

The Development of Inquiry-Based Learning Tools to Improve the Mathematical Problem Solving Ability of Students Grade VII Junior High School (A Preliminary Research)

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Abstract – Learning tools designed to solve this problem are in the form of lesson plans and student worksheets. Designing a lesson plan aims to attract students' interest in learning so that it can improve students' mathematical problem solving ability. The problem-solving ability of SMP / MTs students is one indicator that they have reached a high-level thinking ability. This type of research was a research and development, which aims to produce learning tools that are valid, practical, effective and in accordance with the conditions in the field. The initial observation for the development of inquiry-based learning tools aims to (1) determine the initial conditions of the learning tools developed by the teacher (2) how the students' mathematical problem solving ability is taught in learning mathematics (3) whether it is necessary to develop inquiry-based learning tools to improve students' mathematical problem solving. The results of preliminary observation indicated that: (1) the learning process in the classroom is still dominated by teacher so that students become passive in learning, (2) the learning tools used by the teacher are still incomplete, one of which is the teacher has not been able to make Student Worksheets (LKPD) itself to be used by students, (3) the learning models have not led students to be actively involved in the learning process, 4) In addition, researchers also obtained data that showed that the students' mathematical problem solving ability in these schools is still low. Based on this, a present research on the development of inquiry-based learning tools was conducted to improve the mathematical problem solving ability of the junior high school students (SMP N 3 Lembah Gumanti).

Keywords – Inquiry, Problem Solving Ability, Learning Tools.

I. INTRODUCTION

Mathematics is as one of the basic sciences has an important and beneficial role for the development of science. Mathematics subject matter trains students to think logically, critically and practically, to reason effectively, and to be scientific, disciplined, responsible, and confident accompanied by faith and piety. In mathematics, students are required to have problem solving ability. Solving problems which include the ability to understand problems, design mathematical models, solve models, and interpret the solutions obtained [1].

Problem solving is an integral part of learning mathematics, so it cannot be separated from learning mathematics [2]. Problem solving ability is a skill or potential that students have in solving problems and applying them in everyday life [3]. However, the reality in the field showed that the majority of students have not mastered the ability to solve mathematical problems. The fact that the students' mathematical problem solving ability was low, the researcher also found that based on the results of preliminary observation at SMP Negeri 3 Lembah Gumanti, it was seen that the test results of students' problem solving ability were still low.

This data was obtained by the researcher when giving 2 test questions to 26 students of class VII 4 to see their mathematical problem solving ability. The following are the results of students' answers based on the indicators of mathematical problem solving ability.

Table 1. Achievement of the Indicators of Mathematical Problem Solving Ability for Students Grade VII

Achievement Indicators of Mathematical Problem Solving Ability	Completeness Presentation
Understanding the problem	31%
Planning for problem solving	18%
Solving the problem	39%
Reviewing the process and results	20%

Based on table 1 above, it can be seen that the performance for each indicator is still low which was below 50%. It means that the basic concept of problem solving from the material being taught they have not understood and shows that students have not been able to solve the problem properly, which causes the results of learning mathematics to not meet expectations. The low ability of students to solve mathematical problems is also caused by several factors that the researchers found in school, namely: (1) the learning process that occurs in the classroom is still dominated by teachers so that students become passive in learning, (2) the learning tools used by the teacher are still not complete, one of which is that the teacher has not been able to make Student Worksheets (LKPD) themselves for use by students, (3) learning models that have not yet led students to be actively involved in the learning process, 4) In addition, researchers also obtained data showing that solving mathematical problems, the ability of students at the school is still low.

Based on these problems, various attempts have been made to improve students' mathematical problem solving abilities. One way to overcome this problem is to develop learning tools in the form of lesson plans and worksheets that are more fun and meaningful for students. The reason for the researchers developing these learning tools is because by making Learning Implementation Plans and worksheets prepared by the teachers themselves, learning will be more focused and can optimize learning activities of students through activities that have been arranged in Student Participant Worksheets. Learning models that can accommodate learning tools are in the form of Lesson Plans and Student Worksheets, one of which is inquiry.

Inquiry learning is a pedagogical approach that focuses on the processes and skills needed to conduct research. This process has several stages including: actively identifying a topic or issue (problem), asking questions about the topic / issue, investigating problems with relevant research, thinking critically about the topic / issue; answer questions about the topic / issue at hand, draw conclusions and review the inquiry process. Inquiry makes students learn directly and makes students build the skills needed to increase new knowledge and understanding [4].

Several researchers have used inquiry methods including Tjiptiany, As'ari, & Muksar [5], the results of the study show that inquiry-based learning tools meet the criteria of validity, practicality, and effectiveness. In Hilman & Retnawati's research [6], which produced learning tools consisting of a syllabus, lesson plans, LAS, and daily test tests, each component of the learning device met the criteria of being very valid, very practical and effective.

Based on the problems found, the researcher wants to carry out a research development entitled "Development of inquiry-based learning tools to improve the mathematical problem-solving abilities of students in class VII SMP".

II. METHODOLOGY

This research was a part of a development research. Development research is a research method used to develop or validate products used in education and learning [16]. According to Nana [17] "a development research is a process or step to develop new products or improve existing products that can be accounted for. The products to be developed were inquiry-based mathematics learning tools to improve the mathematical problem solving ability of the students grade VII SMP.

In this research, the development model used was the Plomp model. Plomp divides the development phase into three phases: the preliminary research, the development and prototyping phase, and the assessment phase [18]. The Plomp model was chosen

because it has advantages in product practicality. This design research has three phases: the preliminary research, the development or prototyping phase, and the assessment phase [19].

Moreover, the data were collected through interviews, observation, and giving tests. Interviews were conducted by asking various questions about the problems that occurred during the learning process toward several mathematics teachers at SMP N 3 Lembah Gumanti. Then, the observation was done by observing the learning process in the classroom and also to see the learning tools used by the teacher to match the information provided by the teacher with the actual situation and to analyze the existing learning tools. Furthermore, a preliminary test consisting of 2 questions was carried out to reveal the students' problem-solving ability in solving real-life problems on the material that had been studied.

III. RESULTS AND DISCUSSION

The preliminary research phase was carried out to obtain information about problems in education. In addition, this phase was carried out to obtain an overview of the learning tools being developed. At this stage, identification or analysis was required for the development of inquiry-based learning tools and analyzing the boundaries of the subject matter to be developed. The purpose of this stage was to determine and define the conditions needed in developing learning designs. The activities carried out in the preliminary research phase, namely:

a. The results of the needs analysis

In the needs analysis, the researcher carried out several activities to gather information about learning mathematics. These activities aimed to collect information by interviewing the mathematics students and teachers, as well as observing mathematics learning in the classroom through a checklist. These activities were carried out at SMP N 3 Lembah Gumanti.

Based on the results of interviews conducted with mathematics teachers, it was found that the teacher had designed mathematics lesson plans based on the 2013 curriculum with other teachers in the MGMP or workshops, but the teacher felt that the lesson plans that had been compiled were not perfect and needed improvement because they were only guided by some examples of existing lesson plans on the internet or other co-workers. When asked how the model or method the mother used in learning, the answer was: "still using the lecture method". Then, she was told that there was a model of inquiry, did you recognize it? The teacher replied that she was familiar with the inquiry model, but it had not been applied because of limited time and energy. However, the teacher also wanted to use this model of inquiry, instead she is happy because she can share knowledge with the researcher about the inquiry model.

To find out more information, the researcher also interviewed several students. Based on the results of interviews with students, the information obtained that the students' interest in learning mathematics was still very concerning, which they considered learning mathematics to be difficult to understand and boring and it was difficult for students to remember formulas. When the learning process took place, the students did not focus on the learning material. The students were chatting with each other. In addition, there were some students who wanted learning to be carried out in groups. The students also expected additional learning resources such as LKPD. The LKPD that the students wanted is the LKPD that is easy to understand, full of color, and attractive.

The results of observations through a checklist proved that the students' statements in the interview phase showed that the learning mathematics was less attractive to them. This happens because a learning model has not been used in the learning which the students were led to actively participate in learning and in finding concepts. In addition, it was concluded that the teaching materials used by the teacher were only textbooks.

Based on the results of the needs analysis, in order for a fun and effective learning process to occur for students, it is necessary to develop learning tools in the form of RPP and LKPD which can be used to improve the students' mathematical problem solving ability.

b. Results of curriculum analysis

The purpose of curriculum analysis was to determine whether the material taught was in accordance with the expected competencies. At this phase, a review was conducted towards the 2013 Curriculum for Mathematics class VII SMP / MTs in semester I. This analysis was in the form of a formulation of competency attainment indicators in the syllabus. The description

of KI, KD, and indicators of competency achievement were considered to determine the concepts needed in mathematics learning and measure the achievement of IQ and KD. The material taught in class VII SMP / MTs include numbers, sets, algebraic forms, one-variable linear equations and inequalities.

Based on the results of the formulation of indicators and analysis of the mathematics syllabus for class VII SMP / MTs, the material to be tested was only carried out on the material of Linear One Variable Equations and Inequalities. The results of the curriculum analysis showed several formulation of competency attainment indicators in the material of Equation and Inequality of Linear One Variable class VII SMP / MTs semester I curriculum 2013 which can be seen in Table 2.

Table 2. Curriculum Analysis Results

Basic Competence	Indicators of Competence Achievement
3.6 Describing the linear equations and inequalities of one variable and their solution	3.6.1 Describing the linear equation of one variable. 3.6.2 Determining the solution to a one-variable linear equation 3.6.3 Describing the linear inequality of one variable. 3.6.4 Determining the solution for one variable linear inequality
4.6 Solving problems related to linear equations and inequalities of one variable	4.6.1 Determining the solution of contextual problems related to one variable linear equation 4.6.2 Determining the solution to contextual problems related to the linear inequality of one variable

c. Result of concept analysis

Concept analysis was carried out so that it is easier for the students to understand the material to be studied. Concept analysis is structured to systematically compile material concepts by forming concept maps. In this research it was conducted on the material of linear equations and inequalities of one variable for class VII SMP / MTs odd semester. The results of the concept analysis are arranged in the form of a mind mapping as shown in Figure 1.



Figure 1. Mind Mapping

d. Results of student analysis

Students who were the research subjects were the students grade VII SMPN 3 Lembah Gumanti in 2020/2021 the academic year. On average, the students were 12-13 years old. Based on research conducted by Piaget, children at that age have cognitive development at the formal operation stage (Suherman, 2003: 37). At the formal operation stage, children are able to solve problems and reason using abstract things. The use of concrete objects is no longer necessary. In addition, Budiningsih (2005: 39) also argues that the main characteristic of child development at this stage is that the child has started to think abstractly and logically, and the child already has the ability to draw conclusions, interpret, and develop hypotheses. This means that the students aged 12-13 years are able to participate in inquiry-based learning activities.

Based on the results of the questionnaire given to students, some information was obtained, namely (1) the students argued that learning mathematics at school was less fun because in the learning process the students were only accustomed to being listeners when the teacher explained learning which make them bored in the learning process, (2) the students prefer problems related to everyday problems so that they can benefit from learning mathematics, (3) the students like mathematical problems that are presented using pictures, because with the illustration of pictures will help students to understand the problem, (4) the students prefer bright colors, so that it fosters reading interest and is interesting to see, (5) the students prefer to learn in groups rather than individually, because students can discuss with group friends when they have not yet understood the learning material.

IV. CONCLUSION

From this preliminary research phase, it can be concluded as follows: (1) the learning process in the classroom was still dominated by teacher, so the students become passive in learning, (2) the learning tools used by the teacher were still incomplete, one of which was that the teacher is not yet able making Student Worksheets (LKPD) themselves for the students, (3) learning models that have not led students to be actively involved in the learning process, 4) In addition, the researcher also obtained data showing that the students' mathematical problem solving ability in the school was still relatively low. Based on the needs analysis, curriculum analysis, concept analysis and analysis of the characteristics of students, it is necessary to develop learning-based tools to improve the mathematical problem-solving ability of inquiry of students grade VII SMP / MTs in the form of RPP and LKPD.

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