

On Mathematical Literacy of Lower Secondary School Students in Palembang Through Problem-Based Learning

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ABSTRACT

This research aims at describing lower secondary school students' mathematical literacy in problem-based learning. The research was conducted at SMP Negeri 19 Palembang involving 32 eighth grade students. Due to covid-19 pandemic all classes were conducted through Zoom cloud meetings. Student worksheets were used for learning activities. At the end of class, students were given posttest and interviews using Google form and classroom. Data analysis shows improvements in students' mathematical literacy especially in understanding contextual problems.

Keywords: *Mathematical literacy, problem-based learning.*

1. INTRODUCTION

Mathematics is important because it trains students to think logically and critically in solving real life problems [1]. The objectives of mathematics are contained in the appendix to Permendikbud (ministerial decree) No.58/2014 regarding the SMP curriculum concerning models used as accurate estimates in solving problems by making conclusions based on existing data with critical thinking in the context of mathematics and outside mathematics (everyday life, science and technology) [2] with a junior high school mathematics teacher who stated that students had difficulty determining questions and answering questions with contextual problems. There are three reasons why mathematics literacy is low, namely (1) weak curriculum, (2) teachers in Indonesia are less trained, and (3) lack of support for the environment and schools. This results from Noor's TIMSS research [1] based on the above facts we can conclude it that students' mathematical literacy skills are frequently low.

Both of these refer to mathematical literacy skills because it is the ability to formulate, carry out and conclude in various life contexts including mathematical thinking of concepts, procedures and facts to be able to describe, explain and predict an event [3]. UNISCO also provides the slogan Literacy For All because everyone has the right to get literacy to become an asset in facing life. There are seven

components of Mathematical literacy skills, namely (1) communication, (2) mathematising, (3) representation, (4) reasoning and argument, (5) devising strategies for solving problems, (6) using symbolic, formal and technical language and operation; and (7) using mathematics tools [4].

However, in reality literacy in Indonesia is still low. This is evidenced by the results of PISA from 2000, 2003, 2006, 2009, 2012 and 2015, Indonesia has always been ranked in the top ten lowest with an average of 386 (Level 1) while the international average is 500 (Level 3) [1]. TIMSS results in 2015 also Indonesia got 397. The latest results, namely 2018 Indonesia also ranked 72 out of 79 countries. This is also reinforced by the results of interviews [2] with junior high school mathematics teachers who stated that students had difficulty determining questions and answering questions with contextual problems. There are three reasons why mathematics literacy is low, namely (1) the weak curriculum, (2) Indonesian teachers are less trained, and (3) lack of support for the environment and schools. This is the result of Noor's TIMSS research [1] based on the facts above, we can conclude it that students' mathematical literacy skills are still low.

Based on the facts above, the teacher should use the appropriate learning model in learning mathematics Students are not only expected to have the ability to solve daily problems with formulas and

calculations but must have the ability to reason and think critically in solving problems. The learning model to be appropriate is Problem Based Learning (PBL). Problem Based Learning (PBL) is learning that is focused on students. Students will solve these problems through the knowledge they have. Problem Based Learning (PBL) stated by Barrows is that problem-based learning is from the beginning of the learning process generated through the process of understanding the problem [3]. This PBL model also emphasizes learning that focuses on the actual world. There are five PBL steps, namely (1) oriented to the problem, (2) grouping students into learning, (3) guiding students to collect information both individually and in groups, (4) developing and presenting their work, and (5) analyzing and re-examining the problem-solving process Arrends [3].

2. METHOD

This method used for this research is descriptive qualitative. The aim of this study is to figure out the literacy skills of junior high school students use problem-based learning with topic relation and function [5]

This research started by giving tests to see the students' initial abilities then continued with giving activities or *LKPD* for 4 meetings and finally students will be given a posttest to see how mathematical literacy skills are in the application of Junior high Problem Based Learning (PBL). The data is analyzed by doing data reduction, triangulation and drawing conclusions, while checking the validity of the study was the researcher's persistence, triangulation and peer examination. The products produced in this study were RPP and *LKPD* to be carried out at the time of the study. The subjects of this study were 6 students, 2 high-skilled, 2 medium-skilled and 2 low-skilled. We conducted this research at SMPN 19 Palembang with 32 students in grade 8 [6].

3. RESULTS AND INTERPRETATION

This research was conducted online on *zoom* meetings and discussions on WhatsApp. assignments were collected via google form to test students' initial abilities and in activities or we collected student worksheet and posttest using google classroom app. During the *LKPD* discussion, the students were observed and at the end of the study the students were interviewed.



Figure 1. Implementation of online learning.

3.1. Initial Ability Test

The first stage is a test to determine the students' initial abilities, which are collected by google form. Before the beginning of the study, students were given questions with straight line equations in the form of common questions.

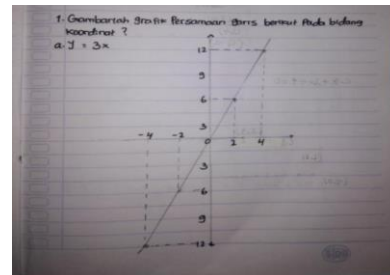


Figure 2. Initial ability test.

At this stage students are given functions and asked to draw their graphs on the coordinate plane.

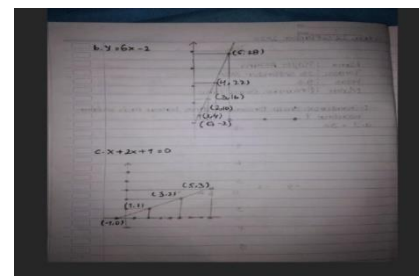


Figure 3. Initial ability test.

At this stage students are given functions and asked to draw their graphs on the coordinate plane.

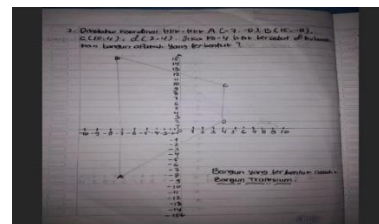


Figure 4. Initial ability test.

At this stage students are given coordinate points, then students are asked to describe and determine the points in each coordinate.

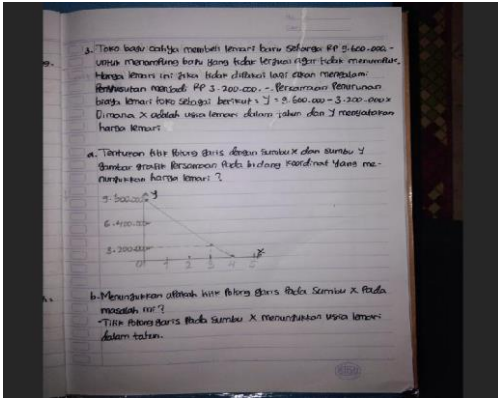
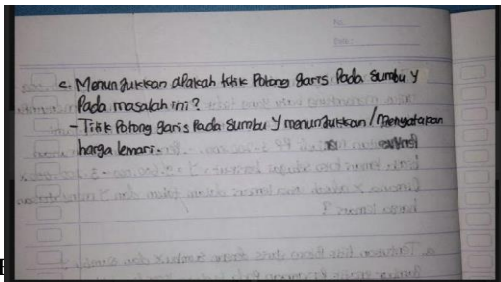


Figure 5. Initial ability test.

Students were asked to process information from contextual issues. Then students were asked to draw a graph of the contextual problem and students are asked to cut the point x



Students were asked to draw a graph of the contextual problem and students are asked the intersection point x.

From pictures above we can see students have the ability to draw a Cartesian diagram in the first question, determine the points on the diagram in the second question, and can process information in the third question. This shows that students already have the basis to continue to LKPD. However, students have obstacles in the third question because they are not used to working on contextual questions in sections B and C because there are incorrect answers.

3.2. Activity 1

The second stage, namely activity 1 regarding extracurricular activities, students are asked to match each activity with the existing terms and conditions, before starting, students were told to watch learning videos and reading materials in the form of books on relation material only. The discussion was carried out on zoom to discuss questions, this activity was carried

out with an allocation of time of 45 minutes, at this initial meeting the students who attended were 27 students out of 32 students. The beginning of the zoom activity was carried out with prayer, asking attendance and discussing learning objectives. After the discussion, it turned out that the students had very satisfying answers.

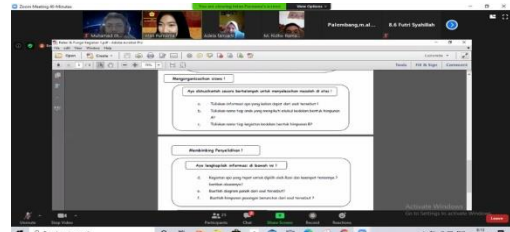


Figure 7. Zoom discussion activities, students present their answers.



Figure 8. Photos of teaching materials in learning process.

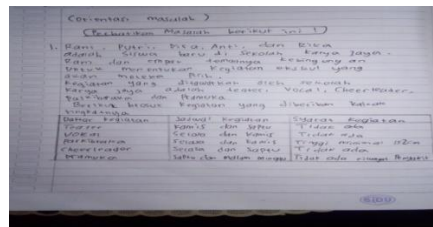


Figure 9. Problem orientation.

Students are given LKPD, students read and understand the problems contained in the LKPD and they will discuss these problems in their respective groups.

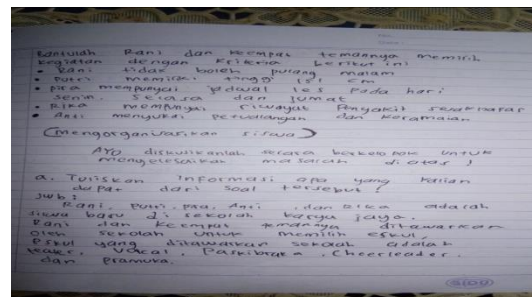


Figure 10. Organize students.

Students has been told to write down the information they get through the results of the discussions they have had. After they get the information they are asked to write set A and set B.

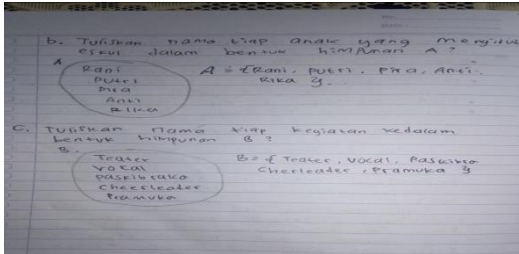


Figure 11. Organize students.

Students are asked to write down the information they get, namely Himpunan B through the results of the discussions they have had.

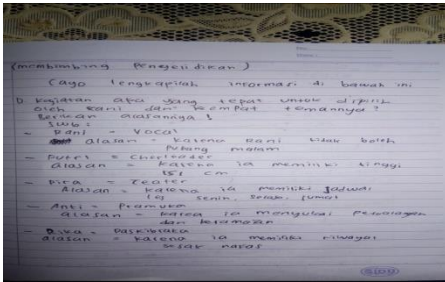


Figure 12. Guiding investigations.

After students understand what problems they get, they are asked to pair the right activities for the problem with reasons, then they are also asked to write down a diagram of the arrows and the set of consecutive pairs.

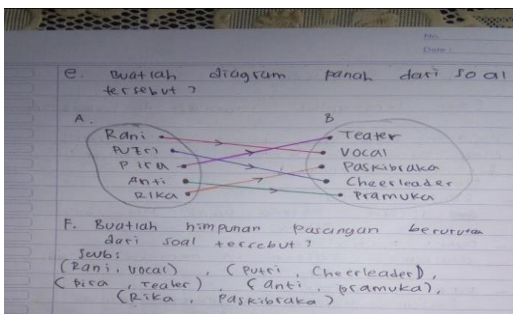


Figure 13. Guiding investigations.

After students understand what problems they get, they are asked to pair the right activities for the problem and give reasons, then they are also asked to write down a diagram of the arrows and the set of consecutive pairs.

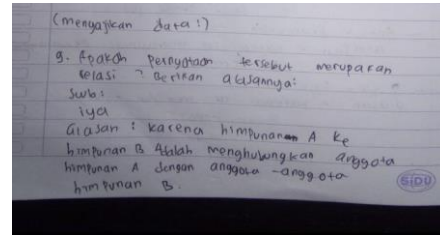


Figure 14. Presenting the data.

After they get the results of the investigations conducted, students are asked to write down the conclusions they can. In the form of a question whether the statement is a relation and they are asked to provide reasons and finally present their answer through the existing zoom.

From the answers from LKPD 1, it shows that students can understand these questions very well. From question A, write the next information, write set A and set B, then students can determine activities based on the right reasons, write arrow diagrams and finally they give the reason that it functions properly. It can be seen that students can understand the LKPD well through the PBL learning model. The LKPD used was PBL-based starting from problem orientation, organizing students, guiding investigations, presenting data and presenting their results through zoom.

3.3 Activity 2

The third stage, i.e., activity 2 regarding family tree activities, students are asked to determine whether the question is a function or not, before start the students are asked to watch learning videos and reading material in the form of books on relation material only. When the second discussion was held, the students who attended were 20 out of 32 students with a time allocation of 45 minutes. The discussion is carried out on zoom to discuss questions, the beginning of the activity is carried out with prayer, asking attendance and discussing the learning objectives. After the discussion, it turned out that the students had very satisfying answers.

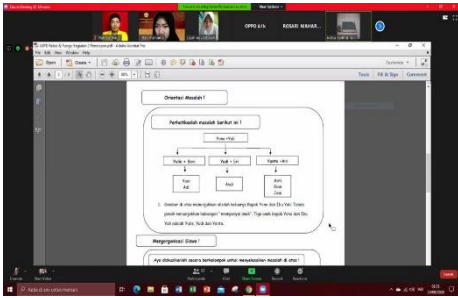


Figure 15. Zoom discussion activities, students present their answers.

Students are asked to write down the information they get through the results of the discussions they have had. After they get the information they are asked to write set A and set B.

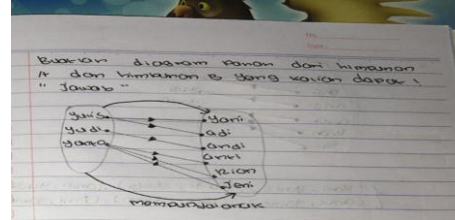


Figure 19. Guiding investigations.



Figure 16. Photos of teaching materials.

After students understand what problems they have, they are asked to make arrow diagrams of the problems

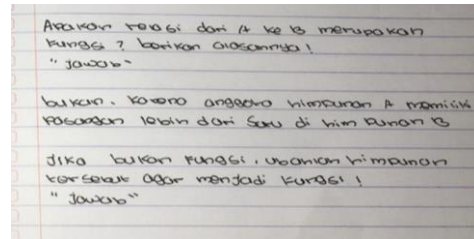


Figure 20. Guiding investigations.

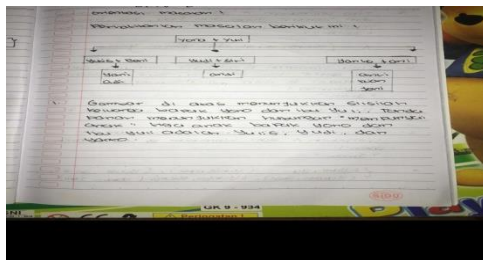


Figure 17. Problem orientation.

Students are given LKPD, students read and understand the problems in the LKPD and they will discuss these problems in their respective groups.

After students understand what problems they have, they are asked to make arrow diagrams of the Problems.

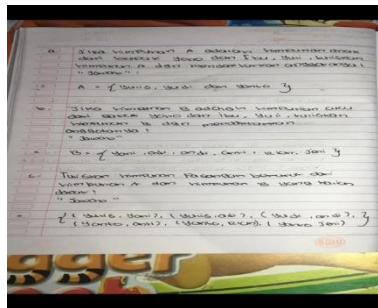


Figure 18. Organize students.

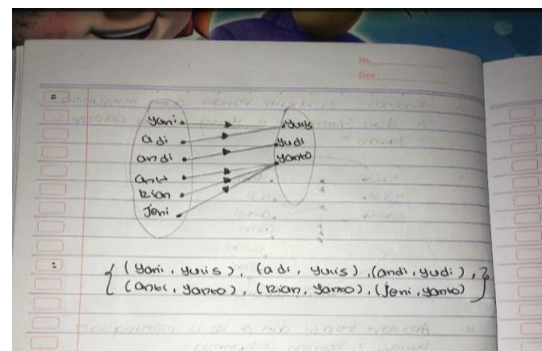


Figure 21. Presenting data

After they get the results of the investigations conducted, students are asked to write down the conclusions they can. In the form of a question whether the diagram is a relation.

From the answers from LKPD 2, it students can understand these questions well. From question A, write the information, then write set A and set B, then students can write down the arrow diagram and finally they give the reason that it is a function if it is a function. It can be seen that students can understand the LKPD well through the PBL learning model. The LKPD used was PBL-based starting from problem orientation, organizing students, guiding investigations, presenting data and presenting their results through *zoom*.

Table 1. Material relations and function indicators

| Skor | Rating Category | Frequenc y | Percenta ge |
|--------|-----------------|------------|-------------|
| 86-100 | Excellent | 3 | 50 % |
| 71-85 | Good | 2 | 33% |
| 56-70 | Adequate | 1 | 17% |
| 41-55 | Marginal | 0 | 0% |
| 0-40 | Failure | 0 | 0% |

Table 3. Lists the categories of students' mathematical literacy skills

| No | Name | Question Number | | | | | | Score total | Score end | Category |
|----|------|-----------------|---|---|---|---|---|-------------|-----------|-----------|
| | | a | b | c | d | e | f | | | |
| 1 | AF | 4 | 4 | 4 | 0 | 3 | 4 | 19 | 79 | Good |
| 2 | DP | 4 | 4 | 2 | 4 | 4 | 4 | 22 | 91 | Excellent |
| 3 | FS | 4 | 4 | 4 | 4 | 4 | 4 | 24 | 100 | Excellent |
| 4 | IN | 4 | 4 | 4 | 4 | 4 | 4 | 24 | 100 | Excellent |
| 5 | KA | 0 | 4 | 4 | 0 | 3 | 4 | 15 | 62 | Adequate |
| 6 | LNE | 4 | 4 | 4 | 0 | 3 | 4 | 19 | 79 | Good |

Based on the table above, there are 3 Excellent students with a percentage of 50%, two good categories with a percentage of 33% and one Adequate category with a percentage of 17%.

4. RESULTS AND DISCUSSION

4.1 Results

After the test was completed, the test was used to measure the mathematical literacy skills of students of SMP Negeri 19 Palembang in grade 8.6 with six subjects, namely 2 high skills, 2 moderate abilities and 2 low abilities, then the test was analyzed [7] The test questions are assessed based on the scoring guidelines that have been made. Of these 2 questions, each question uses indicators such as the following.

Table 2. Lists the grouping of students' mathematical literacy abilities

| Indicator |
|--|
| Define a relation |
| Shows a relation with an ordered set of pairs with arrows and Cartesian diagrams |
| Define a function and not a function |

The results of activity of six research subjects were as follows;

4.2 Discussion

From the results of research conducted at SMPN 19 Palembang with 32 students and research subjects carried out, namely 6 people. 2 high skills, 2 medium skills and 2 low skills [8] When learning takes place through a *zoom* meeting discussion, students are asked to orient the problem by reading the

information from the question so that it is clearer and more understandable, the second step taken by students is guided to organize students, namely the teacher helps students by defining or organizing questions related to the problem, the third step is guiding the investigation namely by the teacher encouraging students to get the right information by looking for explanations and solutions to the problems faced, the fourth step is developing and presenting the work, namely the teacher encourages students to make conclusions and provides reasons for the results that students get, and the fifth step is analyzing and evaluating, namely discussing LKPD that students do through zoom meetings, students present what they are doing and if there is something unclear and inaccurate, this is directly discussed among fellow students here the teacher only acts as a facilitator. Based on the explanation above, the PBL steps are in accordance with what was stated. There are 5 steps in implementing PBL, namely (1) orienting students to the problem; (2) organizing students to research; (3) assisting independent and group investigations; (4) develop and present the work; (5) analyze and evaluate the problem solving process [9-10]

When students have acquired mathematical literacy skills, students can link these questions to the next problem because these PBL steps require students to have mathematical literacy skills to think critically in dealing with math problems in everyday life. According to Ojose, he defines mathematical literacy as a person's ability to know and apply basic mathematical skills that every human being has in everyday life [11-13].

5. CONCLUSION

After conducting the research entitled “on *Mathematical Literacy Of lower secondary school Students In Palembang through Problem Based Learning*” in class VIII 6 SMP Negeri 19 Palembang, the writer can conclude that; (1) Implementation of Problem Based Learning (PBL) makes student learning more enjoyable, (2) Students find it easier to solve problems with HOTS based on contextual questions, this can be proven by the results of the students' initial ability tests before implementing Problem Based Learning (PBL). and the results after implementing the learning. and (3) suggestions for researchers when making questions must be questions that apply the problems faced by real and current situations so that students are more interested and challenged in solving these problems [14]

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