



Creative Thinking Ability based on Students' Metacognition in Creative Problem Solving Learning Model With Recitation and Self-Assessment in Ethnomatematics

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Abstract

This research is aimed to (1) investigate the learning quality of the implementation of Creative Problem Solving model with recitation and self-assessment based on Ethnomatematics in students' creative thinking ability; and (2) explain the creative thinking ability on Creative Problem solving model with recitation and Creative Problem Solving model with recitation and self-assessment based on Ethnomatematics in students' metacognition. Mixed method with Sequential explanatory was applied in this research. The subject of the research was determined by students' metacognition scores in VII C class in SMP N 1 Getasan academic year 2017/2018. Observation, test and interview were employed in obtaining the data. The data analysis appeared to prove that (1) Creative Problem Solving learning model with recitation and self-assessment based on Ethnomatematics has good quality in the stage of planning, learning process, and the final result of learning; (2) low metacognition subjects were able to fulfill the fluency and elaboration indicators, but flexibility indicator, novelty indicator and elaboration indicator had not been fulfilled yet; then moderate metacognition subjects were able to fulfill fluency indicator and elaboration indicator but the flexibility indicator and novelty indicator had not been fulfilled yet, high metacognition subjects were able to fulfill the whole indicators includes fluency indicator, flexibility indicator, novelty indicator and elaboration indicator.

PENDAHULUAN

Education is a sequence of events that includes communication process among people so they grow up to in intact personality. People develop through learning process that lasts a lifetime to have a better personality. The knowledge of skills, habit, hobby, and attitude of a person is formed, modified and developed through learning process. Hudojo (1980) states that a person is learning if there is a process that causes behavior change of the person. The changing of behavior needs effort and takes a long period of time. It changes a person who is not able to do something to be able to do something.

Mathematic is a crucial branch of knowledge to learn and it has correlation with daily activities. Kline as cited in Suherman et al. (2003) argues that mathematic is not a knowledge that could stand alone perfectly but mathematic has function to help people understanding and overcoming, social, economic, and nature problems. Organization for Economic Cooperation and Development (OECD) conducts a survey in once every three years. The survey is known as Programme for international Students Assessment (PISA). The latest survey was conducted in 2015. Indonesia was on the sixty second of seventieth from all the PISA countries members (OECD, 2016). In PISA test, Mathematic skills showed that Indonesian Mathematic skills were still below the average of the others PISA countries members.

Based on PISA result, Mathematic skills become the cause why Indonesia placed on the low level. Creative thinking skill is one of the crucial skills in Mathematic and according to Strom and Strom (2002) creative thinking skill has become the common goal throughout the world and it is an important trend to better develop creative thinking skill for students in education revolution. Fetterly (2010) states that mathematic creativity will make a change which is demanding to fulfill the problem solving requirement faced by the students.

Torrance as cited in Sriraman (2009) claims that creativity is built upon four interrelation components which are fluency, flexibility, novelty, and elaboration. Fluency refers to the continuity of ideas, the flow of association, and the use of basic

and universal knowledge. Flexibility is related to the changes of ideas, approaching problem in various ways, find the solutions. Novelty is characterized by the new mindset which is unique and it produces the original product of mental process or artistic. Elaboration refers to the ability to illustrate, explain, and generalize ideas that supports the students' creativity development. It requires some appropriate learning models to develop creative thinking skill, one of them is Creative Problem Solving (CPS) model. Creative Problem Solving (CPS) a learning model that could become the tool of developing creative thinking skill. According to Isaken (1995), CPS consists of three main components such as (1) Understanding the problem (2) Generating Ideas, it is an attempt to identify the problems solving as much as possible (3) Planning for Action. Creative Problem Solving (CPS) trains the students to develop creative thinking skill in order to solve a problem.

By combining Creative Problem Solving (CPS) with recitation, it involves the students to actively engage and support teaching learning process. Recitation is the way of teaching by giving certain assignments to the students outside the school hours (Djamarah, 2002). It is because students are expected to complete and be accountable for the assignment given by the teacher.

The Creative Problem Solving learning model with recitation becomes more attractive to students if it is developed with the nuances of everyday life. One nuance that can be used so that learning activities become more meaningful is ethnomatematics. Ethnomatematics (ethnomatematics) comes from the word "ethno" which means culture (Orey and Rosa, 2007), "Mathema" is an ability such as counting, sorting, sorting, measuring, weighing, coding, classifying, inferring, and modeling. The ending "tics" comes from the word "techne" and means like the meaning of the technique (D'Ambrosio, 2006). So ethnomatematics is a culture of society that develops or uses mathematical principles in daily life.

Rubio (2016) says that Ethnomatematic learning is a learning application adapted from mathematic concepts in daily activities. Ethnomatematic creates a meaningful leaning

process because it has correlation with daily activities and students' culture. Thus, it helps students' learning process and students' thinking process. It focuses on developing creative thinking Ethnomathematic learning.

The goal of creative thinking development will be achieved well if there is evaluation or assessment in order to be able to find out the development of the learning and it becomes the evaluation materials. One type of assessments that fits with creative thinking skill development is self-assessment. According to Bond (1993) all assessments including self-assessment consists of two primary elements which are making decision about basic skill and making the assessment of skill quality based on the correlation of basic skill. When self-assessment is introduced, it should involve those two aspects.

Treffinger (1995) states, the application of Creative Problem Solving (CPS) in education could increase some effects in learning. One of them is increasing metacognition ability. Metacognition ability affects creative thinking ability and student ability to solve the problem (Treffinger, 1995). According to Schneider & Artelt (2010) metacognition is knowledge of a person about the information processing skill and knowledge of cognitive characteristic in facing problems, and strategies in solving the problems. Schoenfeld (1992) states that, metacognition focuses on three interrelated intellectual habits but those are different. Those are (1) knowledge that is already possessed, how accurate someone's evaluation of themselves (2) control or self-regulation. It is about how a person is able to apply the strategies based on observation in solving the problems. (3) Belief and intuition, mathematic ideas used for solving problems, and how those ideas

The goals of this research are (1) finding out the learning quality in the implementation Creative Problem Solving (CPS) with recitation and self-assessment based on ethnomathematic toward students creative thinking ability; (2) describing creative thinking skill on Creative Problem Solving (CPS) with recitation and self-assessment based on ethnomathematic viewed by students' metacognition

METHOD

The combination research design used is Concurrent Embedded Design. The method is a research method that combines quantitative and qualitative research methods by mixing the two methods in an unbalanced manner (Sugiyono, 2016). In this study qualitative is more emphasis and quantitative is used as supporting data to analyze the results of creative thinking ability tests that are associated with student metacognition. Creative thinking skills associated with metacognition are analyzed quantitatively and then described qualitatively. This study was conducted in SMP N 1 Getasan Kabupaten Semarang on April- May 2018 which the population was the whole student in grade VII academic year 2017/2018. In those seven classes, only two classes were chosen as the sample. Two classes of sample would be examined the same average to make sure that both two classes had the same initial ability. One class was selected as the experiment class. The researcher applied Creative Problem Solving (CPS) with recitation and self-assessment based on ethnomathematics in this class. then, one class was selected as the control class by applying Problem Based Learning (PBL).

The subjects were selected based on students metacognition questionnaire result. There were 6 students which consisted of 2 two with high metacognition, 2 students with moderate metacognition, and 2 students with low metacognition. The subjects of the research were taken by considering students ability to express what is in their mind. Therefore, the disclosure of creative thinking skill could be done appropriately. Here is students' metacognition categorization in the table below.

Tabel 1. Students' Metacognition Categorization

Category	The Number of Student	Percentage
High	5	15.63
Moderate	24	75
Low	3	9.37
Sum	32	100

The data sources of the research were elected students from creative thinking ability test result, students' metacognition questionnaire result, students' self-assessment sheets, and the interview result of students' creative thinking skill. The result of creative thinking skill test was qualitative data source, while the quantitative data sources were students creative thinking skill answer sheets, the questionnaire result, and the interview result of students' creative thinking skill. The quantitative data was examined by using normality test, homogeneity test, the same average test, the average test, the classical completeness test, the different average test, and the different proportional test. Besides, the qualitative data was analyzed by using data validity, data reduction, presentation and verification of the data.

RESULT AND DISCUSSION

Learning Quality

The learning quality by using Creative Problem Solving (CPS) with recitation and self-assessment based on ethnomathematic was a series of activities to improve students competence. The learning quality was measured in three stages such as (1) planning and preparation, (2) classroom environment and instruction, (3) professional responsibility. In the planning stage, the researcher created the learning tools such as syllabus, lesson plan, enthomathematic module, and creative thinking skill test. Then, the tools were validated by the expert validators. The result of the evaluation from the validators were 4,42 which belonged to a very good criteria. Thus, the tools were appropriate to be used in the research.

Tabel 2. The Tools And Instruments Validation Result

Instrument	Score	Criteria
Syllabus	4.44	Very Good
Lesson Plan	4.20	Good
Ethnomathematic module	4.57	Very Good
TKBK test	4.5	Very Good
Average Score	4.42	Very Good

Based on the result, it shows that the learning tools and research instruments belonged to a very good category and it is appropriate to use in the research.

The implementation of Creative Problem Solving (CPS) with recitation and self-assessment based on ethnomathematic was conducted by using syntax learning of CPS which was combined with recitation or giving an assignment at the of the learning. Ethnomathematic based learning was implemented by learning about triangle material which relates with the culture of Kabupaten Semarang such as a tour bridge and Udeng. Udeng is a part of "reog"art that has triangle shape.

In the stage of learning process, the learning quality was measured by observation in dealing with the achievement of learning process. Based on the observation result, the score was in the average of 3,184 or 79,6% so the learning process belonged to a good criteria. The following is the data of students learning process could be seen below in Table 3.

Table 3. Student Learning Process

Learning meeting	Score	Category
1 st	3.23	Good
2 nd	3.15	Good
3 rd	3.0	Good
4 th	3.23	Good
5 th	3.31	Very good
Average	3.184	Good

The quality of assessment stage could be seen from the effectiveness of Creative Problem Solving (CPS) with recitation and self-assessment based on ethnomathematic. Before doing effectiveness test, the researcher examined the preliminary data. The result of the data analysis showed that the data has normal distribution and it has the same variant. Then, there was no difference in the average of both samples. It means that both of the samples could be used for the future research that has the same literacy skills. The final result of creative thinking ability test after normal distribution and homogeneous learning could be seen below in Table 4.

Table 4. The Final Test Of Creative Thinking Ability Test

Aspect	Experiment Class	Control Class
Number of Student	32	32
Average Score	76.23	66.97
Maximum Score	97.50	80.00
Minimum Score	60.63	54.38
Varians	58.68	48.38
Standard deviation	7.66	6.99

The effectiveness of learning process was determined by the calculation of the average test, the classical completeness test, the different average test, the different proportion test. The average was applied to discover the achievement of mathematic creative ability average skill of the students. It could be seen from how many students who got above the standard of minimum completeness of mastery learning in their creative thinking ability. Based on the students' creative thinking skill average test applied T-test. The researcher used Microsoft Excel in obtaining the result $t_{count} = 4,60$ while $t_{table} = 2,04$ so $z_{count} > z_{table}$. It means that the average value of students' creative thinking skill in the experiment class reached the standard of minimum completeness of mastery learning.

Calculation of proportion test obtained by value of $z_{count} = 1,68$. The value $z_{0,5-0,05} = z_{0,45} = 1,64$. The value $z = 1,68 > z_{0,45} = 1,64$, which means that students' completeness proportion as known as Creative Problem Solving (CPS) with recitation and self-assessment

The different average test was applied to find out whether there was a difference on students' ability between Creative Problem Solving (CPS) model with recitation and self-assessment based on ethnomathematic class and PBL model class. Based on the result, the different average test used Microsoft Excel, $t_{count} = 4,97$ and $t_{table} = 1,9$, so $t_{count} > t_{table}$. thus, it could be said that the average of creative thinking skill test in the experiment class was higher than in the control class.

Regression test was applied for investigating whether there was metacognition effects toward students' Creative Problem Solving (CPS) with

recitation and self-assessment based on ethnomathematic. The result of the regression by using IBM SPSS 22 was obtained on Coefficients result table $sig = 0,000$. It means that there was a metacognition effect toward students' creative thinking skill. On the bale of Model summary R Square was obtained 0,720 which means that metacognition influenced students creative thinking skill in the amount of 72%. Then, there was a regression equality $y = 35,00 + 0,628X$ on the ANOVA table. The positive value showed that the positive impact of the metacognition toward creative thinking skill. The metacognition variable (x) was added by one unit in every variable so it would increase creative thinking skill value (y) in the amount of 0,628 or 62,8%.

The improvement of creative thinking skill was used for investigating the improvement of creative thinking skill test on the selected subjects based on high metacognition, moderate metacognition and low metacognition.

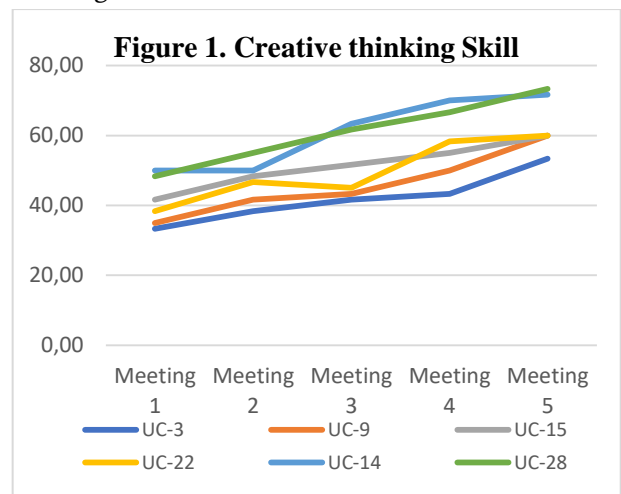


Figure 1. Creative thinking Skill

Figure 1 shows that the positive improvement on the students with high, moderate and low metacognition. Although they had different initial creative thinking skill, students with low metacognition showed good development by almost approaching the creative thinking skill in student with moderate metacognition. Students with high metacognition developed and increased their creative thinking skill significantly. Then, they were more

excellent than the others students with moderate and low metacognition.

This finding strengthened the previous studies. Triyono, Senam, Jumadi & Wilujeng (2017) found out that Creative Problem Solving (CPS) has positive effects toward students' creative thinking skill and students' innovation. CPS was able to be implemented for high and low level of schools. Heleni (2014) said that Creative Problem Solving could improve the students' learning result on VII grader in SMP Negeri 3 Pekanbaru in the material of fraction. Hajiyakhchali (2013) stated that the implementation of CPS was significantly increased students' ability to be better especially for creative thinking skill and problem solving skill. Fitriyantoro and Prasetyo (2016) the implementation of CPS has significant role to improve students' learning result.

Kusuma et al. (2017) state that ethnomathematic learning was very appropriate because it increased students' sensitivity and students' awareness in the learning process, explored the mathematic concepts from culture, and it could relate the mathematic concepts with the culture so the students were more respectful to their culture. Fajriyah (2018) also argued that ethnomathematic created the learning environment with full of motivation and more enjoyable. Thus, it made the students had interest in learning Mathematic which expected to increase students' creative thinking skill. The research of Ogunkunle and George (2015) stated that ethnomathematic learning increased students' creative thinking skill and it was veru effective to be implemented by practice rather than discussion. Aditya (2016) argued that recitation method had positive impacts on the learning process and improve students' learning result. Based on Kurniawan and Harini's research result (2014) showed that recitation method was able to improve students' enthusiasm and students' learning result.

According to the result above, it shows that in the preparation stage, the tools and instruments of the research were in a good category and proper to use. In the implementation stage, the learning conducted in the research was in a good category. Then, in assessment stage, Creative Problem Solving (CPS) with recitation and self-assessment based on

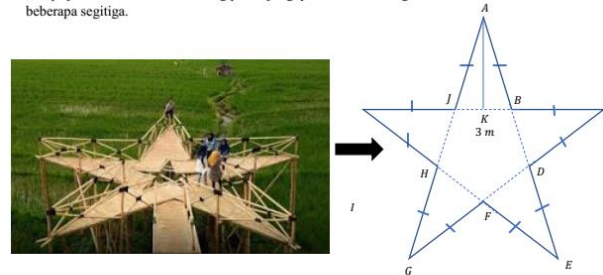
ethnomathematics was effective. Therefore, Creative Problem Solving (CPS) with recitation and self-assessment based on ethnomathematics has quality on students' creative thinking skill.

The Description of Students' Creative Thinking Ability as Viewed by The Metacognition

In this research, what is meant by students' creative thinking ability as viewed by the metacognition was the description of creative thinking which was owned by the students based on metacognition categories. Those categories were high, moderate, and low metacognition. The description of students' creative thinking skill was viewed by four creative thinking indicators based on the test result, interview and triangulation data sources. The following are the description of students' creative thinking skill as viewed by the students' metacognition.

In general, students with low metacognition had les creative thinking ability. Then, they were able to master one indicator of students' creative thinking ability well, on the other hand, they were not able to master the others components such as flexibility, novelty, an elaboration had not been fulfilled yet.

1. Desa wisata kementul merupakan salah satu objek wisata di Kabupaten Semarang yang berupa jembatan berbentuk bintang pada ujungnya. Bentuk bintang tersebut terdiri dari beberapa segitiga.



- Jika Andi dan warga di kampungnya berkeinginan membuat jembatan bintang yang serupa namun dengan ukuran berbeda, yaitu dengan dengan $JK = 3\text{ m}$, $AK = 4\text{ m}$.
- a. Berapakah total bambu yang dibutuhkan untuk bagian pinggir bentuk bintang tersebut (ABCDEFGHIJ)?
 - b. Berapa pula biaya yang dibutuhkan jika bambu seharga Rp. 3000,00 per meter?

Figure 2. Example of a Creative Thinking Ability in the Fluency indicator

Fluency indicator showed that the subject did the task in order, it was started from writing what they understood and what was asked in the questions then solving the problems stated. The result showed that the students had understood the problem and could formulate the appropriate solution so they were able to complete the work correctly.

The other indicators such as flexibility, novelty and elaboration indicators had not been fulfilled yet because the subjects with low metacognition were not able to master those indicators the appropriately. In flexibility indicators the subjects were only able to complete one way of finishing process. In novelty indicator, subjects were not able to bring up the ideas and the works were not clear. While in the elaboration indicator, there was no conclusion and re-evaluation.

In the group of students who had moderate metacognition the fluency indicator and elaboration were fulfilled, while in flexibility indicator and novelty had not been fulfilled well. In fluency indicator, it showed that on the working process it was explained all the information and the meaning of the questions. So it showed that the subjects had understood the problems appropriately. In flexibility indicator, the subjects still faced some difficulties in bringing up various solutions that they were only able to write one type of finishing step.

In Novelty indicator, there was still a drawback where the subjects were able to bring up the ideas in the problem solving but in the finishing step was unclear and understandable. The result of elaboration indicator showed that the subject with moderate metacognition while were able to accomplish the work in order and there was conclusion at the end of the work. The interview result showed that the subjects rechecked the work after finishing it. Following are the result of subject to work on elaboration indicator showed on picture 2.

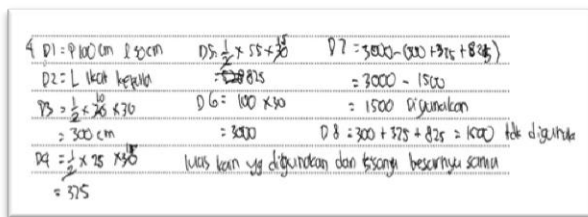


Figure 3. The Example of Subject' Work Result with Moderate Metacognition in Elaboration Indicator

There were some obstacles faced by moderate metacognition students' such as they were not able to bring up the others ideas in solving the problems,

focused on one way solution and they did not try to find other various solutions.

Students with high metacognition showed good creative thinking ability. Those four indicators of creative thinking ability were fulfilled appropriately such as fluency, flexibility, novelty and elaboration indicators.

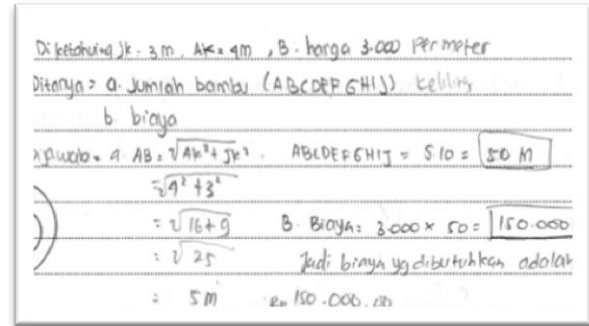


Figure 4. The example of subject work with high metacognition on fluency indicator.

The result showed that the subjects with high metacognition were able to work on the questions based on fluency indicator very well, the basic information was written in full, the steps in doing the work was clear and in order. It showed that they understood the problems very well. The Flexibility indicator in subjects with high metacognition were able to bring up more than one ideas in finding the solution. in the working process, they applied 2 kinds of different ways but it produced the same conclusion.

Novelty indicator was showed in the working process. They worked with their own thinking process which was new and different, it was done clearly and in details. elaboration indicator was showed in the working result and interview result of the two subjects. The working process of both subjects were complete, the finishing step was in order. On the last step of working, there was conclusion which was arranged clearly and understandable. The interview result also showed that the subjects did an evaluation and check the problem that had been done. So they could minimize errors in understanding the problem and the final result.

Generally, the subject with low metacognition still faced some difficulties in creative thinking ability.

The indicator had been fulfilled was fluency indicator, then the others indicators had not been fulfilled yet. The subjects with moderate metacognition had quite good creative thinking ability, although they were not able to fulfilled all the indicators well. They still had lack in flexibility indicator and novelty indicator. Subjects with high metacognition had good creative thinking ability by fulfilling all the indicators well. All the analysis result was conducted in the subjects with low, moderate and high metacognition based on the subjects' result and interview result.

According to Setiawan, Kartono, and Sukestiyarno (2018), students with high metacognition were able to solve the problems by their own ways, students with moderate metacognition were able to solve the problems but without rechecking the work and the students with low metacognition were not able to implement the mathematic problem solving. It was in line with Armbruster (1989) who stated that metacognition played the vital role in creative thinking skill and has significant impacts in every process of creative thinking skill. Luisa, acedo and Sanz (2013) creative thinking skill was the implementation of a person's metacognition. Moreover, the level of metacognition affected the development of creative thinking skill.

Students' Self-Assessment

Self assessment was done to understand the problems and students' difficulties in every meeting, then how the students were able to assess their understanding whether they had understood or not. The result of self assessment showed students' ability to evaluate their own skill. Students with low metacognition said that their skills were still low and not sure to get a good result on the next test. But self-assessment were not able to change students' learning effort and fix their understanding. It could be seen that the result was still low and below the standard of minimum completeness of mastery learning. Students with moderate metacognition were able to understanding the explanation but not sure to do the task related with triangle material well. However, they were nor sure to get a good result on the next result. The result after creative thinking skill test was

better than the previous and it was more than the standard of minimum completeness of mastery learning. It showed that there was the effort done by the moderate metacognition subjects. It's used to improve the skill to they got a better result.

Subject with high metacognition were sure with their skill in triangle material. the subjects had understood and be able to do the task related to triangle task. They were sure to get a good result on the creative thinking skill test. creative thinking skill tests showed that the subjects with high metacognition got a good score. It showed that the subjects were ready for the learning and be able to understand their ability wee. Thus, it gave a good impact on the good learning result.

This result showed that there was correlation between metacognition and self- assessment students with high metacognition were very accurate in assessing an understanding their ability so they knew the follow up steps to develop their skill. Students' with moderate metacognition were also able to understanding themselves and realize that there were still some weaknesses in triangle material. the follow up steps were increasing their understanding so they got a good result in the of creative thinking skill test. Student' with low metacognition were also able to understanding themselves and realize that they still did not understand the triangle material well. Nevertheless, the follow up steps did not work effectively and the result was in the below the standard of minimum completeness of mastery learning.

According to Kartono (2011), self-assessment was included in formative assessment. It could be the reflections for them in their success learning process. Therefore, formative assessment result was very useful for developing their learning process so their learning result would be optimal. Based on Siegesmund's finding (2016), self-assessment increased students' metacognition and make the students to do self- learning (Ambrose, Bridges & Dipietro, 2010). There were some previous studies that stated the importance of self-assessment were increasing the motivation and responsible for the learning they got and increasing the result learning on

the learning process at this time and the future (Black & Wiliam, 2009).

CONCLUSION

There are the result of Creative Problem Solving (CPS) with recitation and self-assessment based on ethnomathematic learning: (1) the assessment of the tools by the expert validator was in a good criteria; (2) the observation of learning process was in a good criteria; (3) the average value of student creative thinking skill in the experiment class has reached the standard of minimum completeness of mastery learning; (4) the students' proportion in the experiment class has reached the minimal score which is 70 or 75%; (5) the average of students' creative thinking skill in Creative Problem Solving (CPS) with recitation and self-assessment based on ethnomathematic learning is better than students' creative thinking ability in PBL learning; (6) there is metacognition impact to creative thinking skill and (7) there is a development of students' creative thinking skill when Creative Problem Solving (CPS) with recitation and self-assessment based on ethnomathematic learning.

Students' creative thinking ability is viewed by students' metacognition. In students with low metacognition, the fluency indicator is in moderate level but the flexibility, novelty and elaboration indicators are still less. Students with moderate metacognition, the fluency indicator is still in a good category, the flexibility indicator is in moderate category, the novelty indicator is in low category and the elaboration indicator is in the less category.

Students' with high metacognition, their fluency indicator is in high category, the flexibility indicator was in the high category, the elaboration indicator is in good category based on the conclusion of the work and evaluation in the end of the work. The self-assessment of low metacognition subjects shows that there is a lack of assessment of their skill but there is no effort to repair it. Moderate metacognition subjects states that the skill is still lack but there is the effort to repair it. then, high metacognition subjects also shows that their skill is

good and they are sure to get a good result and it is proved by the last creative thinking skill test result.

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