



Students' Mathematics Creative Thinking Skills Reviewed by Habits of Mind on Probing-Prompting Learning with Open-Ended Approach

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Abstract

This research aims to describe mathematics creative thinking skill reviewed by habits of mind on probing-prompting learning with open-ended approach. The used research method is mixed method with concurrent embedded design. The population of this research consisted of X grade SMA N 1 Sumpiuh, in academic year 2019/2020. The subjects consisted of seven selected students based on high, moderate, and low habits of mind. The technique of collecting the data used mathematics creative thinking skill test, habits of mind questionnaire, and interview. The results showed that the description of students' mathematics creative thinking skills in each category of high, moderate, and low habits of mind had different mastery of mathematics creative thinking skills. This difference does not depend on the category of students' habits of mind, but because of students' learning activities.

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INTRODUCTION

Mathematics is a science lesson which has important role in current science and technology development. Mathematics is seen as structured and integrated science dealing with pattern and correlation, and thinking ways to surrounding environment. It is in line with Regulation of national education ministry Number 22 Year 2006 about Content Standard of Primary and Moderate Educational Units which state that mathematics is a universal science which becomes basis of modern technology development. It has important roles in various disciplines and it promote human thinking powers (Permendiknas, 2006).

According to Regulation of Education and Cultural Ministry 81 A about 2013 curriculum implementation, one of required skills in learning is creative thinking (Kemdikbud, 2013). Creative thinking skill is one of higher order thinking skills (HOTS). Creative thinking skill is an individual skill to produce various possible solutions or ways to solve the given problems (Siswono, 2011).

Creative thinking skill is important in learning mathematics since to solve the given question will need creativity to trigger new creative ideas (Kemdikbud, 2013). Isnaini (2016) argued that to solve problems, creative thinking is needed to develop students' imaginations and to avoid single and uniform answer of students. This skill is needed to develop human in solving various faced problems in daily lives (Wahyuningtyas et al, 2020). According to Munandar (in Warda et al, 2017), creative thinking skill covers four aspects: fluency, reliability, originality, and elaboration.

This skill is important in learning mathematics. However, in reality, the skill has not been mastered well by Indonesia students (Happy & Widjajanti, 2014). It also happened at SMA N 1 Sumpiuh. The students' creative thinking skills were still low. It was based on preliminary study about mathematics creative thinking skill done at the school and it was found average score 63.96. The students still had difficulties in solving the questions with different correct method. They also could not solve problems by using new uncommon or different methods.

This low mathematics creative thinking skill is caused by several factors, one of them is the applied learning process. Mathematics learning should involve students actively and facilitate them to use their creative thinking skills (Saironi & Sukestiyarno, 2017). One of the expected learning to improve mathematics creative thinking of students is probing-prompting learning with open-ended approach. According to Alfian et al. (2017) probing-prompting by using scaffolding strategy was effective toward mathematics creative thinking skill of students. It is also in line with Fatah et al. (2016) open-ended approach was effective toward mathematics creative thinking skill, even for primary school students.

Probing-prompting is a learning by having the teacher presents several guiding and eliciting questions so thinking process to connect student knowledge to current new learned knowledge to occur (Suherman in Huda, 2013). Open-ended is a learning approach presenting a problem which has more than one answer or solution (opened problems). Probing-prompting learning with open-ended approach is expected to ease student mathematics creative thinking.

Besides cognitive aspect, affective aspect is also required as 2013 curriculum demand which requires students to have 3 aspects: cognitive, affective, and psychomotor aspects (Purwasih et al, 2018). Mullis (Miliyawati, 2014) revealed that there was positive correlation between attitudes and mathematics achievements. One of affective aspects in learning mathematics is mathematical habits of mind.

According to Costa and Kallick (2008), habits of mind are characteristics of what is done by a smart individual while being faced in a problem in which the solution is not known easily. Mathematical Habits of mind are essential mathematics disposition which must be owned and developed by students whom learn high order thinking skill (Hendriana et al, 2017). According to Cuoco (in Hendriana et al., 2017), mathematical habits of mind are the habits of thinking done by mathematicians in dealing with mathematical problems. Habits of mind is also a cognitive framework or pattern that is useful as a guide for someone to think, act, and behave when responding to a situation. Moreover, according to

Marzano (1992) habit of mind is one of the five dimensions of learning, namely: (1) positive Attitude and Perceptions about learning; (2) Acquiring and integrating Knowledge; (3) Extending and Refining Knowledge; (4) Using Knowledge Meaningfully; (5) productive Habits of Mind. After that, Marzano (1992) categorized habits of mind into three groups, those are: self-regulation, critical thinking dan creative thinking.

Furthermore, according to Costa dan Kallick (2008) habits of mind identified in 16 characteristics, those are: (1) Persisting; (2) Managing Impulsivity; (3) Listening to Others-With Understanding and Empathy; (4) Thinking Flexibly; (5) Thinking about our Thinking (metacognition); (6) Striving for Accuracy and precision; (7) Questioning and Posing Problems; (8) Applying past Knowledge to New Situation; (9) Thinking and Communicating with Clarity and Precision; (10) Gathering Data through All Senses; (11) Creating, Imagining, Innovating; (12) Responding with Wonderment and Awe; (13) Taking Responsible Risk; (14) Finding Humor; (15) Thinking Interdependently; (16) learning continuously.

The problem formulations of this research are (1) is probing-prompting with open-ended approach effective to mathematics creative thinking of the students? and (2) how is the description of students' mathematics creative thinking skills reviewed by habits of mind on probing-prompting learning with open-ended approach?

METHOD

This research is a mixed method. The combination design used in this research is concurrent embedded. It is a combined research methods, unequally between quantitative and qualitative (Sugiyono, 2015). In this research, the quantitative research method was used as primary method while the qualitative method was as secondary method.

This research was conducted at SMA N 1 Sumpiuh, in academic year 2019/2020. The population consisted of X graders. The samples were taken based on random sampling and resulted to X Science 3 as experimental group and X Science 6 as

control group. The subjects consisted of seven selected students based on high, moderate, and low habits of mind.

The qualitative data collection technique was test. The developed mathematics creative thinking skill test was in the form of 4 essay questions. The questions were created by considering mathematics creative thinking skill indicators. The techniques of collecting qualitative data were habit of mind questionnaire, interview, documentation, and observation. The questionnaire consisted of 16 indicators with 32 questions. The quantitative data analysis was done by normality, homogeneity, individual and classical accomplishment, variance difference and proportion difference tests. The qualitative data analysis used Miles and Huberman (1984) as the references by following these stages: (1) data reduction, (2) data display, and (3) data conclusion.

FINDING AND DISCUSSION

The quantitative part of the research was done to find out effectiveness of probing-prompting learning with open-ended approach toward the students' mathematics creative thinking skills. The results of initial mathematics creative thinking skill of the students resulted to Actual Accomplishment Standard as calculated by $\bar{X} + \frac{1}{4} SD$ with \bar{X} which is the class average and SD is the deviation standard (Sudjana, 2009). The result of accomplishment standard of mathematics creative thinking skill of the students consist of 67 with $\bar{X} = 63,96$ and $SD = 11,75$.

After conducting research and analyzing the data, the results showed that (1) the average accomplishment of experimental group showed that $t_{count} > t_{table} = 4,866 > 1,699$, then H_0 was accepted. It means mathematic creative thinking skill average of the students taught by probing-prompting learning with open-ended approach was higher than 67, (2) the results of proportion test of mathematics creative thinking skill showed that $z_{count} > z_{table} = 1,897 > 1,64$, then H_0 was denied. It means mathematic creative thinking skill accomplishment proportion of the students taught by probing-prompting learning with open-ended

approach was higher than 75%, (3) the results of proportion test of mathematics creative thinking skill showed that $t_{count} > t_{table} = 2,966 > 1,671$, then H_0 was denied. It means average of mathematics creative thinking skill of the students taught by probing-prompting learning with open-ended approach was higher than expository, and (4) the proportion test result showed that $z_{hitung} > z_{tabel} = 1,936 > 1,64$, then H_0 was denied. It means mathematics creative thinking skill accomplishment score of the students on probing-prompting learning with open-ended approach was higher than those taught by expository. This research showed that probing-prompting learning with open-ended approach was effective to mathematics creative thinking of the students.

On qualitative data analysis, the findings showed from 30 students of experimental group, there were 5 of them categorized high habits of mind. The details are: students with high MCTS consisted of 2 persons while moderate MCTS consisted of 3 persons. There were 21 students categorized as moderate habits of mind. The details are: students with high MCTS consisted of 2 persons, moderate MCTS consisted of 17 persons, and low MCTS consisted of 2 persons. There were 4 students categorized as low habits of mind. The details are: students with moderate MCTS consisted of 3 persons and low MCTS consisted of 1 person. The detailed information could be seen on Table 1.

Table 1. Classification of MCTS Reviewed by Habits of Mind

Habits of Mind Categories	MCTS	
	Students' Numbers	Categories
High	2	High
	3	Moderate
Moderate	2	High
	17	Moderate
	2	Low
Low	3	Moderate
	1	Low

Then, to analyze the students' mathematics creative thinking skills, seven subjects were chosen based on high, moderate, and low categories of habits of mind. The qualitative data analysis showed

that mathematics creative thinking skills of the students reviewed by habits of mind were varied: (1) students with high habits of mind and high MCTS met all indicators of mathematics creative thinking skill, such as fluency, flexibility, originality, and elaboration; (2) students with high habits of mind and moderate MCTS met three indicators, such as fluency, flexibility, and elaboration; (3) students with moderate habits of mind and high MCTS met all indicators, such as fluency, flexibility, originality, and elaboration; (4) students with moderate habits of mind and moderate MCTS met three indicators, such as fluency, originality, and elaboration; (5) students with moderate habits of mind and low MCTS met only one indicator - fluency; (6) students with low habits of mind and moderate MCTS met two indicators, such as fluency and originality, and (7) students with low habits of mind and low MCTS met only one indicator, fluency.

Probing-prompting learning with open-ended approach is expected to ease student mathematics creative thinking. It is in line with Alfian et al. (2017) and Sulistyawati et al. (2018) probing-prompting by using scaffolding strategy was effective toward mathematics critical thinking skill. Probing-prompting also influenced student mathematics creative thinking (Usmiati et al., 2018). According to Firdaus et al. (2016) and Prasetyowati & Dwijanto et al. (2019), open-ended approach could improve student mathematics creative thinking skill. It is also in line with Fatah et al. (2016) open-ended approach was effective toward mathematics creative thinking skill, even for primary school students.

Probing-prompting with open-ended approach provide discretionary to students to obtain knowledge, experience, recognition, finding and solving problems in various ways. Probing-prompting learning open-ended approach trained students to learn actively in learning process to reconstruct their knowledge. This research showed that probing-prompting learning with open-ended approach could be used to improve mathematics creative thinking of the students.

CONCLUSION

Based on the results and discussion, it was concluded that probing-prompting learning with an open-ended approach is effective for student's mathematics creative thinking skill. The mathematics creative thinking skill of students reviewed in terms of various habits of mind. A student with high habits of mind may not necessarily have high mathematics creative thinking skills. There are students with high habits of mind who have moderate mathematics creative thinking skills. There is a student with moderate habits of mind also may not necessarily have moderate mathematics creative thinking skill. There is a student with moderate habits of mind who has high and low mathematics creative thinking skill. Likewise, student with low category of habits of mind does not necessarily have low mathematics creative thinking skill. There is a student with low habits of mind who has moderate mathematics creative thinking skill.

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