Problem based learning and mathematical problems solving skills of junior high school students: a preliminary research

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Abstract. This study is research and development (R & D). A preliminary research of this R & D aims to get information about students’ Mathematical Problem Solving Skills (MPSS) and learning device (known as RPP and LKPD) that the teacher used in learning. Initial observations at SMPN 1 Pariaman and SMPN 2 Pariaman show that: (1) students' MPSS is still low, (2) only a small portion of students are actively involved in the learning process and only some of the students take the learning seriously, (3) The LKPD that the teacher used in learning can’t help students in learning mathematics. Based on this, follow-up is needed in the form of R & D to develop mathematics learning devices based on problem-based learning for junior high school students.

1. Introduction
In the current global era, knowledge of mathematics greatly influences the progress of a country. In everyday life, we will not be separated from mathematics, both from small things to the development of sophisticated technology [1]. Theories that exist in science and the creation of the latest technology are very dependent on mathematics [2]. Based on the importance of mastery of mathematics, mathematics is learned starting from elementary school to tertiary level, but, unfortunately, Indonesian students' mathematical abilities are still far from expected [3-19].

Mathematical Problem-Solving Skills (MPSS) is one of the mathematical abilities that must be possessed by students. MPSS include the ability to understand problems, design mathematical models, solve models and interpret the solutions [20]. MPSS includes the process of finding answers to questions that require procedures or steps that are not routine and are contained in a text, non-routine puzzles, and situations in real life [21]. In learning mathematics MPSS is the core of learning which is a basic ability in the learning process [22]. MPSS are very important not only for mathematician but also for those who will apply it in everyday life [23].

Based on observations made at SMPN 1 Pariaman and SMPN 2 Pariaman information is obtained that: (1) learning in schools has used the 2013 curriculum, (2) the learning process is still dominated by teachers, (3) only a small portion of students are actively involved and learning seriously, (4) when learning takes place it is not seen the teacher uses the student worksheets to help the learning process in the classroom.

One of the causes students low in MPSS is a learning device. A good learning device will assist the teachers to achieve the expected learning goals. For this reason, what can be done to support the learning activities of students is lesson plan (known as RPP) and can be used as a learning medium by using teaching materials such as the student worksheet (known as LKPD) [24].
The development of the learning devices applies one of the learning models that are following the 2013 curriculum and can improve students' competencies. One of the learning approaches that can improve students' MPSS is problem based learning (PBL) [25]. Besides PBL is a learning model that is centered on students related to the use of intelligence from within students to solve problems that are oriented to real-world problems or according to the daily experiences of students that are solved in groups [26, 27]. PBL can improve problem solving skills [28, 29].

2. Materials dan Methods
Based on the problems in the introduction, this study is research and development (R & D). Data in this study was carried out by direct observation in SMPN 1 Pariaman and SMPN 2 Pariaman. Instrument used in this study was an interview guidelines and mathematical problem-solving skills test. Data analysis in the preliminary research of R & D namely reduction, exposure, conclusion stage. These three phases were raised by Miles & Huberman. Reducing the data was an activity to summarize, choose the main things, and focus on the things that are important in accordance with the problem under study. Next, in the data exposure phase the researcher described the problem. Conclusion as the result of research can be obtained in accordance with the expected objectives.

3. Result dan Discussion
From the results of the preliminary research at SMPN 1 Pariaman, information was obtained that learning in schools had used the 2013 curriculum. In the learning process still dominated by teachers, only a small percentage of students were actively involved and learning. Also, when learning takes place it is not seen the teacher uses student worksheets to help the learning process in the classroom.

Furthermore, observations were made at SMPN 2 Pariaman, and information was obtained that learning in schools had also used the 2013 curriculum, but the learning process was still dominated by teachers. In learning process, students had not been actively involved and very rare for students to ask questions or give their opinions about the material being studied, most of them only accept what is conveyed by the teacher. Besides, when learning takes place it is not seen the teacher uses student worksheets to help and facilitate the learning process in the classroom. Teachers are still not there to make their student worksheets as a means of supporting learning in the classroom. There are only mathematics books to guide students in learning.

After conducting observations and interviews, tests were also conducted at SMPN 1 Pariaman and SMPN 2 Pariaman to see the students' MPSS. Then the answer sheets were examined using a scoring rubric for MPSS. The results of the MPSS test was presented in Table 1.

| School          | Indicator of MPSS |
|-----------------|-------------------|
|                 | 1  | 2  | 3  | 4  |
| SMPN 1 Pariaman | 4.84% | 44.35% | 35.48% | 36.29% |
| SMPN 2 Pariaman | 7.26% | 44.35% | 37.90% | 38.71% |

From Table 1 it can be conclude that the percentage of students’ MPSS in class VIII of SMPN 1 Pariaman and SMPN 2 Pariaman less than 50%. So, it can be said that the MPSS of students in both schools is still relatively low. The MPSS test that researchers provide is as follows.

Andi is playing plane-nursing. At first, Andi’s plane was in position (0,0). Andi moves his plane following the following pattern (1) 1 unit to the right and 2 units to the top, (2) 2 units to the right and 3 units to the top, (3) 3 units to the right and 4 units to the top. Etc. Determine the coordinates of Andi’s aircraft position now if it has been moved 5 times.

From the results of students' answers on observations made by these researchers there was no student who answered the questions correctly (see Figure 1 and Figure 2).
Based on the answer sheet of students in Figure 1 which represents the answers of other students, where students do not answer questions about questions that have indicators of MPSS, including students not yet writing down the completeness of the information available in the form of known and asked questions. Students directly to the mathematical model itself in the form of graphs, but students are also wrong in modeling or choosing the right strategy to solve the problem, as a result, students cannot solve existing problems in the questions given by researchers, other than that students also do not able or not to interpret the results. This shows that students are still not able to interpret the questions properly and correctly.

Based on Figure 2, it can be concluded that students have not been able to understand the problem and choose information about what are known and asked. It can be seen that the students' answers do not write down the information needed, such as what is known and what is asked, but the students just make a model or strategy to solve the problem. It appears that students have made a graph of Cartesian coordinates of the problem but it is not correct in solving the problem. Learners make the answers lead to the pattern of numbers instead of the exact point the coordinates stop after moving 5 times. And also seen students do not verify the results. This shows that students are did not understand the purpose of the problem properly and correctly.

The low of students' MPSS at SMPN 1 Pariaman and SMPN 2 Pariaman occurs because the learning devices were used by the teachers have not been able to promote students' motivation in learning mathematics so that it has an impact on mathematical abilities possessed by students especially problem solving abilities are still low. When observing, it seems that the teacher has designed a learning tool in
the form of lesson plans (known as RPP) but is still general, not following the conditions and conditions of the students. In the steps of learning only makes students passive in the learning process. This can be seen when the teacher learning process only explains the subject matter and provides training to students. The activity has not encouraged students to find their concepts.

Based on interviews with mathematics teachers at SMPN 1 Pariaman, information was obtained that the teacher had used a Student Worksheet (known as LKPD) but that was only once and that was only the general SW. In the SW flow, there are no specific learning paths such as the model or approach in the SW. At SMPN 2 Pariaman, information was obtained that the teacher had never used LKPD, the teacher only came from the printed book that was used. The teacher takes references to be taught from existing printed books such as the questions given all contained in the printed book used.

According to Widodo [30], LKPD is a worksheet that contains step instructions following the learning model that is designed to be able to promote students’ MPSS. In an LKPD there are problems that students must solve and problem-solving steps that must be done. With the help of LKPD, both students and teachers no longer have difficulties and are helped in solving problems in learning mathematics.

To improve MPSS, a teacher is required to have the knowledge, special skills, and professional attitude. The teacher must be able to use the learning model so that students can understand the concepts that have been taught. A teacher besides explaining the concepts, principles, and theorems the teacher must also teach by creating good conditions so that the active involvement of students can take place. So, it is important to develop a learning device that appropriate to curriculum 13, namely PBL or PBI [31].

PBL as one of the learning models has the characteristic of always starting and focusing on problems [32] and “learn how to learn” [33]. PBL promote students’ MPSS via real world problems as a context [34]. PBL provides the opportunity for students to solve problems and find alternative solutions to problems. PBL steps according to the Ministry of Education and Culture are (1) orientation to problems, (2) Guiding students to learn, (3) individual and group investigations, 4) students present their work [31].

4. Conclusion
Based on the result of the preliminary research conducted at SMPN 1 Pariaman and SMPN 2 Pariaman can be concluded that: (1) students’ MPSS very poor, (2) RPP and KLPD that the teacher use so far did not help students to learning mathematics. Thus, further action needs to be taken in the form of research into the development of mathematical learning devices based on PBL to promote.

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