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# Analysis of Creative Thinking Ability Based on Self-Regulation in Model Eliciting Activity Learning with Performance Assessment

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**Abstract**

This research aims to describe creative thinking ability seen from self-regulation of the students on Model Eliciting Activities learning (MEAs) with performance assessment. This research was a sequential explanatory. The population was VII grade students of SMP Ibu Kartini Semarang, consisting of four classes. The technique of sampling was purposive sampling. It was selected VII C as experimental group. The subjects were grouped based on self-regulation with high, moderate, and low categories to be interviewed dealing with mathematical creative thinking. The instruments were test and interview. The findings showed that MEAs with performance assessment was qualified well and description of creative mathematics thinking based on self-regulation of the students varied.

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## INTRODUCTION

Mathematics is the main subject at every school level. Mathematics is a science that discusses order and pattern (Siagan, 2016). Based on the curriculum, mathematics lessons get more hours than other subjects. However, in reality there are many students who do not want mathematics because they consider mathematics to be a complicated thing especially in geometry. This is supported by Saironi & Sukestiyarno (2017) which states that most students consider mathematics to be a difficult and burdensome subject. One of the geometry material which results are still low is quadrilateral, this is due to the students' activity who do not support learning (Mustakim, 2016).

Based on observations made previously, found other facts that cause learning outcomes quadrilateral material is still low. There are still many students who are late to enter school, do not complete the tasks given by the teacher, cheating during the test, and less use of library facilities as their learning sources. This proves that students do not have good self-regulation in the learning process, especially in learning mathematics. Hermanto, et al (2018) & Semana & Leonar (2018) stated that the learning environment also affects students' self-regulation especially in the low category which will interfere with their activities in learning mathematics and will limit them in developing their thinking skills. The statement is in accordance with Dent & Alison (2015) and Broadbent & Poon (2015) states that in students' self-regulation greatly affect the students' social cognitive abilities in learning. In addition, students' self-regulation skills also predict their success in adjusting to their positive development, for example greater self-confidence and a better level of professionalism for long-term life (Razza, et al, 2013).

Self-regulation of students also influences their mathematical creative thinking abilities because understanding mathematical concepts requires high creative thinking abilities. As stated by Tabach & Firedlander (2016) states that the mathematical creative thinking ability of students greatly determines the students' ability to conceptual understanding. The most important thing in mathematical creative thinking is, if students are able to meet the fluency, flexibility, originality , and elaboration indicator (Hendriana, et al, 2017, Utami, et al, 2014, Siswono, 2011, & Wang, 2011). However, the facts show that students' mathematical creative thinking ability is still relatively low, this is seen when students are given a repetition about rectangular material, in working on problems they tend to have the same answers and almost make the same mistakes too, this triggered by the lack of students' creativity in giving ideas or answers about the problems given, so there are no varied answers. It is also in accordance with what was expressed by Singer, et al (2016) concluded that in mathematics learning especially in geometry material the students' creativity ability is very influential on the cognitive-flexible style of students.

One solution to overcome the problem of low creative mathematics thinking ability students, teachers can use learning models in an innovative and creative through Model Eliciting Activities learning (MEAs that support the activities of students in bringing in, getting or obtaining solutions from problems given through students' thinking processes to create a mathematical model as a solution Amalia, et al (2015) which states that teachers assume that learning with MEAs has an advantage in the problem-solving process in the mathematics class even though they have obstacles in the implementation and design of MEAs. from this learning, students can apply mathematical procedures to form a mathematical model with high creativity (Wessels, 2014).

The use of appropriate learning models in the learning process should be supported by appropriate assessments so that they are in line with the learning objectives that have been planned beforehand. Masrukan (2014) states that assessment is a systematic procedure with the aim of gathering information about the characteristics of people or objects. This is also supported by Tejeda & Katherina (2017) who revealed that by using performance assessments it can find out whether students can link their knowledge with real-life situations. In addition, performance assessment is

an assessment that focuses on the learning process of students, for example, in the process of finding an answer to a problem, making presentations on the results of their work and can produce a project, so learning becomes more effective (Suryati, et al 2013) . Handayani, et al (2013), Hasanah, et al (2016), & Emiliannur, et al (2018) argue that performance assessments can be used to assist students in solving problems related to everyday life and are able to measure the success of students because it will accustom students to actively participate in learning by showing their performance in understanding and solving problems.

Based on the problems that have been described, research is needed on the use of MEAs learning performance assessment to determine students' mathematical creative thinking abilities in terms of self-regulation.

## METHOD

This Mixed Method research used sequential explanatory design. It is a blend method which has more quantitative portion than its qualitative portion. The qualitative background is also stronger than the others.

The procedure in this research used quantitative data as initial phase, data analysis, and interview as the second phase to complete the qualitative data. This research was done within three stages: initial, quantitative, and qualitative stages. The initial stage covered observation, learning and research instrument formulation, learning and research instrument validations.

The test of creative mathematics thinking ability before being used to take data from experimental and control groups, it was initially tested on a pilot class. It was done to find out validity, reliability, difficulty, and comparative power of the test. The tested data was analyzed and revised when needed. The quantitative stage covered initial ability test of the students, MEAs learning promotion with performance assessment, self-regulation questionnaire distribution, and mathematic Creative thinking ability. After the distribution of the questionnaire, the students were grouped into high, moderate, and low categories. Then, each category was interviewed dealing with creative mathematics thinking ability. The final stage covered interview, data analysis, and conclusion drawing of the research.

The data was analyzed quantitatively to find out MEAs learning quality wit the performance assessment. Meanwhile, dealing with effectiveness, it covered learning achievement passing grade, higher proportion of learning achievement for experimental group, better average score of creative mathematics thinking ability, higher percentage of learning achievement passing grade of experimental group 75%. Qualitatively, it was analyzed by using Miles and Huberman, covering from data reduction, presentation, conclusion, and verification (Apriliani & Hardi, 2016).

## RESULTS AND DISCUSSION

Based on the findings of creative mathematics thinking ability on experimental group, the average was 70 while the control group was 63. The learning achievement of experimental class was 88% while the learning achievement passing grade on control group was 66%. Based on creative mathematics thinking ability test, the students and standar normal data with $\alpha = 5\%$, gained $Z_{table} = 0.448$. From the calculation, it gained $Z_{count} = 1.63$. Tus, $H_0$ was denied and $H_1$ was accepted. It mean that the percentage of minimum passing grade of the student was 60.72 on MEAs learning with performance assessment higher than 75%. Based on t – test, $t_{count} = 3.79$ and $t_{table} = 1.99$. Thus, $3.79 = t_{count} > t_{1}.\alpha = 1.99$. Then, $H_0$ was denied. Thus, creative mathematics thinking ability of the students taught by MEAs with the performance assessment was higher than those taught by PBL. The proportion test gained score $2.07 = z > z_{0.5-\alpha} = 0.4808$ with $\alpha = 5\%$. Thus, creative mathematics thinking ability of the students taught by MEAs with performance assessment was higer than those taught by PBL.

The students taught by MEAs with performance assessment passed the minimum passing grade. The classical passing grade test

gained result that the experimental group proportion gained 60.72, or beyond 75%. Besides that, the researcher also tested the variances of experimental and control groups. Based on the test of variance, it gained that average of creative mathematics thinking ability of the experimental group students in solving the question was better than the control group. The minimum passing grade portion of the experimental group was better than the control group. Those statements showed that MEAs with performance assessment could be said qualified. It was also caused by syntax conducted in the class which guided the students to get used to in creatively thinking to solve the given problems. Meanwhile, the initial purpose of the strategy, giving performance assessment, was to provide freedom for students to solve problems based on their own ideas. This learning and the supportive strategy would develop creative thinking power of the students with their freedom.

Qualitatively, MEAs learning with performance assessment could be said qualified because the instrument validation results showed that the instrument was valid and categorized well. Then, the implementation of the leanring done by the researcher was also categorized well based on observer's judgement in each meeting, categorized good. In judging stage, the students' responses taught by MEAs with performance assessment was also categorized good because the students felt comfortable and active in joining the learning.

MEAs learning with qualified performance assessment was also supported by Zulkarnaen (2015). He showed that eliciting model activities in mathematics learning contributed significantly to creative mathematics thinking ability of stduents, about 64% from 30 students. The reason of MEAs' implementation was strengthened by Amalia et al (2015). They stated that creative mathematics thinking ability after intervened by the learning model could be better than before the intervention. Yudha (2018) states that the use of performance assessment was to improve learning achievement, especially geometry matrial for junior high school. Ahmar (2016) concludes that there is positive correlation between self-regulation to creative mathematics thinking ability of students. There were 4 high self-regulated students, 25 moderated self-regulated students, and 3 low creative mathematics thinking ability were analyzed and are presented in Table 1.

**Table 1.** The Summary of Creative Mathematics Thinking Ability Analysis Based on Self-Regulation

| Categories | Numbers of Subjects | Indicators | | | |
|---|---|---|---|---|---|
| | | Fluency | Flexibility | Elaboration | Originality |
| High | 2 | √ | √ | √ | √ |
| | 2 | √ | √ | √ | × |
| Moderate | 2 | √ | √ | √ | √ |
| | 18 | √ | √ | √ | × |
| | 5 | √ | √ | × | × |
| Low | 1 | √ | √ | √ | × |
| | 2 | √ | √ | × | × |

Based on the table, the same category subjects had various creative mathematics thinking ability. It is also seen althought the subjects were in different categories but they had similar creative mathematics thinking ability. It was the influence of MEAs learning with performance assessment done in experimental group.

The result was then triangulated by using interview to the selected subjects. It was done to get more information dealing with creative mathematics thinking ability of the students and to get relevant conclusion with subject condition in the classroom. Here is one of the works of high self-regulated students in Figure 1.

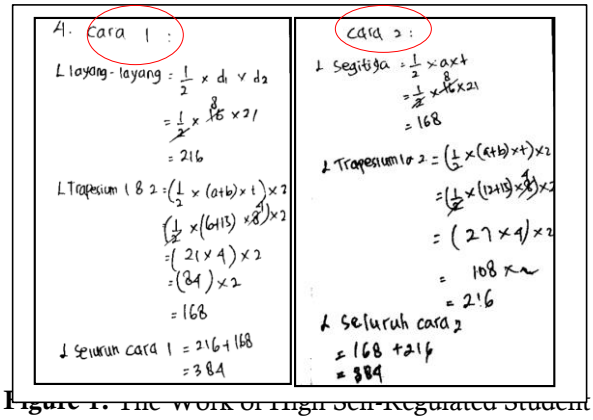


**Figure 1.** The Work of High Self-Regulated Student

On the Figure 1, it can be seen that the work of the student has shown high creative mathematics thinking ability. The subject could understand and solve the question accurately. The fluency indicator was filled because the subject could write the answer correctly without any obstacle. The flexibility indicator was also met because the subject could provide more than one solution in which two of them were correct. The first step was the subject look for the large of the kite, then the large of trapezoid. The second step was the subject loof for the large of the triangle then the large of trapezoid. The elaboration indicator was met because the subjects could write and explain in detail on paper. The originality was also met because the subjects could create new idea in providing answer without cheating their friends. It could be seen on the subject's work which was different to the other subjects.

Here is the work of a moderate self-regulated subject, presented in Figure 2.

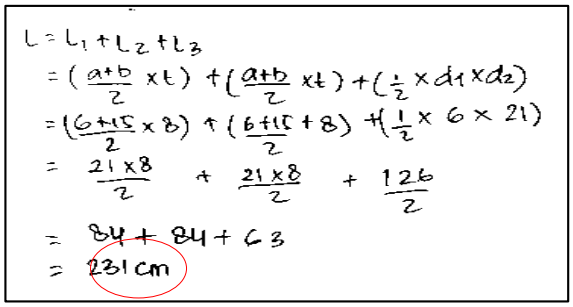


**Figure 2.** The Work of Moderate Self-Regulated Student

On the Figure 2, it can be seen that the work of the subject has shown creative mathematics thinking ability. The subject could understand the question and solve it correctly. The fluency was met because the subject could write the answer fluently although there was an error in the last calculation. The flexibility was not met because only one solution was provided. The elaboration was met because the subject could could write and explain in detail on the paper. The originality indicator was not met because there were no new ideas created in answering the question.

Subject with low self-regulation could not provide any answer on number 4. The subject did so because he had no sufficient time and forgot the formula to solve. However, on different question, the subjects could solve the given problems although it was not perfect. It could be seen on one of the works of the subjects on number 2. Figure 3 show the work of low Self-regulated students.

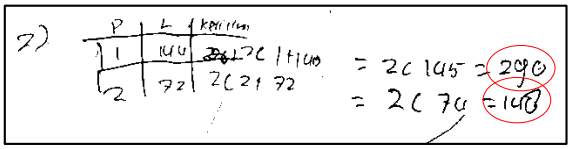

**Figure 2.** The Work of Low Self-Regulated Student

In Figure 3, it is seen that the subject has shown creative mathematics thinking ability. The subject almost understood the question and solved accurately. He could seek any possibilities of length and width of a rectangle when it was noticed although they had alternatives but the indicator of fluency was met. The flexibility indicator was seen when the students answerd with various possibilities of width and length of the given rectangle. Dealing with elaboration indicator, the subject could not explain in detail.

Based on the findings, generally the high self-regulated students could solve problems dealing with creative mathematics thinking ability because their self-regulation and creative mathematics thinking ability had positive correlation (Ahmadi, 2014 & Madji et al, 2017). Besides that, Jalou (2015) also states that students with good self-regulation could improve their creative mathematics thinking ability in solving problem. It was proven from all met indicators

of creative mathematics thinking ability, such as fluency, flexibility, elaboration, and originality.

When the works of the students were triangulated by interview, in answering each question, the students' works were written clearly and in detail. The students with high self-regulation could meet all indicators or three of them maximally. Althought the originality had not been met maximally because they were not used to deliver their own ideas and they tended to use the teacher's way. The finding was also supported by Munahefi et al (2017) stating that high self-regulated students could achieve all creative mathematics thinking ability indicators, fluency, flexibility, elaboration and originality. It was also supported by Ahmar (2016) stating that higher self-regulation resulted to higher creative mathematics thinking ability achievement.

Moderate self-regulated students could not meet the originality because they still had similar answers to the others. They were still conflused when they were given different ways than the usual. They had not been habitualized with the given question model althought it was repeated several times. Munahefi et al (2017) stated that moderate self-regulated students had met creative mathematics thinking ability indicators but it was not maximum, especially the originality. It was supported by Noriza et al (2017). They stated that moderate self-regulated student only could meet fluency and reliability but not with originality and detail elaboration.

Based on the findings, generally low self-regulated students could not solve the problems dealing with creative mathematics thinking ability because lower self-regulation would lead to lower creative mathematics thinking ability achievement (Ahmar, 2016). It was proven by their works which mostly only met fluency indicator. Only several question were done and met flexibility indicator. The low self-regulated students could not meet the originality because they only imitate their friends' works. They could not seek their own solution. It was also stated by Munahefi et al (2017) that low self-regulated students could only achieve fluency and flexibility indicators but not the originality because they tended to imitate their friends' works.

## CONCLUSION

Based on the discussion, it was concluded that MEAs with performance assessment to creative mathematics thinking ability of the students was qualified. The planning stages used were valid on the implementation of MEAs learning with performance system, categorized good. In the implementation stage was also good. The influence of MEA with the assessment resulted to creative mathematics thinking ability description seen from various self-regulation of the students. The high self-regulated students could achieve all creative mathematics thinking ability indicators but only two of them did not achievem originality. The moderate self-regulated students could not achieve originality indicators but two of them could meet all indicators and 5 of them could achieve two indicators. The low self-regulated student could only achieve fluency and flexibility creative mathematics thinking ability although there was only one student achieving three indicators.

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