects well but not with monitoring and evaluating aspects.
5. Low achiever student's metacognition ability
6. The student fulfilled only predicting aspect. The other aspects such as planning, monitoring, and evaluating were not fulfilled by the student.

Based on the research about the analysis of students' metacognition ability through jumping task strategy to solve the geometry problem, the suggestions are as follow.

1. For the next researcher, another research related to this topic can be conducted at different grade level.
2. For the next researcher, the problem of geometry can be more complex so it can truly explore the metacognition ability.
3. For the teachers, teachers are suggested to elicit students' metacognition ability by giving a question with jumping task strategy about geometry frequently in order to increase students' metacognition ability.
4. For the students, metacognition awareness about knowledge or learning ability can be used as the benchmark or self-reflection.

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