Creativity of Secondary Mathematics Teacher within Solve the 2-Dimensional Figure Problem Based On Teaching Experiences

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Abstract: Creativity is an ability produced from the cognitive activities to get ideas in solving problems by combining the concepts that have been mastered to mark by fluency, flexibility, novelty, and elaboration. This study aims to get description about the creativity of the junior mathematics teachers and senior mathematics teachers on the problems on plane figures. This study is an explorative study with qualitative approach. The instruments used in this study are the researcher itself as the main instrument supported with the written assignments on the problems on plane figures, and the valid and reliable interview guidelines. Data collection was conducted by doing task-based interviews. There are two subjects in this study which are junior mathematics teachers and senior mathematics teachers. The result of this study shows that junior secondary mathematics teachers in solving the problems on plane figures more creative than senior secondary mathematics teachers in the aspect of fluency, flexibility, novelty, and elaboration.

1. Introduction
Creativity is a term that can’t be released from human life every day, for example a great farmer think about how to solve his problem, that is process the waste material so it can be used by the other lifes around him. Then, creativity is also a word that always follows an artistic masterpieces or a new science invention or unreal innovative product, for example Basuki Abdulah’s painting, creating electric car and or the others. Sometimes creativity is defined as an exceptional ability that brought from born or obtained when adult, especially for artists and scientist ([1]:16).

Creativity is defined different by many experts according to each viewpoint. Alexander [2] defined creativity as a mentality process that involve creation of a concept and new ideas, or seeing the new relation between every concept and ideas that has been exist. In line with the above opinion, Munandar [3] explained that creativity is an ability to seeing many solution to a problem possibility. Furthermore, Semiawan ([4]:7) also explained that creativity is an ability to give new ideas and apply it in problem solving. Based on that some opinion, basically creativity is a person ability to produce something new, both in new creation or combination with some things that has been exist.

If we examine the meaning of creativity above, then everyone could be a creative human. The result showed that style of parents in raised their child and house environment play an important role to stimulate creativity ([1]:55). Effort to cultivate the creativity in school as described in Constitution Number 20 Year 2003 ([5]:4), about National Education System, explained that national education aims to develop potential learners to be a human who is faithful and devoted to God Almighty, noble, healthy, knowledgeable, capable, creative, independent and become a democratic state citizen, and
responsible. To make one of those national educational purpose reached, i.e. to develop learners ability or potential became a creative human, educational process need to pay attention how to improve learners creative thinking by not only emphasizing upgrading to get ideas, but also encourage the desire and develop bravery to do it.

Besides, in Ministerial Regulation Number 41 ([6]:6) about Standard Process also mentioned that learning process in every units of primary and secondary education must be interactive, inspiring, delightful, challenging, and motivating the learners to actively participate and provides enough space for initiatives, creativity, and independence in accordance with talent, interest, physical, and psychological development of learners. But according to observation in the field, found that the most learning process, especially math, still not yet develop student creativity. It was because generally the teacher only emphasizing the quantity of the math not the quality of math.

Based on the description above can be concluded that the emphasis in education develops student creativity through educational process. To reach it, education system also must be conditioned to build character of the student that could raise student creativity. Teacher has a very important role in order to realize the aims of national education, one of those is creative student.

According to some theories, everyone has a creative ability, but most people don’t know how to become creative. According to Evans [7], latest study showed that people can be taught to be more creative. As well as Sebastian’s opinion, creativity doesn’t appear because of genetic, but because of habit and skill which can be trained and developed. It is shown through Sebastian’s experience in dozen years leading some company, apparently the result of workers personality for IQ rarely change but in work attitudes and creativity can be raised after honed. Beside that, Weisberg ([1]:17) explained that “creativity rooted in past experience and sourced in the same process of thinking which we all use everyday”. Both of that opinion explain that someone creativity might be affected by his experience in order to faced problem in their life. Therefore can be presumed that teaching experience of teachers affected their creativity. The fact in field, there is a teacher have long teaching and there is teacher just teach. According to teaching experience of that teacher, teacher can be divided into two, that are senior teacher and junior teacher. Senior teacher is a teacher that have long teaching experience, while junior teacher is a teacher that still have less experience in teaching.

Open ended maths problem is a one means which can be used to train and developed creativity or creative thinking. According to Plucker and Makel ([8]:52),“..., Divergen Thinking tests ask for multiple responses to either figural or verbal prompts, and responses are scored for fluency, flexibility, originality, and elaboration of ideas.” So divergen thinking can be seen from fluency, flexibility, originality, and elaboration of ideas. Geometry is a one part in mathematics that gave much problems which to solve it using divergen thinking. Subjects of geometry in Middle School based with two-dimentional figure material. Because of that, two-dimentional figure material is one of the subjects of geometry that gave much spaces to train and develop creativity. According to above description, then to reached one of national education purposes, it is important to do a study about how maths teacher’s creativity in Middle School within solve the two-dimensional figure problem is reviewed from the different teaching experience. Therefore, the purposes of this study are (1) to describe junior maths teacher in Middle School creativity within solve two-dimentional figure problem and (2) to describe senior maths teacher in Middle School creativity within solve two-dimentional figure problem.

2. Literature Review

2.1. Creativity
There are many literatures show many options which can be used to expressed and defined creativity. Some people said that creativity is a kind of special thinking, while the other people said that creativity is moreover to produce a product. Stein said, "Creativity is a process that results in a novel work that is accepted as useful, tenable, or satisfying by a group of people at some point in time” ([9]:148). Creativity was defined more emphasizing to process, so creativity is a process produce a product by transfigure from the existing products and that product unique, having some purposes, and worth for the creator that marked with newly, useful, and satisfy for a group which having a same vision is some times.

That thing in line with Healy and Schifter opinion ([10]:104), “creativity as the ability to take existing objects and combine them in different ways for new purposes”. Therefore creativity is an ability to create a new combination according to existing concepts with do an action of combining some element which have not combined yet before. Besides, creativity is also an ability to find new relations and seeing something according to perspective or viewpoint that hasn’t exist before. Pames [4] also explained that creative ability could be called trough problem that spurring five creative attitude, that are fluency, flexibility, originality, elaboration, and sensitivity. Fluency is an ability to express the same ideas to solve the problem. Flexibility is an ability to produce any ideas to solve a problem outside the common category. Originality is an ability to give an unique or exceptional response. Elaboration is an ability to develop ideas in details to realize that idea become true. Sensitivity is an ability to catch and produce problem as a response to a situation. Furthermore, the characteristics of creative person are having some new ideas, brave to be different, create a thought that still doesn’t popular, doesn’t be afraid to try, and doesn’t be afraid of failure ([11]:10).

According to descriptions above, so in this study, creativity was defined as an ability which produce from cognitive activity to get an idea within solve the problem by combining concepts that have been mastered which marked by fluency, flexibility, novelty, and elaboration. According to Guilford (in [7]) fluency related to ability to easily produce as much as possible ideas. Flexibility refers to the ability to generate many kinds of ideas. Then Evans also stated that flexibility is also one of basic from novelty or originality. In solving problems, this flexibility related to an ability to try various approaches. Then the meaning of flexibility in this study is an ability result from cognitive activity to get an idea or thought in order to solving problems by doing combinations from concepts that have been mastered which is marked by diversity of ideas or strategies that are used to find the answer from the problems that faced. Evans [7] stated Creativity earns in new ideas and discoveries. Any definition of creativity must be included the element of novelty. And then elaboration --- the ability to supply details to complete a given outline or skeleton figure. That state including the meaning that elaboration is an ability to develop or detailing something in detail. Therefore in this study the meaning of elaboration is an ability resulting from cognitive activity to get an idea or thought in order to solving the problems by doing combination from concepts that have been mastered which is marked by ability to develop or expand an idea in order to get response from the problems faced.

2.2. Math Teacher
Republic Indonesia Constitutions Number 14 Year 2005 explained that teacher is a professional workers with the main task which are educating, teaching, guiding, directing, training, assessing, and evaluating learners in early childhood education in figureal education way, basic education, and middle education. Then teacher have a role as professional workers in primary education, middle education, and early childhood education in figureal way which appointed in accordance with the legislation. Based on understanding and position teacher in above constitutions, teacher is the human figure that take position and has a role in education. Then function of the teacher is to improve human dignity and has a role as learning agent that has a function to improve the quality of national education. Therefore teachers has very important role in order to determining educational process. A professional teacher expected to produce qualified graduates. Professionalism of teacher as a spearhead of curriculum implementations in the class needs to get an attention (Depdiknas, 2005). Teacher has a
responsibility to seeing everything that happen in the class in order to help the student development process. Delivery of learning materials is only one of the various activity in study as a dynamic process in every phase and student development process.

2.3. The Different Teaching Experience

According to years of service or the length of the predicate teachers teach, then according to Ministry Regulation PAN Number 16 Year 2009 about Teacher Functional Position and Teacher Credit Number can be divided in 4 group, namely first teacher, young teacher, medium teacher, and main teacher. Furthermore, in this study the meaning of the differences of experience teaching, maths teachers are classified into 2, namely junior math teacher and senior math teacher. Junior math teacher is a math teacher who has been teaching for less than or equal to 8 years since first teaching certificate was taken out from authorized party. Senior math teacher is a math teacher who has been teaching for more than 8 years since first teaching certificate was taken out from authorize party.

2.4. Creativity Math Teacher of Middle School within solve Two-Dimensional Figure Problems

Something important that need to remember that creativity is also awakened or produced ideas or concepts and also combine ideas that has been exist to produce something new. Creativity is one of the parts that integral from human and with that creativity which separate the human with creatures in the world. Futhermore Rogers (in Plucker in [12]) said “The very essence of the creative is its novelty, and hence we have no standard by which to judge it.” That stated explain that something basic to see creativity is novelty, but there is no standard yet that could assess them. Because of that, in this study novelty is defined as new for teacher who became a subject reasearch.

Furthermore, creativity in this reasearch related with how to solve the faced problems. Guilford ([9]:156) stated that “…problem solving and creative thinking are closely related. The very definitions of those two activities show logical connections. Creative thinking produces novel outcomes, and problem solving involves producing a new response to a new situation, which is a novel outcome”. The state explained that there are relationship between creativity and problem solving because problem solving become an aspect in creative. In line with Middle School Maths Teacher in order to solving the two-dimenstional figure problem, then according to theory that has explained, can be concluded some definitions as follows. Middle School math teacher creativity within solve the two-dimenstional figure problem is an ability resulting from cognitive activity maths teacher to get an idea or thought in order to solving the two-dimenstional figure problem by doing combination from concepts that have been mastered which marked by fluency, flexibility, novelty, and elaboration. Maths teacher’s fluency within solve the two-dimenstional figure problem are ideas diversity or strategy that math teacher used to finding answer from two-dimenstional figure problem given. Maths teacher’s novelty within solve the two-dimenstional figure problem is the given answer or idea/strategy that maths teacher use to get answer that hasn’t exist before. Maths teacher’s elaboration within solve the two-dimenstional problem in this study, there are two things, namely maths teacher elaboration to find the another answer from the two-dimenstional figure problem given and maths teacher elaboration from the face problem to classroom learning.

3. Result And Discussion

3.1. Creativity Of Middle School Junior Math Teacher to Solve the Two-Dimenstional Figure Problem

Creativity of Middle School junior math teacher in two-dimenstional figure problem solving, that is divided exactly-6 cm isosceles triangle into two parts that have a same area, shown in the following description. Middle School Junior maths teacher’s fluency showed by diversity of the answer within solve the two-dimenstional figure problem according to the result of the division the name of the figures which obtained, that is two right triangles isosceles which congruent, two random triangles which its pedestal and its height is equal, a trapezoidal isosceles, and random quadrangle, a right isosceles triangle, a circle and a figure with n-facets and two figures with n-facets.
Middle School Junior maths teacher’s flexibility to solve the two-dimensional figure problem showed by diversity idea that is used to finding an answer in divide right-6 cm isosceles triangle, that created triangle heavy line, created random figure that have 9 cm² area, and created random figure which consist of 36 swaths.

Middle School Junior maths teacher’s novelty to solve two-dimensional figure problem showed by the answer of how to divide triangle into two parts which has the same area that had never been though before, namely one part of the divide results are random figure which have 9 cm² area and the divide results of the second figure are two figure with n-facet, and idea or method that never thought before, namely create 9 cm² area random figure and create random figure that consists of 36 swaths on swaths paper with 0.5 cm of size. The novelty within this is new according to Middle School’s mathematics junior teacher, because that answer is newly found when working and previously thinking or did by that teacher.

Elaboration of Middle School’s mathematics junior teacher shown when solve the problem of two-dimensional figure and development that teacher did based on the problem of two-dimensional figure that already finished and can applied on learning in class. First, there is elaboration of main idea to subs idea for obtaining some other alternative answer based on the previously answer, that is development of idea from trapezoidal figure to circle and triangle figure. Second, there is elaboration of idea after finishing two-dimensional figure that teacher did by making 4 open questions which can applied on learning in class.

3.2. Creativity of Middle School Senior Maths Teacher to Solve the Two-Dimensional Figure Problem

Creativity of Middle School senior math teacher in two-dimensional figure problem solving, that is divide right-6 cm isosceles triangle into two parts that have a same area, shown in the following description. Middle School Senior maths teacher’s fluency is shown by diversity of answers to solve the problem of two-dimensional figure based on obtained names of the figures divided result, there are two congruent right isosceles triangle, two figures of n-facet, and two incongruently triangle but have the same pedestal, length, and high.

The flexibility of Middle School’s mathematics senior teacher shown by diversity of ideas that use to find answer on dividing right 6-cm isosceles triangle, that angle is divided by line of right triangle, making heavy line of triangle, making random figure that consist of 36 swaths with 0.5 cm of size and curve line. The novelty of Middle School’s mathematics senior teacher within solve the problem of two-dimensional figure is shown by answer to dividing triangle into two parts that have same area that not yet thinkable previously, there are two figures of n-facet, and idea/strategy that not yet thinkable previously, there is making random figure that consist of 36 swaths with 0.5 cm of size.

Elaboration of Middle School’s mathematics senior teacher is shown when solve the problem of two-dimensional figure and development that teacher did based on problem of two-dimensional figure that already finished and can applied on learning in class. First, there is elaboration of main idea to the other ideas for obtaining some other alternative answer based on the previously answer, there are development divided line from straight line to curve line. Second, there is elaboration of idea after finishing the problem of two-dimensional figure that teacher do by making 2 open questions that can be applied on learning in class, that are 1 geometry question and 1 arithmetic.

4. Conclusion

The result of this study showed that (1) middle school’s junior maths teacher creativity within solve the two-dimentional figure problem, cover (a) fluency, is shown by there are diversity in answer to
solve the two-dimensional figure problem based on the result of the division figures obtained; (b) flexibility, is shown by there are diversity in idea that used to find answer within divide a right-6 cm isosceles triangle into two parts with the equal area; (c) novelty, is shown by new answers and ideas/strategies that have never been thought before in solving the two-dimensional figures problem; and (d) elaboration, is shown by develop idea to create random figure with 9 cm$^2$ area to trapezoidal figure, right isosceles triangle, and circle; and (2) middle school’s senior maths teacher creativity within solve the two-dimensional figure problem, cover (a) fluency, is shown by there are diversity in answer to solve the two-dimensional figure problem based on the name of the result of the division figures obtained; (b) flexibility, is shown by there are diversity in idea that is used to find answer within divide a right-6 cm isosceles triangle into two parts with the equal area; (c) novelty, is shown by new answers and ideas/strategies that have never been thought before in solving the two-dimensional figures problem; and (d) elaboration, is shown by develop idea to create line divider from straight line into curved line.

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