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Development of Learning Instructions Based on The Model Eliciting Activities (MEAS) Approach to Improve Students Mathematical Problem Solving Skills of Students Class X Senior High School Padang

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Abstract— Students' mathematical problem solving abilities have not been achieved optimally. One of the causal factors is the unavailability of learning instructions that can facilitate students to improve their mathematical problem solving skills. This is the basis for developing mathematics learning instructions in the form of lesson plans and student worksheets based on the Model Eliciting Activities (MEAs) approach which can facilitate students to improve their mathematical problem solving skills. The purpose of this study is to produce learning instructions based on the Model Eliciting Activities (MEAs) approach that are valid and practical to improve the mathematical problem solving abilities of students class X Senior High School. The research subjects were students of class X Senior High School Padang. This research is a development research with the Plomp model. Because of Covid-19 pandemic situation, this research only did the preliminary research stage and the development stage. At the development stage, the design and assessment of learning instructions is carried out through the stages of formative evaluation. This study produced learning instructions in the form of lesson plans and student worksheets based on the Model Eliciting Activities (MEAs) approach that met valid and practical criteria to improve the mathematical problem solving abilities of students class X of Senior High School Padang.

Keywords— Learning Instructions, MEAs Approach, Problem Solving.

I. INTRODUCTION

Problem solving ability is one of mathematical abilities that has an important role in the students' success [1], [2], [3], [4]. Less [1] in their survey on the current situation on mathematics and science education in Bandung, sponsored by JICA, stated that: "solving mathematical problems is one of mathematics activities that is considered important by both teachers and students in all levels, ranging from elementary to high school ". The ability to solve problems is one of the abilities that students who study mathematics must have. This problem solving ability emphasizes more on how to accept a problem and solve the problem that is

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received. Students who have the ability to solve mathematical problems are expected to be able to solve math problems or mathematics that are found in everyday life.

In fact, when viewed in an international scope, the learning achievement of Indonesian students is far behind. Based on the results of a study conducted by the Organization for Economic Cooperation and Development (OECD) in its competition known as the Program for International Student Assessment (PISA), Indonesia was ranked at 72 out of 78 participating countries in 2018. The characteristics of the questions on PISA are contextual, requiring reasoning, argumentation and creativity in solving. Based on interviews with mathematics teachers, it found that the mathematical problem solving abilities of class X Senior High School students were not satisfactory. Students have difficulty working on the given questions, especially problems solving problems. In learning mathematics in class so far, teachers often use conventional methods which was teacher-centered. Therefore, that learning process has not been able to facilitate students to develop their mathematical problem solving abilities.

Based on that situation, it is necessary to design learning that can make students active in learning and provide opportunities for students to develop their thinking processes. Students need to be given the opportunity to develop a thinking process and convey their mathematical ideas. Students need a lot of experience to solve math problems. One way that can be done so that students are interested in solving math problems is to provide mathematical problems that can be found in everyday life.

Mathematical modeling is one strategy for solving mathematical problems. Students who are trained to solve mathematical problems by means of mathematical modeling, students will be familiar with the stages in modeling, namely simplifying problems, creating mathematical models, transforming and solving problems with models and interpreting the results. Thus, the learning carried out is expected to improve students' mathematical problem solving abilities. The learning process in accordance with MEAs approach.

MEAs is a mathematics learning approach to understand, explain, and communicate mathematical concepts contained in a problem presentation through mathematical modeling. MEAs have its potential to develop mathematical talents, because they involve students in complex mathematical tasks [5], [6], [7], [8]. Learning with MEAs approach can help students explore creativity in making mathematical models of real problems and encourage students to actively participate in the learning process. Chamberlin & Moon [5], Coxbill [9], Wessels [10] also stated that the application of MEAs approach was carried out using realistic learning scenarios. It is hoped that it can generate interest from students, so that students can easily understand the problems because they are close to their daily lives [11], [12], [13].

Learning mathematics with MEAs approach, students are more active. MEAs approach provides opportunities for students to share knowledge in the learning process and the modelling result can be reused to build, describe, explain, manipulate, produce a mathematically significant solution system [14], [15]. Learning with MEAs approach requires students to work in small groups consisting of 3-4 students [7]. Students who work in groups have the opportunity to discuss, express their ideas or opinions through words, and listen to their friends' ideas or opinions. The most important activity in MEAs approach is the activity of creating a mathematical model [16], [17]. Chamberlin & Moon [5] stated that the creation of a mathematical model requires a strong concept of understanding the problem, so that it can help express their thoughts.

The implementation of learning in class basically requires a learning instruction. Learning instructions are an important part of a learning process. The importance of learning instructions shows that its supports the learning process, because learning instructions can affect the quality of learning and the quality of learning is closely related to the quality of education. In addition, the instruction also plays a role in facilitating students in achieving competencies and learning objectives. Thus, for the implementation of learning, a Lesson plan and student worksheet are needed. Thus, it is necessary to develop mathematics learning instructions in the form of lesson plan and student worksheet based on the Model Eliciting Activities (MEAs) approach.

II. METHOD

The type of this research is development research. The development model used in this study was adapted from the Plomp model. The Plomp model consists of 3 stages, namely preliminary research, the development or prototyping phase, and the assessment phase. However, because the situation is still in the Covid-19 pandemic, this study only reached a small group evaluation.

In the preliminary research stage, several activities were carried out including needs analysis, curriculum analysis, concept analysis, and student analysis. Needs analysis aims to collect information about the problems contained in mathematics learning.

Information collection was carried out through interviews with class X high school mathematics teachers, giving questionnaires to students, and giving questions to students to see the students' initial mathematical problem solving abilities. Curriculum analysis aims to analyze the curriculum against two supporting aspects, namely core competencies and basic competencies. The analysis was carried out on the curriculum in mathematics class X Senior High School semester I. This analysis was carried out to study the material coverage, learning objectives and strategies chosen as the basis for developing learning instructions. Concept analysis is carried out by identifying the main concepts to be taught, detailing and systematically arranging the material to be studied by students according to the order in which they are presented. Student analysis aims to determine the characteristics of students that can be used as a basic foundation in designing learning instructions so that it can make it easier to arrange learning instructions from the language level and the level of problem difficulty.

Based on the results of the analysis at the preliminary research stage, a design for developing learning instructions based on MEAs approach in the form of lesson plan and student worksheet is compiled in accordance with the guidelines for developing teaching materials issued by the Ministry of National Education [18], [19] by taking into account the feasibility of content, presentation, language, and appearance. At this stage of development or prototyping, a series of prototypes were developed. The prototype was evaluated by referring to Tessmer's formative evaluation, which includes self-evaluation, expert review, one-to-one evaluation (individual evaluation), and small group (small group evaluation).

III. RESULT AND DISCUSSION

The results of research on the development of learning instructions based on the Model Eliciting Activities (MEAs) approach are as follows:

a. Preliminary Research Results

Learning instructions based on MEAs approach were designed after conducting the preliminary research stage. Preliminary research activities begin with conducting needs analysis, curriculum analysis, concept analysis, and student analysis. Needs analysis aims to collect information about the problems contained in mathematics learning. Based on interviews with mathematics teachers, it was found that the mathematical problem solving abilities of students were not satisfactory. Students have difficulty working on the questions given by the teacher, especially problems solving questions. This fact can also be seen from the results of the students' mathematical problem solving ability tests which show that they are not optimal. In mathematics learning so far, teachers often use conventional methods. This learning has not been able to facilitate students to develop their mathematical problem solving skills.

The teaching materials used in mathematics learning have been using textbooks that can be borrowed from the library. In mathematics lessons also use students worksheet, but not every meeting uses students worksheet. Students claim that they need students worksheet to help understand mathematical material and assist in practicing solving math problems or working on problems. Based on the student questionnaire, information was obtained that the students worksheet criteria expected by students, namely: students worksheet had attractive colors and images, and varied questions. In addition, the size of the students worksheet chosen is the size of the usual students worksheet (A4 size students worksheet).

The results of the curriculum analysis show that the core competencies and basic competencies are in accordance with the 2013 curriculum. In addition, indicators of competency achievement and learning objectives are in accordance with basic competencies. In class X Senior High School semester 1, there are 6 basic competencies that can be arranged into 5 chapters, namely the equation and inequality of the absolute linear value of one variable, one variable rational and irrational inequality, three-variable linaer equation system, two-variable inequality system, and functions. The results of the questionnaire analysis of students class X Senior High School 2 Padang obtained information that students need Students Worksheet to help understand mathematical material and assist in problem-solving or problem solving exercises. The students worksheet criteria expected by students are: color, have an attractive image, and varied questions.

b. Results of the Development Stage

Based on the results of the analysis at the preliminary research stage, a learning instruction was designed in the form of a lesson plan and student worksheet based on the MEAs approach.

1) Designing Lesson Plan and Student Worksheet

The lesson planis designed systematically which contains the components of lesson planwriting as stated in Permendikbud No. 22 of 2016 [20]. The learning activities presented in the lesson plan refer to learning with MEAs approach which is integrated in the students worksheet. The students worksheet based on the MEAs approach consists of 3 parts, namely a description of the material, group discussions, and exercises. In the material description contains a summary of the material and an illustration of the problem, accompanied by examples of its solution. In group discussion activities, students are presented with problems that can be found in everyday life. The students worksheet also presents steps in solving problems.

Material using MEAs approach is presented according to the indicators of competency achievement. Students worksheet contains clear instructions on the steps that must be taken by students. The cover section contains the title "Students Worksheet Mathematics Based on the Model Eliciting Activities (MEAs) Approach". The 2013 curriculum logo indicates the Students worksheet that was developed based on the rules and guidelines in the 2013 curriculum. On the students worksheet cover there is also a description of the students worksheet for Senior High School / Islamic Senior High School mathematics class X semester 1 and the identity of the compiler. Students worksheet uses simple and communicative language and is in accordance with the level of understanding of high school students. In addition, the orders and questions in the students worksheet are arranged in clear sentences so that they are able to direct students to carry out activities or answer questions as expected.

2) Self Evaluation Results

After design of the learning instruction are complete and before consulting and discussing with experts, a self-evaluation is carried out first of the learning instructions that have been designed. In general, many mistakes occur in typing words. In addition, researchers also estimate the adequacy of the free space in the students worksheetas a place for students to write the answers.

3) Results of Learning Instruction Validation by Experts (Expert Review)

The aspects observed in the lesson plan are the component aspects and the lesson plan format. Lesson planvalidation was carried out by 3 validators. Overall, the Lesson planbased on MEAs approach has met the very valid criteria with an average validity index of 3.37. Lesson planvalidation was carried out by 5 validators, namely 2 mathematics education experts, 1 high school mathematics teacher, 1 Indonesian language expert, and 1 educational technology expert. Overall, the validity of the student worksheet based on MEAs approach has met the very valid criteria with an average overall validity index of 3.44. Students worksheet validation results can be seen in Table 1.

Table 1. LKPD Validation Results

No	Aspect Validation	Index Validation	Criteria
1.	Didactic or Presentation	3,37	Very Valid
2.	Material or Content	3,38	Very Valid
3.	Language	4	Very Valid
4.	Graphics or Display	3	Valid
Average Validity Index		**3,44**	**Very Valid**

4) Results of Individual Evaluation

This individual evaluation was carried out by asking three students of class X of Senior High School Padang to try the worksheet. As long as students try to work on the worksheet, researchers pay attention to what students are doing and record things that occur or obstacles during work on the worksheet and write it on the observation sheet. According to the three students, the instructions, problems, and questions in the worksheet were easy to understand. Meanwhile, the terms that exist in students worksheet such as

reality principles, model construction principles, and other MEAs approach principles are new to students. Students feel curious in solving problems related to everyday life such as the problems presented in the students worksheet.

5) Small Group Evaluation Results

In small group evaluation, students take part in learning activities using students worksheet based on the MEAs approach. In this evaluation, the researcher immediately acts as a teacher by using lesson plan based on the MEAs approach. Based on the results of observations information was obtained: students can receive the learning process and students worksheet based on the MEAs approach well, the learning process using student worksheet has been carried out well, material and sample questions along with discussion already in the Students Worksheet, making it easier for students in the learning process. Students are enthusiastic in the learning process. Students dare to come forward to solve the questions / problems given. The time available is sufficient to complete the worksheet.

IV. Conclusion And Suggestion

This research is a development research that produces learning instructions based on the Model Eliciting Activities (MEAs) approach. These instructions are in the form of lesson plan and students worksheet Model Eliciting Activities (MEAs). Based on the research process and results, the following conclusions were obtained:

a. The process of developing learning instructions based on the Model Eliciting Activities (MEAs) approach in the form of lesson plan and students worksheet was carried out using the Plomp development model. However, because the situation is still in the Covid-19 pandemic, the stages of the Plomp model carried out are preliminary research and development stages. At the development stage, a formative evaluation consists of self-evaluation, validation by experts, individual evaluation, and small group evaluation.

b. This research produces learning instructions in the form of lesson plan and students worksheet based on the Model Eliciting Activities (MEAs) approach that meets valid and practical criteria to improve the mathematical problem solving abilities of class X students of Senior High School Padang.

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