Mathematical Literacy Capability through Problem Based Learning Model in Junior High School

(1). Adi Asmara, (2). Prof. Dr. Bambang Sahono, M. Pd, (3) Dr. Alexon, M. Pd, (4). Dr. Rosane, M. PdAdi Asmara, Prof. Dr. Bambang Sahono, M. Pd, Dr. Alexon, M. Pd, Dr. Rosane, M. Pd

Department of Mathematics Education, Faculty of Education and Pedagogy, Muhammadiyah University of Bengkulu

ABSTRACT
This research aims to find out the difference between problem based learning models and conventional to students' mathematical literacy skills. This research was conducted by experimental method. The research population is a grade VIII student of SMP Negeri 10 North Bengkulu. The sample consists of two groups, namely the Problem Based Learning model group and the Conventional group. Both groups were given pre-tests to determine the initial ability of students' mathematical literacy. After the Pre-Test, the Problem Based Learning group gets learning with problem based learning synaesses and conventional groups get learning according to conventional synapses. Both classes give post-test to find out the differences and improve students' mathematical literacy skills. Data processing and data analysis are performed using T-Test with the help of Microsoft Excel 2010 software. The results showed (1) There were differences in students' mathematical literacy skills with problem based learning and conventional models; (2) Students who learn with the Problem Based Learning model are better than students who get conventional learning.
KEYWORDS: Mathematical Literacy, Problem Based Learning.

I. INTRODUCTION

In the 21st century today mathematical literacy is very important to every student. The development of mathematical literacy is the main pokus in mathematics learning. This is as mentioned in the 2013 curriculum.

The development of this mathematical literacy capability based on the results of the Programme For International Atudent Assessment (PISA 2018) shows that the mathematical literacy skills of students in the country are still low. Indonesian students have only reached the stage of formulating, using and interpreting mathematicians in various contecations. Based on observations in SMPN 10 North Bengkulu, researchers

it is noted that many students complain because they often have difficulty understanding questions, often make mistakes, have not been able to carry out problem solving procedures properly and choose the right strategy in problem solving.

Literacy in english literacy derived from latin littera (letters) whose meaning involves mastery of the writing systems and the accompanying conventions. However, literacy mainly relates to language and how it is used,

while the writing language system is secondary. Mathematical literacy ability is an individual's ability to formulate, interpret, and use in a variety of contexts and mathematics helps a person to understand the usefulness or benefits of mathematics in daily life. Organisation For Economic Operation And Development (OECD 2019). Mathematical literacy is defined as a person's ability to formulate, apply and interpret mathematics in various contexts of daily life (Johar ,2012; Ojose, B 2011).

while the writing language system is secondary. Mathematical literacy ability is an individual's ability to formulate, interpret, and use in a variety of contexts and mathematics helps a person to understand the usefulness or benefits of mathematics in daily life. Organisation For Economic Operation And Development (OECD 2019). Mathematical literacy is defined as a person's ability to formulate, apply and interpret mathematics in various contexts of daily life (Johar ,2012; Ojose, B 2011).

This ability helps a person to recognize that mathematics plays a huge role in every aspect of life and to make reasoned decisions and is also needed constructively, engagingly and reflectively. This means mathematical literacy can help individuals to recognize the role of mathematics in the real world and as the basis for consideration and decision-making needed by society.

The Problem Based Learning model in this study provides students with the opportunity to be able to play an active role in solving the problems faced in daily life.

The Problem Based Learning model according to Cazzola (in Fitriono, Yuli, Rochmad, Wardono, 2015) is a learning approach centered onstudent contruktivism based on analysis, resolution, and discussion of the given problem, the problem raised by the teacher is a real and interesting problem so that students are trained to solve problems that require creative thinking.

According to Amin (2017) Problem Based Leraning is a learning model using authentic (real) problems as a context for students in solving and thinking critically to gain knowledge and learn to take care. Authentic problems become the starting point in problem based learning, thus encouraging students to collect information and data in solving problems.

According to Abdurrozak (2016) also suggested Problem Based Learning is a learning sutu that emphasizes the provision of real problems in daily life that students must solve through independent investigation to hone creative skills in problem solving in order to form solutions of the problem as essential knowledge and concepts of learning. From the above opinion it can be concluded that Problem Based Learning is a learning model that uses real-world problems as a context for students to learn about critical thinking and problem solving skills.

According to Abdurrozak (2016) the steps of Problem Based Learning (PBL) are as follows:

Figure 2.3 Steps of Learning Problem Based Leraning

No	Phase	Teacher Behavior
1	**Phase : 1** Orienting students on issues	• Discuss learning objectives • Describe important needs • Motivate students to engage in problem-solving activities
2	**Phase : 2** Organizing students to conduct research	• Help students define and organize learning tasks related to their problems
3	**Phase : 3** Helping students to conduct independent investigations and groups	• Phase : 5 • Analyze and evaluate processes for troubleshooting problems
4	**Phase : 4** Develop and identify artifacts and exhibits	• Assist students in planning and preparing the right artifacts such as reports, recordings, videos and models. • Assist students in planning and preparing the right artifacts such as reports, recordings, videos and models.
5	**Phase : 5** Analyze and evaluate processes for troubleshooting problems	• Help students reflect on their investigations and the processes they use

II. RESEARCH METHODS

This type of research is experimntal experiments aimed at testing comparative hypotheses with the desi gn of research where in the experiment class of problem based learning models and control classes with convent ional learning models.

SMP Negeri Place 10 North Bengkulu. Research Time for the 2019/2020 school year. Grade VIII student population. A sample of 33 grade VIIID students as an experimental class, and grade VIIIA 34 experimental graders control. Sampling random sampling is a simple random sampling, by randomize the class of the population.

Defenisi operasiona this research (1) problem based learning model and conventional applied in accordance with the steps /syntak of each learning model. (2) Mathematical literacy ability is the average of the

mathematical literacy ability test scores obtained by students before and after being given good treatment on. Problem Based Learning and convesional learning models.

Test Data Collection technique in the form of a set of math literacy questions of the initial test (pre-test) in order to know the initial ability of the student before being given treatment and the final test (post-test) aims to know the ability after being given treatment. The test question used is a question of mathematical literacy ability test that is first validated by experts, namely lecturers and teachers of mathematics subjects.

Research data analysis techniques through several tests are:

Analysis Prerequisite Test

a. Data Normality Test

A normality test is required to test whether the distribution of data is normal or not. To test normality used kolmogorov smirnov test. To test the normality of the data, the hypothesis to be tested is as follows:

H_0 : Normal distribution of data.

H_1 : Data distribution is not distributed normally

b. Variance Homogeneity Test

The homogeneity test aims to find out whether the variance between sample groups is homogeneous or not. In this case it was done with the Barleth test at a significance level of 0.05. The criteria used are when the calculated value is $x^2{}_h > x^2{}_t$, table value, then H0 states the variance of the score is homogeneously rejected, in other case accepted.

III. RESULTS AND DISCUSSIONS

This research was conducted in SMPN 10 North Bengkulu using two sample classes namely grade VIIIB, and VIIID. VIIID class is 33 students as an experimental class, and viiib class of 34 control experiment class.

Pre-Test and post-Test data are treated. Pre-test and Post-Test data were instincted to see if there were differences in mathematical literacy capabilities in both groups. Then based on post-test data dinalisi which model gives better results. Furthermore, as a condition for using parametric statistics, hypothesis testing includes data normality tests and variance homogity tests.

Pre-Test and Post-Test data on students' mathematical literacy capabilities are obtained descriptive statistics on a lot of data (n), total score ($\sum$), average (x), maximum score, minimum score, and standard deviation (s). can be seen in the following table 2:

Table 2 Distribution of Post-Test results and post-test
Student Mathematical Literacy Capabilities

Nilai	Problem Based Learning						Konvensional					
	n	$\sum$	X	S	Min	Maks	n	$\sum$	x	s	Min	Maks
Pre-Test	32	304	9.50	3.82	3	18	34	372	10.94	3.797	5	18
Post-Tes	33	547	17.09	2.52	13	21	34	505	14.85	3.798	6	20

Based on table 2 above, can be seen the total score of Problem Based Learning class Pre-Test is 304 with an average score of 9.50 and the total post-test score is 547 with an average score of 17.09 meaning that the treatment given to students with the Problem Based Learning learning model increased the total score by 243 with an average score increase of 7.59. For the total pre-test score obtained in the convesional class was 372 with an average score of 10.94 and the total post-test score of 505 with an average score of 14.85 meaning the treatment given to students with conventional learning models increased by 133 with an average score increase of 3.91. It can be concluded that students who get learners with problem based learning models are much improved than students who get conventional learning models with an average grade increase of 7.59 and 3.91. Standard deviation (s), Pre-Test data of Problem Based Learning class students as low as 3.82 with post-test sebasar 2.52 and conventional class pre-test data as low as 3,797 with post-test of 3,798.denagn max score post-test problem based learning class 21 and max score post-test conventional class 20. This means that classes that get the Discovery Learning learning model get higher grades.

Therefore based on the above description, it can be said that there are differences in the mathematical literacy capabilities of students taught with problem based learning and conventional models, and problem based learning models provide better results disbanding conventional models. The difference can be seen in the following images 1 and2.
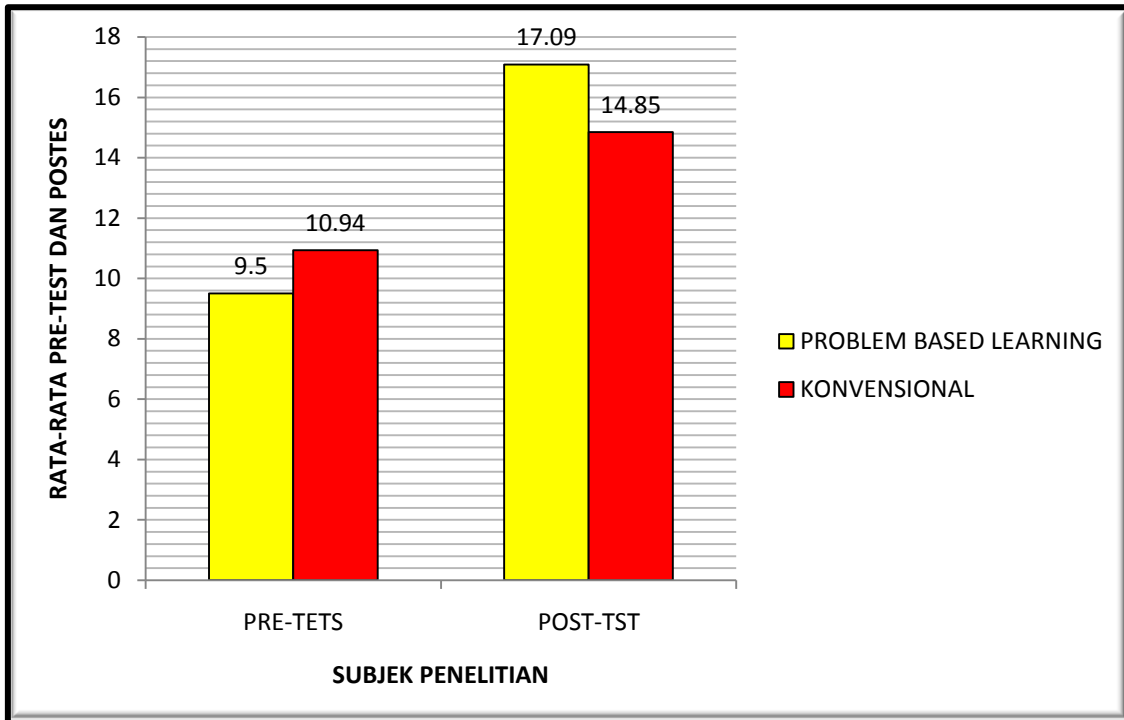
Figure 1. Average Pre-Test And Post-Test Mathematical Literacy Capability Model Problem Based Learning And Conventional
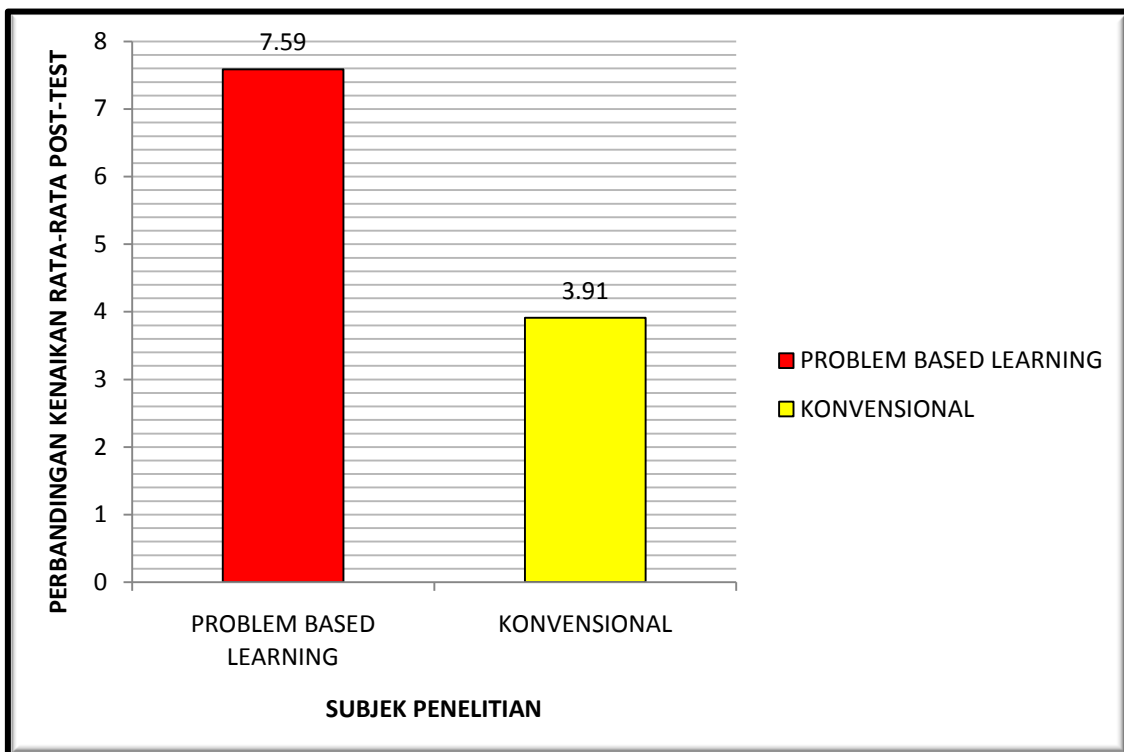

Figure 2. Comparison of Increase in Mathematical Literacy Ability of Students Model Problem Based Learning

Based on the results of data analysis using descriptive statistics for students' mathematical literacy skills prior to the implementation of the Problem Based Learning learning model has an average score of 9.50, for the highest score is 18. Then for the mathematical literacy ability of students after the application of the problem based learning model has an average score of 17.09, for the highest score of 21. The results of the inference statistical analysis (Paired Sample T-test) obtained a value of significance less 0.05. This means that there is an increase in students' mathematical literacy skills after the application of the Discovery Learning learning model.

This is in accordance with previous research conducted by Nur Indah (2016) in his research showing that there is an improvement in students' math literacy skills after the use of problem based learning learning models. Other research conducted by Asmara, A and Risnanosanti (2019) in the study showed that there was an improvement in students' mathematical literacy skills after the study model was implemented.

The improvement in students' mathematical literacy skills is due to several factors. One of them is different learning steps. Problem-based teaching is an effective approach to teaching high-level thought processes. This learning helps students to process the information that is already in their minds and compile their own knowledge of the social world and its surroundings. This learning is suitable for developing basic and complex knowledge. Problem Based Learning has student-centered characteristics, designed based on real problems that encourage students to build a rich understanding of contextual mathematical concepts through a series of constructive questions.

IV. CONCLUSIONS AND SUGGESTIONS

The research conducted at SMPN 10 North Bengkulu aims to determine the level of mathematics literacy ability of students by applying problem based learning model to grade VIII math learning providing good results to improve students' mathematical literacy skills. The sample in this study is grade VIII. B with a total of 32 students.

Based on the data analysis, it can be concluded (1) There are differences in the mathematical litrasi ability of students taught with problem based learning models and conventional learning models in SMPN 10 North Bengkulu. class VIII. (2) Problem Based Learning learning models have better average results in mathematical literacy than conventional learning models.

From this study obtained the results that there is an improvement in the math literacy ability of students who after the application of problem based learning models.

REFERENSI

[1].   Asmara, A Dan Risnanosanti. 2019. Literasi Matematika Siswa Smp Melalui Model Problem Based Learning. *Jurnal MATH-UMB.EDU* 6(3)- 163.53.187.236.
[2].   Abdurrozak, R. 2016. Pengaruh Model Problem Based Learning Terhadap Kemampuan Berpikir Kreatif Siswa. *Jurnal Pena Ilmiah* : Vol. 1, No 1 Pp 871-880.
[3].   Amin, Saiful. 2017.Pengaruh Model Pembelajaran Problem Based Learning Terhadap Kemmapuan Berpikir Kritis Dan Hasil Belajar Siswa. *JPG (Jurnal Pendidikan Geografi),*   4(3).Pp.25-36.
[4].   Ating Somantri. 2016. *Statistika Dalam Pendidikan* . Bandung : Pustaka Setia.
[5].   Arends, R.I. 2012. *Learning To Teach (9thEd.).* New York: Me Graw-Hill, Companies, LNC.
[6].   Fitriono, Yuli, Rochmad Dan Wardono. 2015. *Model PBL Dengan Pendekatan PMRI Bernilai Serupa PISA Untuk Meningkatkan Kemampuan Literasi Matematika Siswa*, UJMER, 4(1) : 65-65
[7].   Hosnan. 2014 *Pendekatan Saintifik Dan Kontekstual Dalam Pembelajaran Abad 21: Kunci Sukses Implementasi* Kurikulum 2013. Jakarta. Ghalia Indonesia, 287-288.
[8].   Johar. R . 2012. Domain Soal Pisa Untuk Literasi Matematika. *Jurnal Peluang*. Vol 1.(1), 1-10.
[9].   Jose, B. 2011. Mathematics Literacy: Are We Able To Put The Mathematics We Learm Into Everyday Use. *Journal Of Mathematics Education* 4(1), 89-100.
[10].   Kemendikbud. 2013. *Modul Pelatihan Implementasi Kurikulum 2013*. Jakarta: Kementrian Pendidikan Dan Kebudayaan RI.
[11].   Kurniasih & Sani .2014 *Strategi-Strategi Pembelajaran*: Alfabeta Bandung, 66-67.
[12].   Nur Indah,Dkk. 2016. Peningkatan Kemampuan Literasi Matematika Siswa Melalui Penerapan Model Pembelajaran Problem Based Learning Di Kelas Vii Smp Negeri 5 Pallangga Kabupaten Gowa. Mapan : *Jurnal Matematika Dan Pembelajaran*.
[13].   OECD. 2019. *Programme for International Student Assessment (PISA) 2018 Results in Focus- What 15-year-olds know and what they can do with whatthey know*. OECD Publishing.
[14].   .2019.PISA 2018 Results (Volume I): What Students Know and Can Do, PISA, OECD Publishing, Paris, https://doi.org/10.1787/5107¢754-en.
[15].   *Sagala, Syaiful.* 2009. *Konsep Dan Makna Pembelajaran. Bandung: Alfabeta.* (Hal 61).

[16]. Syah. 2004. *Psikologi Pendidikan Dengan Pendekatan Baru*. Bandung : PT. Remaja Rosdakarya Bandung: Alfabeta.
[17]. Uno. 2009. *Pengertian Matematika*. Jakarta : Bumi Aksara