The Development of Mathematics Lesson Equipment Based on Model Eliciting Activities (Meas) Approach to Improve Mathematical Reasoning Skill of Students Class X of Senior High School Padang (Study of Preliminary Analysis)

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Abstract—Mathematical reasoning skill of students from several schools was still not optimal yet. One of ways to solve this problem was by developing mathematics lesson equipment based on Model Eliciting Activities (MEAs) approach. This research was development research, which aimed to produce lesson equipment based on Model Eliciting Activities (MEAs) approach. From results of preliminary analysis, it was found the lesson equipment that was in accordance with students characteristics and used curriculum as well as the order of the content based on the result of concept analysis. This learning equipment would have the role in improving students mathematical reasoning skill.

1. Introduction
Mathematics has very important roles in our lives. This is because mathematics is a tool to develop thinking processes, which relate to ideas and abstract concepts, deductive reasoning and structured ideas in which the relationships are set logically [1]. Besides, mathematics is also needed to fulfil practical needs and solve problems in daily life. For example, we can do calculating, presenting, data processing and interpreting. Additionally, mathematics helps to understand other subjects, such as: physics, chemistry and economy. Therefore, mathematics is a core subjects to be learned in every level of education.

Mathematical reasoning is a skill that is expected to be owned by students in learning mathematics [2]. Mathematical reasoning is important component of learning mathematics because it is a tool to understand the abstraction [3]. However [4] explains that mathematical reasoning is integrated in problem solving. If related to the thinking process, mathematical reasoning is the core component of thinking process that involves the generalisation and describes the valid conclusion about ideas and how those ideas related [4].

Mathematical reasoning can also be seen as dynamic activity that involves the variation of ways of thinking to understand ideas, formulate ideas, find the relation among ideas, and describe the conclusion about ideas and relation among ideas. Mathematical reasoning could happen when students: 1) observe the pattern and order; 2) formulate the generalisation and conjecture that relate to the order being observed; 3) assess/test the conjecture; 4) construct and assess mathematical arguments; and 5) describe (validate) the valid conclusion about ideas and its relation [2], [4]. In this paper, mathematical reasoning
is defined as the process of making conclusion about ideas and its relation in order to solve mathematical problems.

Regarding the statements that have been explained by the experts, we need to create mathematics learning that can improve mathematical reasoning skill. The facts are that mathematics is taught by the pattern of learning theory, giving the examples and exercises. The students take a note of every concept and material being taught with or without understanding. Even, they are less able to use the concepts that they have summarised to solve the exercises.

Some experts also state the condition, process and mathematics learning achievements that are not satisfied. In learning mathematics, the students just duplicate and make a note of the ways of solution explained by the teacher [5]. The students pay attention to ways of solution explained by the teacher but they do not explore the knowledge that they get by themselves. In addition, mathematics learning less involves the students to learn actively, less emphasizes the understanding to the students and they just listen to teachers’ explanations [6]. This learning activity makes the students tend to do the rote learning without understanding what is taught by the teacher, so that the learning becomes not-meaningful [7].

Beside the learning process, another factor that causes the lack of mathematical reasoning of students is that students’ worksheet (LKPD) used is not adequate yet. Based on the observation that has done, LKPD used in the school contains the summary of content and exercises. The presented content is the short summary containing formulas of related concepts. The presented problems consist of routine problem that just asked the students to calculate. Only a few of the problems are related to the daily life and are problem solving and reasoning problems.

The learning in the school can be optimized by improving students’ mathematical reasoning. One of ways that could be done is by using Model Eliciting Activities (MEAs) approach. MEAs is learning approach to understand, explain, communicate the concepts embedded in a problem by constructing a model [8]. By constructing this model, the students have big chances to exploit their knowledge in learning mathematics. By using MEAs, the learning becomes more meaningful because the students can connect the concept that they learn with the previous concepts [9].

The learning with MEAs approach asked the students to work in small groups consisting of 3-4 students [10]. By working in groups, the students have chance to discuss, express their ideas by words, as well as listen to ideas of their peers. The most important thing in learning with MEAs is the activity to construct mathematics model. The construction of this model requires a strong concept about problem understanding so that it can help the students to transform their thinking [9]. Mathematics model can be defined as the interpretation of a situation or object in mathematical form. Through modelling, the students are accustomed with the modelling steps, namely: simplifying the problem; making mathematics model; transforming and solving the problem with the model; then interpreting the result. This is in accordance with the findings of some studies stating that MEAs has the potential to improve students ‘problem solving skill [11]. Next, MEAs is used to improve students’ problem solving skill [12]. Additionally, using MEAs also can improve representation skill and problem solving skill [13]. The same opinion is also stated by [14] and [15].

In the implementation, learning with MEAs approach needs to be equipped with the lesson equipment that can support the fulfilment of the expected learning objective, such as: lesson plan (RPP) and students’ worksheet (LKPD). LKPD in this research contains of guidance and problems collection that have been designed well so that the students not only get the routine problems given by the teacher. LKPD using MEAs approach contains of problems related to students’ daily life, so that the students become easier in understanding every given problems. LKPD also consists of problems direction that can guide the students, which is started from understanding the problem, constructing the models of given problems, so that they can present mathematical ideas by translating the problems into pictures, symbols, mathematics equation, until they can find the solution. Through LKPD based on MEAs approach, it is expected to improve students’ mathematical reasoning skill.

In this study, the features of the valid and practical lesson equipment based on MEAs approach to improve students’ mathematical reasoning skill of class X as well as how effective this lesson equipment to improve students’ mathematical reasoning skill were discussed. The aim of this study was to describe
the valid and practical lesson equipment based on MEAs approach to improve students’ mathematical reasoning skill as well as to find out the effectiveness of the lesson equipment.

2. Research Method
This research was development research that aimed to produce lesson equipment, which was in accordance with students’ needs. The development research was research method used to produce certain products and test the effectiveness of those products [16]. The development model used in this research was adapted from Plomp model consisting of three stages, namely: preliminary research; development or prototyping phase; assessment phase [17]. In this research, lesson equipment, such as RPP and LKPD were developed for students of class X senior high school based on the results of initial investigation.

Preliminary research was carried out by identifying and analysing everything needed to develop lesson equipment based on MEAs approach. The aim of this stage was to find out the initial description of the products that would be developed. On this stage, some analysis were carried out, such as: needs analysis; curriculum analysis; students analysis and concept analysis, aiming to find out the description of the problems that were happening in mathematics learning as the basis to determine the alternative solution and products specification that was needed, to find out the learning content that was coherent and in accordance with the learning with MEAs approach, to find out the lesson equipment that was relevant with students’ characteristics, and to find out the scope of content on lesson equipment that would be developed.

The subjects of this research were students of class X senior high school in Padang. They were students with mixed ability (low, medium and high ability). The data was collected by doing the analysis of core competence (KI), basic competence (KD), concepts and students, interview guidance and observation direction.

3. Result and Discussion
On the need analysis step, the information was collected by observing mathematics learning in the classroom and the interview was done with the mathematics teachers in several schools. Based on the result of the need analysis, it can be concluded that the students needed the learning that can fulfil their needs to become active in the learning. In other word, we can define this learning as group discussion based learning. Thus, the RPP and LKPD, supported by the real problems that can guide the students to construct the knowledge by themselves, were required to be designed. So that, the students will become easier to understand the concepts instead of memorize the content. The teacher required the lesson equipment in order to improve students’ activity in constructing their knowledge, so that their concept understanding can be enhanced as well.

On the curriculum analysis, analysis was carried out by reviewing the used curriculum in the trial school, namely curriculum 2013 for mathematics subject on the first semester of class X senior high school. The aim of this analysis was to learn the scope of content and learning objective based on MEAs approach. Based on the result of the analysis carried out on KD and achievement indicator of competence, the change or order toward KD and indicator that has been stated in curriculum 2013 was not carried out. This was because the arranged KD was in accordance with the difficulty level of the content. It was started by introducing the form of absolute value, linear equation system of three variables, linear equation system of two variables and function.

On the student’s observation, the observation toward the learning process in the classroom was carried out as well as the questionnaires were given to the students in order to find out their characteristics. The questionnaires contained of items used to find out the interest, thinking process, learning tendency and others that can describe the characteristics of the students in class X senior high school. Based on the results of the observations and questionnaires, it can be concluded that the students in class X were already on formal operation stage based on their age range. Next, regarding their style of learning, the students preferred to learn with their peers and they tended to learn in groups. Other characteristics were that they were still less focused and less active in mathematics learning. Based on those characteristics,
it was required to develop lesson equipment that can facilitate students’ habit and accommodate the characteristics that they possessed.

The concept analysis aimed to determine the learning objective and content that was required in developing lesson equipment. This was carried out by identifying the core concepts being taught, detailing and arranging it systematically. Additionally, the core contents in this research were absolute value, equation involving the absolute value of algebraic form, rational equation, linear equation system of three variables, linear equation system of two variables and function. Based on the result of initial investigation, then mathematics lesson equipment based on MEAs approach was developed in order to improve mathematical reasoning skill of the students. Next, RPP and LKPD were developed based on MEAs approach.

RPP was designed as the guidance for the teacher in implementing the learning process. RPP was designed based on KI, KD consisting of some indicators. The components of RPP were designed based on Permendiknas No. 58 year 2014. The learning activity presented in RPP was based on the steps and principles of learning with MEAs approach. The display of RPP identity, core competence, basic competence, achievement indicator of competence, learning objective, learning content, learning method and approach, assessment and source of learning were designed almost the same with the RPP in general. The components of RPP that became the unique feature of MEAs approach can be seen on the steps of learning.

At the core activities, the learning that was in accordance with the steps of learning with MEAs was carried out. The steps of learning were designed in order to facilitate the fulfilment of MEAs approach principles. The learning with MEAs approach consisted of 5 steps of learning. The first step, the teacher asked the students to read and understand the story or article that was given on problem sheet existing in LKPD. The presented story related to students’ daily life. So, the first step was expected to facilitate the fulfilment of MEAs approach principle, namely: reality principle.

The second step was that the students gave response to the given question from the first step. This question was readiness question that was presented on the article existing in LKPD, which was used to introduce the context of the problem to the students so that they got the description about the problem that will be solved. The third step was that the teacher asked the students to read given problems and assured that every group understood with those problems.

The fourth step of learning with MEAs was that the students tried to solve the problems in order to produce the model as the final solution of the problems. On this step, the students discussed and tried to construct the model in order to solve the problems so that the model construction principle of learning with MEAs can be fulfilled.

After constructing the model, the students wrote out the model that they got on LKPD so that the model documentation can be fulfilled. After that, they were asked to check back the model that they obtained. By checking back the model, then the self-evaluation principle has been fulfilled. Thus, the students got the model that has been valid, which would be used to solve the similar problems. This facilitated the fulfilment of the simple prototype principle of learning with MEAs.

The last step of learning MEAs was that the students presented their model in front of the classroom. At this step, one group was asked to present the results of their discussion. After presenting the results of their discussion and other groups commented on it, the students were asked to do the problems as exercises provided in LKPD. This activity facilitated the fulfillment of the construct share ability and reusability principle.

The content of LKPD was arranged by paying attention to the learning with MEAs approach. The steps of MEAs, the principles of MEAs, the important components of MEAs were displayed in the designed LKPD.

On the initial page of LKPD, there was the manual of LKPD that can be used by students as guidance in learning. LKPD based on MEAs approach was started by displaying an article related to the problem that will be solved by the students. This was in accordance with the first step of learning with MEAs approach on the lesson plan, which was called as readiness question.
The next part of LKPD was the problems that must be solved by the students. There was a direction in which the students were asked to work in their groups and discuss the given problems. This was in accordance with MEAs learning that was done in groups. From the given problems, the students were expected to produce the model as the solution. So, the model construction principle can be fulfilled.

In LKPD, there were spaces for the students to document the model that they obtained based on the results of their discussion. This facilitated the fulfillment of the model documentation principle. Next, LKPD contained direction to recheck the solution that has been obtained by the students. This activity was expected to facilitate the fulfillment of MEAs learning principles, namely the self-evaluation principle. The following was the example of problem that was used in LKPD as well as the example of checking back activity.

![Figure 1](image.png)

**Figure 1.** The problem that was used in LKPD and the activity of checking back

The next part of LKPD was the activity that facilitated the students to make the conclusion from the problems that they have already solved. This activity was the implementation of MEAs approach principles, namely: the simple prototype principle where the solution of the problem that has been obtained by the students was called as simple prototype that can be reused in different situations.

Reusing the solution that has been obtained was called as the construct share ability and reusability principle. In LKPD, the activity that fully facilitated the fulfilment of this principle was doing the exercises.
4. Conclusion and Suggestion

The finding of the research showed that mathematics lesson equipment based on MEAs approach that was developed was in accordance with the data of preliminary investigation results, namely: curriculum analysis; concept analysis; student analysis. The mathematical problems that were provided in LKPD were also made based on mathematical reasoning indicators. Based on the conclusion above, mathematics lesson equipment based on MEAs approach can be used as mathematics lesson equipment, especially to improve concepts’ understanding of the students.

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