An Analysis of Students’ Creative Thinking Skill in Creating Open-Ended Mathematics Problems Through Semi-Structured Problem Posing

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Abstract. This study aims to analyze how students of Mathematic Education study program in one of tertiary education providers in Salatiga Regency, Indonesia, creates open-ended problems via semi-structured problem posing. A qualitative descriptive method was employed to study a population of research subjects that had been selected through a stratified random sampling based on their academic ability level. As many as 30 students were categorized into Upper Level Academic ability (AA), Average Level Academic Skill (AS), and Lower Level Academic Skill (AB). Three students from each category: AA, AS, AB, were randomly selected as the research subjects. Their creative thinking skills were measured by the number of problems, strategies, and variations of open-ended problems and its solutions that had been created by students as representations of creative thinking aspects: fluency, flexibility, originality and elaboration. Results show that AB students had under developed creative thinking skills, while AS students began to develop their creative thinking skills, and AA students demonstrated their developed creative thinking skills.

1. Introduction
Thinking skills consist of the ability of memorizing, basic thinking, critical thinking, and creative thinking [1]. Competencies in implementing learned knowledge in solving problem and capabilities in applying new strategies to solve problems serve as attributes of students with creative thinking skill [2]. Aspects of creative thinking skills include fluency, flexibility, originality, and elaboration [3, 4].

It is crucial to train creative thinking skills as part of students’ ingenuity to face the global competition. Indonesian Law on national education system addresses the importance of creative thinking skill training for the undergraduate students by stating that education system should develop students’ potential to become religious, honorable, well educated, and competent in thinking creatively, independent, democratic, and responsible students. While empirical studies indicate that Indonesian students have unsatisfactory creative thinking skills [5, 6].

As a subject, mathematics has a potential to develop student’s creative thinking skills. Mathematical creative thinking involves cognitive process of applying mathematical procedures. Mathematics is described as the result of logical processes enriched with problem solving activities. Mathematical problem solving methods are diverse and varied; as a consequence, the subject would improve students’ creative thinking skills [2]. However, conventional mathematic education in Indonesia tends to be dominated by mathematical problem solving activities with single alternative of
correct answer. Teachers are conventionally conform to one procedural and correct answer, despite knowing the possibilities of assisting students to explore alternative ways to the correct answer, as a result, students’ creative thinking skills are still not empowered [7]. Undergraduate students are not accustomed to search for as much as possible correct solving for a single problem.

One of mathematical learning enhancing students’ creative thinking skill is the open-ended learning [8]. The open-ended teaching drives students to explore their ability to solve mathematical problems through varied methods to reach correct solution [9]. Five dimensions for achieving students’ creative thinking skill empowerment are: (1) attitude and perception, (2) acquire and integrate knowledge, (3) extent and refine knowledge, (4) apply knowledge meaningfully, and (5) habits of mind. As a dimension, the habits of mind, is the highest dimension that contains three high level cognitive skills, which are critical, creative, and self-regulated.

In order to optimize the training of students’ creative thinking skills, open-ended activities could be integrated with semi-structured problem posing. Students will be given a particular theme of mathematical concepts, then be instructed to find problems and its problem solving within the theme given. Not only students are required to solve open-ended tasks conventionally, but they are also being guided with problem posing steps. This method ensures students’ open-ended activities in finding numerous of problems, strategy, and variations of correct answers in a better-planned way. Open-ended learning through semi-structured problem posing is considered capable of maximizing students’ creative thinking skills. Previous studies on creative thinking skills empowerment towards students tend to apply a single learning method such as a problem based learning and an open-ended learning, while integrated method combining more than one learning strategies were rarely found [10, 11].

2. Research Problem
The research question was: How are undergraduate students’ creative thinking skill in formulating problems of equation and slope of line concepts in open-ended problem through semi-structured problem posing?

3. Method
This is a qualitative descriptive research. Qualitative descriptive analysis was used to portray quality of students’ problem formulation variations as representations of their creative thinking skills. The research was conducted from August to September 2017.

3.1. Subjects of Research
The population of research subject was selected from stratified random sampling based on the level of academic capability. As many as 30 semester 5 undergraduate students of Mathematic Education in one of tertiary education in Salatiga, Indonesia, were classified into three groups of upper (AA), moderate (AS), and lower (AB) academic capability based on their previous semester GPA.

Students were categorized by their score: AA students were ones with A- and A mark, whose score range from 8.1 to 100, while AS students had either B-, B, dan B+ mark, whose score range from 7.1 – 8.0, and AB students had either C-, C, dan C+ mark, whose score range from 6.1 – 7.0. Three students from each group then were taken randomly as research subjects, resulting total nine research subjects from AA, AS, and AB students.

3.2. Instrument and Procedures
The research instruments consisted of, (1) Stimulation of open-ended problem phenomenon using the concepts of equation and slope of line, (2) Rubric of assessment of students’ creative thinking result, (3) Rubric of problem complexity created by students, and (4) Interview guide about students’ problems discovering processes. Problem Stimulation in the form of a straight line concept phenomenon which was able to reveal students’ creative thinking skill aspect comprehension. The rubric of creative thinking assessment is developed by [4] with indicators of creative thinking aspects such as fluency, flexibility, originality and elaboration. The fluency aspect was measured by the
students' ability to generate many ideas when they were solving the problem. While the flexibility aspect was measured by the students' ability to generate different ideas in solving the problem. Further, the aspect of originality was measured by the students' ability to provide original solutions for solving problems. Last but not least, the elaboration aspect was measured by the students' ability to expand their ideas. The rubric of problem complexity, which was created by the students were categorized based on its difficulty level of the problem made by the students. Interview guidelines were used to reveal how the students' creative thinking processes have not been revealed in the students’ paperwork.

The research procedures were as follow: (1) Students were given stimulations from an open-ended task about the phenomenon from the concept of straight line; (2) Students, by using semi-structural problem posing, were asked to formulate the line equation as many as possible, to calculate the slope of the line, to find the difference among line equations, and to find the equation of line along with its slope if the line was shifting and/or rotating; (3) The students solved the open-ended problem about the concept of a straight line during the four meetings, in which the 1st and 2nd meetings were about the equation of lines and 3rd and 4th meeting were about the slope of the line; (4) In-depth interviews about the students' creative thinking process were further conducted during the learning process, and; (5) The students’ paperworks in finding open-ended problems were assessed by using the rubric of creative thinking skill and the rubric of problem complexity to analyze aspects of the research subjects’ creative thinking skills developments.

3.3. Data Analysis
The data were analyzed descriptively to reveal the variation of problems generated by all of the AA, AS, and AB students, the empowerment of AA, AS, and AB students’ creative thinking aspect, and also the complexity of the problems generated by AA, AS, and AB students. In addition, a qualitative analysis of developing creative thinking skills process from AA, AS, and AB students was conducted. The qualitative analysis were conducted by observing the depth of students’ creative thinking aspects including fluency, flexibility, novelty, and elaboration.

3.4. Results of Research
Data on problem variations, aspects of creative thinking, and the complexity of problems generated by AA, AS, and AB students through the open ended problem solving activities integrated with semi-structured problem posing were visualized in Table 1.

Table 1. Variations of open-ended problems created by students in semi-structured problem posing

| Students’ Academic Ability | Variety of Problems Made by Students | Categorization by Creative Thinking Aspects | Problem Complexity (Scale 1 – 4) |
|----------------------------|-------------------------------------|---------------------------------------------|---------------------------------|
| AB                         | What does it mean by line equation? | Fluency 1                                  |                                 |
|                            | What is the meaning of gradient?    |                                              |                                 |
|                            | Decide the gradient of the following line equation! |                                              |                                 |
|                            | Determine the line gradient through the following points: |                                              |                                 |
|                            | Are line $5x + 2y = 3$ and $10x = 2 - 4y$ parallel? |                                              |                                 |
|                            | Describe linear inequalities: (a) $4x + 2y < 8$ and (b) $3x - 5y >15$. |                                              |                                 |
Students’ Academic Ability

Variety of Problems Made by Students

Categorization by Creative Thinking Aspects

Problem Complexity (Scale 1 – 4)

AB, AS

- Draw the graph of the line equation
  \[ y = 3x + 3 \]

- Determine the straight-line equation that goes through the point (2, 1) with the line gradient \( \frac{1}{2} \).

- Determine the equation of the straight line which goes through the points (4, 2) and (-1, -4).

- Find the equation of the tangent on the curve
  \[ y = x^2 - 3x \]
  at the point (1, 2).

- The line equation which goes through the point (5, 6) with \( m = 8 \) is ....

- The tangent curve equation \( y = 8x + 5 \) at the point with absic 3 is ....

AS, AA

- Determine the line gradient on the following graph.

- Determine the equation of the line that goes through the point (3, 1) and parallel to the line
  \[ y = 2x + 5 \].

- From the line equation \( y = 2x + 3 \), draw the graph, then what happens to the graph if the gradient is changed into 1?

Fluency
Flexibility
Originlity
Elaboration

Data distribution and the allocation of creative thinking aspects of AA, AS, and AB students on each learning meeting were visualized in Table 2.

Table 2. Distribution of creative thinking aspects of AA, AS, and AB students based on the number of problems found.

| S  | SSA | Meeting 1 | Meeting 3 |
|----|-----|-----------|-----------|
|    |     | Line      | The Slope of Line |
|    |     | Flu | Flex | Ori | Ela | Flu | Flex | Ori | Ela |
| A  | A   | 3   | 3   | 4   | 6   | 2   | 2   | 3   | 3   |
| B  | A   | 4   | 3   | 5   | 5   | 2   | 2   | 3   | 4   |
| C  | A   | 3   | 4   | 4   | 5   | 2   | 3   | 3   | 3   |
| TOTAL | 10 | 10 | 13 | 1 | 6 | 7 | 9 | 10 |
| D  | AS  | 4   | 4   | 0   | 0   | 1   | 2   | 0   | 0   |
| E  | AS  | 5   | 3   | 0   | 0   | 2   | 2   | 0   | 0   |
| F  | AS  | 4   | 5   | 0   | 0   | 2   | 3   | 0   | 0   |
| TOTAL | 13 | 12 | 0 | 0 | 5 | 7 | 0 | 0 |
| H  | AB  | 3   | 0   | 0   | 0   | 1   | 0   | 0   | 0   |
| I  | AB  | 3   | 0   | 0   | 0   | 1   | 0   | 0   | 0   |
| J  | AB  | 2   | 0   | 0   | 0   | 0   | 0   | 0   | 0   |
| TOTAL | 8 | 0 | 0 | 0 | 2 | 0 | 0 | 0 |

Explanation

S : Subject
SSA : Students’ Academic Ability
Flue : Fluency
Flex : Flexibility
Ori : Originality
Ela : Elaboration

Table 1 shows that the problem variations generated by AB students were diverse; this indicates that AB students' creative thinking skills in the fluency aspect had been developed. However, other aspects of creative thinking skills such as flexibility, originality and elaboration had not yet developed in AB students. Problems generated by AB students had a low complexity. The problems generated by AB students were more on the cognitive level questions; this indicated that AB students had not fully understood the concept of equation and the slope of the line.

Table 1 also indicates the varied problems produced by AS students, further, the problems generated had demanded high comprehension completions, for instance, the problem "Draw the graph of the line equation \( y = 3x + 3 \); The tangent curve equation \( y = 8x + 5 \) at the point with abscis 3 is...". These problems indicates that two aspects of creative thinking skills of AS students, which are fluency and flexibility, have been developed. Although it is also evidenced that the originality and elaboration aspects are not developed yet. AS Students had produced problems with higher complexity than AB students, showing that AS students have better comprehension of the line equation concept compared to the AB students.

Table 1 further demonstrates that along with diversified problem variations, AA students had created problems that demands higher comprehension problem solving, the generated problems required solutions with expanded ideas and extended original completions, for instance, the problem "from the equation of line \( y = 2x + 3 \), draw the graph, then what happens to the graph if its gradient is changed into 1?". These formulated problems indicate that all aspects of AA students' creative thinking skills such as fluency, flexibility, originality and elaboration have been well developed. Problems generated by AA students had the highest complexity compared to AB and AS students. It is evidenced that AA students had mastered the concepts of line equation and the slope of the line.

Table 2 exhibits the problems generated by AB students were mainly derived from the fluency aspect, whereas the problems formed from other aspects, such as flexibility, originality, and elaboration both on the equation of the line and the slope of the line had not been created. This indicates that the AB students' creative thinking ability had not fully developed yet. Meanwhile, the problems generated by AS students have showcased the mastery of fluency and flexibility aspects of creative thinking skills, while problems demonstrating the cognitive aspects proficiency of originality and elaboration were not found. This indicates that AA students' creative thinking skills have begun to develop compared to AB students. The number of problems generated by AA students had included the aspects of creative thinking such as fluency, flexibility, originality and elaboration, both on the concept of line equation and the slope of the line. These findings indicate that AA students have had developed their creative thinking skills.

The individual interviews with research participants who were consecutively referred to as AA subjects (A, B, and C), AS subjects (D, E, and F), and AB subjects (G, H, and I) deduces that: A, B, and C had followed open-ended with semi-structured problem posing learning well. The open-ended problems formulated by A, B, and C were varied from problems provided by the book. They also provided diversified problem solving formulations with more than one correct answer. The problems formulated had demonstrated their comprehension of previous learning experiences and of their surrounding environment.

Students D, E, and F had experienced difficulties in learning the open-ended with semi-structured problem posing. While the students could formulate open-ended problems containing aspects of fluency and flexibility, the problems were unvaried, both in terms of problem solving strategy and problem variant. Partially, the open-ended problems generated by D, E, and F were similar with either their reference books or problems they had learned before. D, E, and F failed to create problems stimulating individuals to better understanding of the concepts of equation and slope.
of the line. The students were doubtful that their generated open-ended problems were feasible to be solved by others. This could be seen from the frequency of erasing and rewriting problems that they made. Their level of confidence had not been fully emerged, the time spent to find problems and the completion was relatively longer than the A, B, and C students. G, H, and I had also been struggling in formulating the open-ended problems. Their abilities in thinking creatively were limited to the fluency aspect. G, H, and I assumed that they did not know what problems they should make. This was because the students did not understand the concept of equation and the slope of the line, there were many concepts that had been studied but have not been understood by G, H, and I. The students failed to generate open-ended problems, and the problems they had created were not included as part of equation and/or the slope of the line concepts. In other word, the students could not distinguish concepts of equation and the slope of the line from other concepts in mathematics. Not only that the problems they made were imitation of the existing problems in the reference books, but they also failed to generate the problem solutions. G, H, and I did not have much handwriting in the provided opaque papers. Most of the time given was spent by G, H, and I to be in silent, or turning their heads to the left and right.

4. Discussion

The findings indicate the gap in creative thinking skills amongst AA (subject A, B, and C), AS (subject D, E, and F), and AB (subject G, H, and I) students who were taught the open-ended learning through semi-structured problem posing. AB students’ creative thinking skill were limited to the fluency aspect, whereas AS students’ were limited to fluency and flexibility aspects, while AA students have fully developed creative thinking skills. These indicate that open-ended learning through semi-structured problem posing is less applicable to minimize the creative thinking skills gap amongst AA, AS, and AB students.

These findings contrast with the previous research results, which had proved that open-ended learning and problem posing are able to empower students' creative thinking skills [9, 12]. Previous research focused on students in the class group treatment without considering the existing individual distinction such as variations in students’ academic ability. This study confirms that, although open-ended learning and problem posing are able to empower students' creative thinking skills, it failed in minimizing the creative thinking skill gap amongst AA, AS, and AB students. In other word, students with high level of academic skills will earn better comprehension, while students with low academic skills will be indifferent.

The creative thinking skills gap amongst AA, AS, and AB students, who were learning to formulate questions and answers of open-ended through semi-structured problem posing, is caused by the domination of competitive learning and less encouragement of mastery learning. Considering mastery learning, if students were normally distributed based on their academic abilities in the classroom, then they are given the same quality and study time, then the students’ learning outcomes will be distributed according to their academic abilities, thus, learning outcome gap between AA, AS, and AB students would emerged. Conversely, if students were normally distributed based on their academic ability in the classroom, and are given time allocation based on their needs, then the learning outcomes gap amongst AA, AS, and AB students could be minimized [13-15].

In open-ended learning through semi structured posing problem students were normally distributed based on their academic ability in the class. Then, they were given the same teaching quality and study time allocation; consequently, the research findings demonstrated the gap of creative thinking skills amongst AA, AS, and AB students. This gap in open-ended learning through semi-structured problem posing was also caused by the individualized learning, which excludes social interaction and peer discussions amongst students. Individual learners are more prone to distress and are easily stuck and feeling hopeless, especially when being given with difficult problems [16]. As a result, AA students were showing better performance, while, AB students were becoming more passive, causing unprogressing academic achievements and failing in empowering their creative thinking skills. Other factors contributing to the gap in the creative thinking skills amongst AA, AS, and AB students are the
diversed initial knowledge/learning readiness, as students with minimal initial knowledge were mostly found to be experiencing difficulties in creating open-ended problems through semi-structured problem posing. This argument is supported by [17] which states that competitive learning were less able to facilitate students with costumed learning time allocation, causing the learning outcomes gap between upper and lower academic students.

This study confirms research statement of [18] that by creating problems using semi-structured problem posing, students are able to express their ideas and perceptions in various means and to learn in fun ways. The opportunity to develop varied ideas and to create fun learning environment serve as the basis to improve the four aspects of students’ creative thinking skills: (1) fluency, (2) flexibility, (3) originality, and (4) elaboration [4]. In addition, some researchers recommends the application of inquiry learning in order to encourage students to be actively involve in the thinking skills exploration and empowerment processes [7]. Through the efforts in finding open-ended problems via semi-structured problem posing, students have numerous opportunities to generate ideas, to plan, to find solution, to argue, and to develop their creativity [18, 19].

The contribution of the open-ended learning model towards the improvement of students' mathematical creative thinking skills is also facilitated by semi-structured problem posing, in line with the nature of students’ mathematical creative thinking empowerment [7]. The activity of finding open-ended problem through semi-structured problem posing also forms the basis of open-ended learning [20]. The problem finding involves forming students’ mathematical creative thinking skills, in order to find answers or problems with or without guidance from teachers. Mathematical activities, rule or relationship discoveries implementing students’ knowledge, observation, when applied to solve open-ended problems would encourage students’ creative expression and influence their competencies in creative problem solving.

In addition, the discovery of mathematic rules and relationships employing correct students’ knowledge stimulates students to think creatively, provides students with opportunities to learn mathematical concepts by exploring questions and its answers. Further, it also assists students to learn in fun ways, supports them to gain in-depth comprehension of material concepts, and help them to exercise their mathematical creative thinking [21].

The combination of open-ended learning and semi-structured problem posing in mathematic teaching have significant contribution in improving mathematical creative thinking. It is argued that the integration of open-ended problem finding through semi-structured problem posing would facilitate students in managing and understanding information effectively and systematically. The ability to manage and to comprehend information are keys to reach aspects of creative thinking [19-20].

The process of problem finding through semi-structured problem posing serves as an ideal technique to train individuals’ mathematical creative thinking skills [10]. This is due to the assumption that human mind map utilizes all cognitive skills, particularly skills of imagination, connecting ideas, and flexibility. [9] state that the application of open-ended problems helps students to create relationships between information of previous concepts and materials being learned. [21] also argues that students using semi-structured problem posing could remember, organize, and frame the reflection of their learning experiences better. The implementation of open-ended learning through semi-structured problem posing are supported by previous research conducted by [21, 4], and [6]. Other research proves that creative thinking skills could be improved through proper learning approach, in accordance to students’ condition.

5. Conclusions
The findings conclude that AB and AS students' creative thinking skills in using open-ended learning through semi-structured problem posing have not been well developed. The creative thinking skills developed in AB students are limited to the fluency aspect, while the creative thinking skills that develop in AS students are limited to the aspects of fluency and flexibility. Interviews to AB and AS students concluded that students had difficulty in open-ended learning through semi structured
problem posing. Different findings emerged in AA students, as they did not have difficulties in following instructions from open-ended learning through semi-structured problem posing strategy. Open-ended learning through semi-structured problem posing has capability in developing all aspects of AA students’ creative thinking skill.

A number of previous studies have shown that open-ended learning and problem posing have the ability in empowering students’ creative thinking skills. This study confirms that even open-ended learning and problem posing are able to empower students' creative thinking skills, but it have not been able to minimize the creative thinking skills gap amongst AA, AS, and AB students. A research on the empowerment of creative thinking skills using other learning strategies is advised in order to diminish the creative thinking skills gap amongst AA, US, and AB students.

References
[1] Muglia, S., Saiz, C., Rivas, S. F., Maria, C., Vendramini, M., Almeida, L. S., Franco, A. (2018). Creative and Critical Thinking: Independent or Overlapping Components?. Thinking Skills and Creativity, 27(1), 114–122. https://doi.org/10.1016/j.tsc.2017.12.003
[2] Nadjafikhah, M., & Yaftian, N. (2013). The Frontage of Creativity and Mathematical Creativity. Procedia Social and Behavioral Sciences, 90, 344–350. https://doi.org/10.1016/j.sbspro.2013.07.101
[3] Huang, P., Peng, S., Chen, H., & Tseng, L. (2017). The Relative Influences of Domain Knowledge and Domain-General Divergent Thinking on Scientific Creativity and Mathematical Creativity. Thinking Skills and Creativity, 25(48), 1–9. https://doi.org/10.1016/j.tsc.2017.06.001
[4] Zubaidah, S., Fuad, N. M., Mahanal, S., & Suarsini, E. (2017). Improving Creative Thinking Skills of Students Through Differentiated Science Inquiry Integrated with Mind Map. Journal of Turkish Science Education, 14(4), 77–91. https://doi.org/10.12973/tused.10214a
[5] Fitriani, D., Kaniawati, I., & Ramalis, T. (2017). Creativity of Junior High School’s Students in Designing Earthquake Resistant Buildings. Journal of Physics: Conference Series, 895, 1–8.
[6] Yusnaeni, Corebima, A. D., Susilo, H., & Zubaidah, S. (2017). Creative Thinking of Low Academic Student Undergoing Search Solve Create and Share Learning Integrated with Metacognitive Strategy. International Journal of Instruction, 10(2), 245–262. Retrieved from http://www.e-iji.net/dosyalar/iji_2017_2_16.pdf
[7] Apino, E., & Retnawati, H. (2017). Developing Instructional Design to Improve Mathematical Higher Order Thinking Skills of Students. Journal of Physics: Conference Series, 812, 1–8. https://doi.org/10.1088/1742-6596/755/1/01100
[8] Surif, J., Ibrahim, H., & Dalim, F. (2014). Problem Solving: Algorithms and Conceptual and Open-Ended Problems in Chemistry. Procedia Social and Behavioral Sciences, 116: 4955-4963. https://doi.org/10.1016/j.sbspro.2014.01.1055
[9] Ramaraj, A., & Nagammal, J. (2016). Investigating The Creative Processes and Outcomes of an Open-Ended Design Task: A Qualitative Study on Two Days Practicum for Architecture Students. Thinking Skills and Creativity, 21, 1–8. https://doi.org/10.1016/j.tsc.2015.11.005
[10] Aydoğdu, B., Buldur, S., & Kartal, S. (2013). The Effect Of Open-Ended Science Experiments Based on Scenarios on The Science Process Skills of The Pre-Service Teachers. Procedia Social and Behavioral Sciences, 93, 1162–1168. https://doi.org/10.1016/j.sbspro.2013.10.008
[11] Gholami, M., Moghadam, P. K., Mohammadipoor, F., Tarahi, M. J., Sak, M., Toulabi, T., & Pour A. H. H. (2016). Comparing The Effects of Problem-Based Learning and The Traditional Lecture Method on Critical Thinking Skills and Metacognitive Awareness in Nursing Students in a Critical Care Nursing Course. Nurse Education Today, 45, 16–21. https://doi.org/10.1016/j.nedt.2016.06.007
[12] Yusuff, K. B. (2015). Does Self-Reflection and Peer-Assessment Improve Saudi Pharmacy Students’ Academic Performance and Metacognitive Skills? Saudi Pharmaceutical Journal,
[13] Ozden, M. (2008). Improving Science and Technology Education Achievement using Mastery Learning Model. *World Applied Sciences Journal*, 5(1), 62–67. Retrieved from http://idosi.org/wasj/wasj5(1)/10.pdf

[14] Prayitno, B. A., Corebima, D., Susilo, H., Zubaidah, S., & Ramli, M. (2017). Closing The Science Process Skills Gap between Students with High and Low Level Academic Achievement. *Journal of Baltic Science Education*, 16(2), 266–277. Retrieved from http://www.scientiasocialis.lt/jbse/files/pdf/vol16/266-277.Prayitno_JBSE_Vol.16_No.2.pdf

[15] Shafie, N., Norainun, T., Shahdan, T., & Shahir, M. (2010). Mastery Learning Assessment Model in Teaching and Learning Mathematics. *Procedia - Social and Behavioral Sciences*, 8: 294–298. https://doi.org/10.1016/j.sbspro.2010.12.040

[16] Suastika, K. 2017. Mathematics Learning Model of Open Problem Solving to Develop Students Creativity. *International Electronic Journal of Mathematics Education*. 12 (6), 569-577.

[17] Prayitno, B. A., & Suciati. (2017). Narrowing The Gap of Science Students’ Learning Outcomes Through INSTAD Strategy. *The New Educational Review*, 50(4), 123–131. https://doi.org/10.15804/tner.2017.50.4.10

[18] Michalopoulou, A. (2014). Inquiry-Based Learning Through The Creative Thinking and Expression in Early Year Education. *Creative Education*, 5, 377-385

[19] Li, Y., & Li, D. (2009). Open-Ended Questions and Creativity Education in Mathematics. *Journal of the Korea Society of Mathematical Education Series D: Research in Mathematical Education*, 13(1), 23-30.

[20] Mihajlovic. (2015). Open-Ended Problems and Problem Posing in Elementary Mathematics Classroom. *The 9th IMCGC*, Sinaia, Romania.

[21] Abu-Elwan. Reda. (1999). The Development Mathematical Problem Posing Skills for Prospective Middle School Teacher.In A. Rogerson (Ed.) *Proceeding of International Conference Mathematical Education into the 21" Century: Sosial Challenge, Issue and Approaches*, (Vol.II, pp: 1-8), Cairo, Egypt.