

CHAPTER I

INTRODUCTION

1.1 Background

When learning about mathematics, we have to see exactly where mathematics come from. Mathematics comes from God, and has God's attributes. When God is omnipresence and eternal, so does mathematic (Poythress, 2015). The truth of mathematic is the same to all universe and goes beyond time. When God is transcendent and immanent, so does mathematics. For example, the truth of $2+2=4$ is beyond the world, but this truth is also relevance to every aspect in human daily life, to define four apples, four oranges, four fishes, and etc.

Poythress (2015) states that to know mathematics is the same as to know God. The more we know mathematics, the more mysteries revealed and new mysteries come. This fact will bring us awe of mathematics as we awe of God. When we believe in the trinity of God, those trinity is also on mathematics. Mathematics must be conceived as the part of His Word not as the part of created world. From the description above, it can be concluded that every time we deal with mathematics, actually we also deal with God.

God allows human to understand mathematics through the logic that He gives to human. It is caused that all logic is from the eternal Logos who is God (Wallenfang, 2017). The next two arguments also support that mathematics can be understood by logic. Mathematics is a field of study that focus on logic of shape, quantity, and arrangement (Jennex, 2015) and it depends on logic to demonstrate its truth. Supporting previous argument, Whithead and Russel as cited in

Poythress (2015) also states that logic is used as starting point in order to derive the properties of numbers.

Mathematic is learnt by academics from elementary until university level. Mathematical ability in each level has been established in detail with the following education institution. NCTM (National Council of Teachers of Mathematics), which is the world's largest mathematics education organization, has established the mathematical ability that should be possessed by each level internationally. Besides, Kurikulum 2013 has established the mathematical ability that should be possessed by each level the mathematical ability for each level nationally. This research focuses on mathematical ability at XI grader students.

According to core competences and basic competences of Kurikulum2013, for grade XI, mathematical ability that should be reached by students is the ability to understand, apply, present, analyze, and prove mathematical fact. On the other hand, NCTM (2000) states that, "*Secondary school students need to develop increased abilities in justifying claims, providing conjectures, and using symbols in reasoning.*"

Unfortunately, not all of those abilities were possessed by XI-MIA grader students. They had good ability in understanding mathematical concept, it was proved by their high score when they answered the formative questions about the derivative operation. It was only two students who didn't pass the test. They loved to apply simple formula to solve the simple mathematics problem. However, when discussing about the proof about differentiation concept, they seemed not to have any interest to follow the discussion. They looked confused when they had to combine several concepts.

Whereas, to learn about differentiation, the students don't only need the ability to apply the formula delivered, but they also need the ability to analyze, generalize, and prove the material delivered. Those abilities actually can be concluded as the ability to reason. Actually, mathematical reasoning (Gardner, 2006 as cited in Lestari and Yudhanegara, 2017) is the ability to analyze, generalize, synthesize, give the right reason, and solve the unfamiliar problem. Therefore, XI-MIA grader students had to be familiar with mathematical reasoning ability.

In order to assure that the XI-MIA grader students had weak reasoning abilities, researcher gave the open-book quiz about the gradient and equation of tangent. From the test results, none of XI-MIA grader students passes the standard score (KKM). This result was totally different when the students did the test about differentiation operation which was only applying one math formula. It was only two students who didn't pass the standard score (KKM).

Then, researcher tried to reflect about what the researcher had done so far. Previously, researcher taught the material directly, gave the easy to answer question, and gave less opportunity for students to think. Then, researcher realized that how can student reasoning ability improved if the teacher didn't make the situation in class so that their reasoning ability can be increased.

Therefore, something different must be done toward XI-MIA grader students. Researcher had to implement a learning model which enabled students experienced the conditions as follows. They could think more than previous meetings, they could get the new material not only by teacher's explanation, and they could be familiar with difficult problem.

Researcher realized that direct teaching method was less suitable to make students experience those conditions. Therefore, researcher was trying to implement learning model that enables students to improve their mathematical reasoning ability.

The characteristic of learning model which has contribution to improve students' mathematical reasoning ability is a learning model which encourages students to understand the material and to be active to think during the learning processes (Safrida, Ikhsan, and Hajidin, 2019). So, based on literature review, at least there are three several learning models which provide that situation are as follow; discovery learning model, realistic mathematic education, and problem posing learning model. Those learning models are defined as follow. Discovery learning model is a learning model which encourages students to get the new concept of material by themselves with guidance given (Safrida, Ikhsan, and Hajidin, 2019). Besides, realistic mathematics education learning model is also a learning model which can encourage students to understand the material well by requiring the students to formulate knowledge with their ability during learning activities (Susanti and Rustam, 2018). Students can formulate mathematical concept by solving the contextual problem given. While, problem posing learning model is a learning model which the students are asked to pose question based on certain situation (Lestari and Yudhanegara, 2017).

From those learning models, researcher chose problem posing learning model which was implemented at this research. It is caused by the uniqueness of this learning model which is to ask student to make problem that is not on other two learning models. This activity brings positive situation for students to think.

With this learning model, the role of student is not only as a problem solver, but they have right to create the problem according to the hint given. With this learning model, they are active as a problem poser (Ellerton, 2013). This learning model also enables students to formulate the new knowledge based on the previous knowledge (Mahendra and Budiyo, 2017). It can happen because the stage of this learning model insists the students to re-construct the problem given (Kar, 2016 as cited in Mahendra and Budiyo, 2017). Therefore, by implementing problem posing learning model, XI-MIA students are expected to have improvement on their mathematical reasoning ability, such as to present, analyze, generalize, and prove mathematical concept.

The ability to reason is really important to face various arguments in daily life. If we just receive those arguments, without think for that argument deeply, then we will be directed to the false principle. Therefore, indeed in order to have right understanding, then someone must really understand about what they believe and responsible with. Graham (2009) says, *“the knower interacts with and is responsible for the known, whether the known is a person, a thing of creation, or an idea.”*

In order to improve students' mathematical reasoning ability, some new activities must be applied, such as letting students to analyze material delivered, and discuss challenging problem. However, researcher believed that this isn't easy for XI-MIA students, since they are more familiar to learn simple concept and easy problem. However, Tong tells the reader about what the attitude that teacher must have as follow. Tong (2006) stated that a good teacher was the one who is

trying to make the students to fight. So, the students have to be more responsible to use their mind in order to solve not.

1.2 Research Question

Based on the background, so the research questions for this research are:

1. Does problem posing learning model affect students' mathematical reasoning ability?
2. How does problem posing learning model improve students' mathematical reasoning ability?

1.3 Research Purposes

According to the research question above, then the purposes of this study are:

1. To know whether the implementation of problem posing learning model can improve students' mathematical reasoning ability.
2. To know how problem posing learning model can improve students' mathematical reasoning ability.

1.4 Explanation of Terms

Mathematical reasoning ability (Gardner, 2006 as cited in Lestari and Yudhanegara, 2017) is the ability to analyze, generalize, synthesize, give the right reason, and solve the unfamiliar problem. The indicators of mathematical reasoning ability which are used in this research are: 1) present mathematical data and argument in writing and graph, 2) generalize a mathematical statement after analyzing mathematical situation, 3) evaluate or prove mathematical statement, 4) make conjectures.

1.4.1 Problem Posing Learning Model

Problem posing is a learning model which the students are asked to pose question based on certain situation (Lestari and Yudhanegara, 2017). The steps of problem posing which are used on this research are divide the students into several group heterogeneously, delivering the material, discussing problem example, asking students to create the problem, and discussing the questions made by students.

1.4.2 Differentiation

Differentiation is one unit in Mathematic for High-School which has been set by Kurikulum 2013. Differentiation is one of Calculus branch that is about finding a derivative or gradient function (Martin, 2012).

