

# The Development Of Learning Instruction Based On Problem Based Learning To Improve Problem Solving Ability Of Students In Grade VII (Preliminary Research)

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**Abstract**— The problem encountered in school is that students' mathematical problem solving abilities are not optimal. It can be improved by using learning instruction based on Problem Based Learning. The purpose of this study is to develop learning instruction based on Problem Based Learning (PBL) to improve students' mathematical problem solving abilities. The type of research is development research using Plomp's model which consists of three phases namely preliminary research, development or prototyping phase, and assessment phase. This article discusses the preliminary section. Questionnaires, teacher interview guidelines, field notes, educational test questions were used as instruments. The results of data analysis show that 1) Students mathematical abilities was low, 2) the learning process focused on the teacher, 3) Students' involvement in the learning process was lack, 4) The learning instruction used by teachers are not facilitating students to improve mathematical problem solving skills , 5) Students feel difficult to understand the language used in learning resources.

**Index Terms**— *Problem Based Learning* (PBL), Mathematical Problem Solving Ability.

## 1 INTRODUCTION

Mathematics has a very important role in the development of science because mathematics can make someone think logically, rationally, critically, and confidently. It made mathematics learning applied from the elementary school level to the university level. One of the purpose of learning mathematics is to improve the high-level abilities of students. One of these abilities is the students' mathematical problem solving abilities. Mathematical problem solving ability must be possessed by students because in solving a mathematical problem students use the knowledge they have to determine the steps of completion so that students get new experiences after solving the problems. To improve the ability of students to solve mathematical problems there are many obstacles encountered in the learning process. In fact, students' mathematical problem solving abilities are not optimal. This shown from previous studies conducted by [6], [7], [9], [12], [13] and several studies at the international level including, [3], [5], [8], [11], [14], [15], [17]. The results of these studies indicate that students' mathematical problem solving abilities are still low.

This situation meets with the actual learning when we are conducting preliminary research at SMP Negeri 26 Padang and SMP Negeri 34 on September 8-15, 2018. As shown in following question:

*Adit and Daffa had ducks. Adit had 6 cages with each cage containing 20 ducks while Daffa had 7 cages with each cage containing 5 more than the number of dacks in the Adit cage. Determine the many ducks that Adit and Daffa had?*

From the student's answer in completing the problem, it seems the students have difficulty in determining the steps to solve the problem so the problems cannot be resolved. Students also find difficulty in identifying problems so that when writing down the known elements in the problem, students only rewrite the questions. The low mathematical problem solving abilities of students is also showed by the results of the students ability test of mathematical problem solving, as shown in table 1 :

TABLE 1  
Percentage Completeness of Mathematical Problem Solving Ability Test Results for Semester 1 Class VII Students

School	Number of Students	Percentage Completeness (%)
SMP Negeri 26 Padang	32	40,63
SMP Negeri 34 Padang	31	41,67

Table 1 shows that the percentage of completeness test results of students' mathematical problem-solving ability is still low. The test results of students who are above the average have less than 50%. The researcher also observed the lack of involvement of students in the learning process. The teacher has facilitated students to ask if there are materials that they do not understand. However, most of students choose not to

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respond. When the teacher gives a question that is different from the presentation with the questions exemplified before, the students seem confused to finish it. Based on observations and interviews with several teachers, it can be concluded that students are having difficulty to solve the question of solving problem.

When students solve the problem there are several indicators that do not look like students have difficulty writing down known the elements in the question (known and asked), students find the difficulty to determine the steps to solve the problem. The LKPD that is used does not facilitate students in developing mathematical problem solving abilities. From the questionnaire given to students, information was obtained that students had difficulty understanding the language used in the book and students understood the explanation from the teacher than reading the book.

This situation causes ineffective learning process. One of the causes of the ineffectiveness of the learning process is the lack of optimal preparation of learning tools (RPP and LKPD) such as found in the journal [1] and [4].

One of the solutions to improve students' mathematical problem solving abilities is to develop learning tools based on Problem Based Learning (PBL). PBL is a learning model that begins with giving a problem related to daily life to students in accordance with the learned material.

PBL is learning uses a real problem as the beginning of students to learn about critical thinking and problem solving skills to obtain knowledge and essential concepts from the material being studied [7]. Defines that problem-based learning is a learning approach that has characteristics of using real problems as a context for students to learn critical thinking, problem solving skills and obtain knowledge about the importance of learning materials[7].

This study using the PBL model has been applied in several previous studies such as [7], the results of the study are that the improvement of mathematical problem solving abilities of students who get problem-based learning is better than students who get conventional learning. While the studies conducted by [2], [5], [13], [15], and [16], it was concluded that PBL models can improve students' mathematical abilities.

The PBL model has several advantages, namely this model is good for understanding the contents of the lesson, it can provide satisfaction to find new knowledge for students, it develop students' mathematical thinking skills such as problem solving skills, and it provide opportunities for participants to apply the knowledge they have in the world real. Based on these advantages, it is suggested for teachers to develop PBL-based learning devices. PBL steps used in this study are the orientation of students to the problem, organizing students to learn, guiding the investigation of students individually or in groups, developing and presenting the work, analyzing and evaluating the problem solving process.

## 2. METHOD

The type of research conducted is Development Research. Sugiyono (2014) says that Development Research is a research method to produce a product and test its validity, practicality and effectiveness. This research is useful for developing a product in the form of PBL-based LKPD and RPP to improve the mathematical problem solving abilities of class VII junior high school students. The developed materials are instructional that are valid, practical and effective.

The development model used is the Plomp model which consists of three phases, namely the initial investigation phase (preliminary research), the development phase or prototype creation (development or prototyping phase), and the assessment phase. In the initial investigation phase (preliminary research) the researcher conducted three activities, namely needs analysis, student analysis, curriculum analysis, and concept analysis. After all the activities have been completed, continued in the development phase or prototype making (development or prototyping phase), the activities carried out in this phase are the creation or development of learning devices that will be piloted and revised in their own evaluation and expert review. The results obtained in this phase continued in the assessment phase of the activity carried out to assess the practicality and effectiveness of the learning tools that had been developed.

## 3. RESULTS AND DISCUSSION

The initial investigation phase (preliminary research) is carried out for the purpose of knowing the problems contained in the learning process and knowing the things needed for learning instructions that will be developed in Class VII Middle School students. The initial investigation phase (preliminary research) consists of three activities including:

### a. Needs Analysis

At this stage, the information is obtained using teacher interview guidelines, field notes, student questionnaires, and preliminary test questions. Based on the results of interviews with several teachers, information was obtained as follows:

1. When the learning process takes place, students look lazy especially when working on a question that has a different with the previous example.
2. When students are given a story questions that contain indicators of problem solving, students cannot solve them well. Some indicators of problem solving are not seen when students solve the problem so that the problem cannot be solved properly. It can be said that students' mathematical problem solving abilities are not optimal.
3. The time for implementing is not sufficient because there are students who do not understand the material described and the teacher has to explain again.

4. Learning resources are LKPD and textbooks.
5. The used LKPD is not a self-designed LKPD.
6. LKPD can help students understand the material but the teacher keeps explaining the material at the beginning of learning. However, the LKPD that is used has not been able to facilitate students to improve mathematical problem-solving skills because there are no steps that guide students to solve a problem well.
7. Teachers often use group discussion methods and frequently asked questions in learning. The learning method used by the teacher is tailored to the character of the students and the material to be learned. Although the learning method used by the teacher has been adapted to the character and material to be studied but most students still do not understand the material being studied. This can be seen from the response of students during the learning process and student learning outcomes, most of which are still under the KKM.
8. LKPD which is expected by the teacher is LKPD which contains steps that can guide students to solve non-routine problems and can improve students' mathematical problem solving skills.

Based on observations on the learning process, it seems that students less involvement in the learning process. Only some students want to respond and work actively on the problem in front of their class. If there are things that are not understood, students prefer to ask their friends instead of asking directly with the teacher.

From the questionnaire given to students, this research obtained information as follows:

1. Students assume mathematics is a difficult and unpleasant lesson. However, they realized that mathematics has many benefits.
2. Students are not actively asking the teacher, but students prefer to ask their friends if there is material they do not understand. This is indicated by the percentage of students' responses stating that they chose to ask friends rather than directly to the teacher with a percentage of 40.63%.
3. Students have problems with the LKPD that are used because it is difficult to understand questions and images that are not clear.
4. Students with a percentage of 75% said they were not actively asking the teacher when the learning process took place.

From the tests results analysis of mathematical problem solving abilities, this research obtained than less than 50% of students did not complete. Students who came from SMP Negeri 26 achieved 40.63% and those from SMP Negeri 34 were 41.67%.

#### b. Learner Analysis

Analysis of students is useful to find out the basis for designing learning instructions that will be developed. This is for knowing the academic abilities of students, knowing the environment of students, the preferred form of learning and desired LKPD and the colors that students like.

Students in one class have diverse academic abilities, including low, medium and high ability. Most students live on the coast and near the market. This should make students dare to express their opinions while studying. However, in reality students prefer to ask with friends rather than teachers.

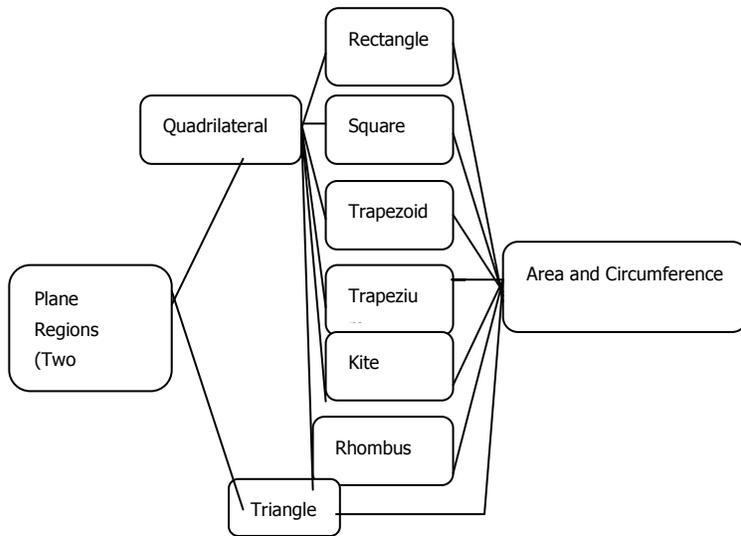
The forms of learning favored by students are in groups. Regarding LKPDs that are liked by students are LKPDs with drawings, attractive colors, and fixed sizes of LKPD sizes that are usually, easily understood. The dominant color favored by students for LKPD is blue.

#### c. Curriculum Analysis

Analysis of this curriculum was conducted on Core Competencies (KI), Basic Competencies (KD), and indicators of competency achievement for second semester junior high school mathematics material in class VII. This analysis is done to improve and to pay attention to the achievement of competencies in the learning instructions. Based on the syllabus given by the teacher especially on quadrilateral and triangle material, differences are indicators of competency achievement consisting of 6 indicators into 14 indicators and indicators of competency achievement consisting of 1 indicator into 4 indicators that aim to improve students' problem solving skills. Before the revision for one meeting, all plane regions such as meeting-2 discussed extensively for plane regions, while after revision for each meeting discussed one type of plane region for the area and the circumference of the plane. This causes the learning objectives of each meeting to change according to the indicators of achievement of competency per meeting.

#### d. Concept Analysis

Research will be conducted on quadrilateral and triangle material. Concept analysis is done by determining and compiling the concepts of quadrilateral and triangle material which will be studied systematically. Preparation of material is done so that students easily understand the material. Concept maps of quadrilateral and triangle material can be seen in figure 3 below:



Based on the problems that researchers found in the field, students need learning tools that can improve their mathematical problem solving abilities. Learning tools that will be designed are guided by the results of needs analysis, student analysis, curriculum analysis, and concept analysis. Learning tools are designed based on PBL characteristics.

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## 5. CONCLUSION

From the results of this research, it can be concluded as follows: 1) students' mathematical problem solving abilities are not optimal, 2) LKPD used by students have not been able to facilitate students to improve the ability to solve problems, 3) Learners like learning in groups, 4) Students like LKPD that is easy to understand, colored, has clear images. Based on the results of the data analysis, This is important to develop PBL-based learning instruction.

With the development of PBL-based learning tools, it is hoped that students can be active in the learning process and improve students' mathematical problem solving skills.

## 6. REFERENCES

- [1] Barlenti, I. 2017. Pengembangan LKS Berbasis Project Based Learning Untuk Meningkatkan Kemampuan Pemahaman Konsep. (Jurnal), (<http://www.jurnal.unsyiah.ac.id> ,27 November 2017).
- [2] Fatimah, Fatia. 2012. Kemampuan Komunikasi Matematis dan Pemecahan Masalah Melalui Problem Based Learning. Jurnal Pendidikan dan Evaluasi Pendidikan UT Padang.
- [3] Fitriani, Nelly. 2017. Hubungan Antara Kemampuan Pemecahan Maslah Matematis dengan Self Confidence Siswa SMP yang Menggunakan Pendekatan Pendidikan Matematika Realistik. Jurnal Euclid, vol.2, No.2, p.341 ISSN 2355-1712
- [4] Iqbal, M. 2017. Pengembangan lembar kerja peserta didik (LKPD) Dengan Pendekatan Kotekstual Ditinjau Dari Pemahaman Konsep Dan Disposisi Matematis.(Jurnal),(<http://digilib.unila.ac.id>,25 November 2017).
- [5] Kodrayati, Laila dan Budi Astuti. 2016. Pengaruh Model PBL Terhadap Kemampuan Komunikasi dan Kemampuan Pemecahan Masalah Matematika Kelas V SD. Jurnal Prima Edukasia, Print ISSN: 2338-4743, Online ISSN: 2460-9927.
- [6] Mawaddah, Siti dan Hana Anisah. 2015. Kemampuan Pemecahan Masalah Matematis Siswa pada Pembelajaran Matematika dengan Menggunakan Model Pembelajaran Generatif (Generative Learning) di SMP. EDU-MAT Jurnal Pendidikan Matematika, Volume 3, Nomor 2.
- [7] Sumartini, T.S. 2016. Peningkatan Kemampuan Pemecahan Masalah Matematis Siswa melalui Pembelajaran Berbasis Masalah. Jurnal "Mosharafa", Volume 5, Nomor 2 ISSN 2086 4280.
- [8] Thuy, Phi Van. 2017. Developing Students' Metacognitive Skills In Mathematics Classroom. Vietnam: Anale. Seria Informatică. Vol. XV fasc. 1 – 2017.
- [9] Ulvah, Shovia. Kemampuan Pemecahan Masalah Matematis Siswa ditinjau melalui Model Pembelajaran SAVI dan Konvensional. Jurnal riset pendidikan : ISSN: 2460-1470.
- [10] Utami, Ratna Widianti dan Dhoriva Urwatul Wutsqa. 2017. Analisis Kemampuan Pemecahan Masalah Matematika dan Self –Efficacy Siswa SMP Negeri di Kabupaten Ciamis. Jurnal Riset Pendidikan Matematika : 4 (2), 2017, 166-175 ISSN 2356-2684 (print), ISSN 2477-1503 (online).
- [11] Wadelin, D. 2014. Teaching Mathematical Modelling and Problem Solving- A Cognitive Apprecisanship Approach to Mathematics and Engineering Education. Sweden JEP – Volume 4, Issue 5, Special Issue: "CISPEE".
- [12] Windari, Fimatesa. 2014. Meningkatkan Kemampuan Pemecahan Masalah Matematika Siswa Kelas VIII SMPN 8 Padang Tahun Pelajaran 2013/2014 Dengan Menggunakan Pembelajaran Inkuiri. Jurnal Pendidikan Matematika Vol. 3 No. 2.
- [13] Yerizon. 2013. Student Responses Toward Student Worksheets Based on Discovery Learning for Students with Intrapersonal Intelligence. Universitas Negeri Padang doi:10.1088/1757899X/335/1/01213.
- [14] Yerizon dan Dewi Harni Nasution. 2019. Development of Student Worksheets Based On Discovery Learning To Improve Student Mathematical Problem Solving Ability In Class X Senior High School. International Journal Of Scientific & Technology Research Volume 8. Issue 06 ISSN

2277-8616.

- [15] Yuliasari, Evi. 2017. Eksperimentasi Model PBL dan Model GDL Terhadap Kemampuan Pemecahan Masalah Matematis Ditinjau dari Kemandirian Belajar. *Jurnal Ilmiah Pendidikan Matematika* ISSN 2301-7929 (print), ISSN 2502-1745 (online).
- [16] Yustianingsih, Rizza. 2017. Pengembangan Perangkat Pembelajaran Berbasis Problem Based Learning (PBL) Untuk Meningkatkan Kemampuan Pemecahan Masalah Matematis Peserta Didik Kelas VIII. *Jurnal Nasional Pendidikan Matematika* ISSN 2549-4937.
- [17] Zulfah. 2017. Pengaruh Penerapan Model Pembelajaran Kooperatif Tipe Think Pair Share dengan Pendekatan Heuristik Terhadap Kemampuan Pemecahan Masalah Matematis Siswa MTs Negeri Naumbai Kecamatan Kampar. *Journal Cendekia: Jurnal Pendidikan Matematika* Volume 01 No. 2, November, pp. 1 – 12 E-ISSN : 2579-9258.