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The Effect of the Implementation of Problem-Based Learning Models on the Mathematical Literacy Ability of Grade 7th Student's

Muhammad Farid Nasrulloh^{1*}, Zulaikhotun Nurlia²

1Mathematics Lecturer, Universitas KH. A. Wahab Hasbullah

2Collage Student, Universitas KH. A. Wahab Hasbullah

*Corresponding author: faridnasrulloh@unwaha.ac.id

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abstract

The purpose of this study was to observe and analyze the effect of the problem based learning model on increasing students' mathematical literacy at MTs Al-Asy'ariyah in the 7th grade even semester. The research method used is a quasi-experimental research with a quantitative research approach. The population in this study were all 7th grade students at MTs Al-Asy'ariyah Jombang City. This study used 2 groups as research subjects, namely the control group and the experimental group. The instruments in this research are using test instruments, learning media and student response questionnaires. The tests used are pretest and posttest. Analysis of the data in this study is to perform a normality test, homogeneity test and test the effectiveness of the problem based learning learning model. The results showed that the problem based learning model had a positive and significant effect on increasing students' mathematical literacy. The description of the learning model shows good results. Likewise, the description of students' mathematical literacy abilities showed good results, and the correlation value between problem based learning learning models and students' mathematical literacy levels showed a very strong significance.

Keywords :

Problem-Based Learning Models, Mathematical Literacy Skills, Mathematic education



Open Access

INTRODUCTION

The science of calculation in life is unavoidable. People have never realized that every time they do something, the science of calculation must be involved, especially during buying and selling transactions. One of the sciences that discusses calculations mathematics. Mathematics lessons are not foreign to the community because mathematics lessons have been obtained since they were still in early school. It is undeniable that not a few students do not like mathematics. This is common and can be caused by several factors, including lazy students repeating learning, low interest in learning, how to deliver material, student conditions, lack of student activity during learning etc. These factors also affect the low learning achievement of students, especially in mathematics. This is in accordance with the statement from (Yanti, 2017, hlm. 17) that students still think that mathematics is a boring and difficult subject so it is necessary to cultivate the perception that mathematics is not a difficult thing. This can also cause the ongoing learning process to be inefficient and the learning objectives not to be achieved. In addition, the consistency of the psychological condition of students is also changing so that there is a need for creativity and innovation in processing learning.

The change in knowledge in this case begins with knowledge transformation. The real form of knowledge transformation is by exploiting, merging or transforming into new knowledge. Of course the changes are based on the new assignments that are made face it, in this case is solving mathematical problems (Nafi'an, 2021). Based on the results of observations through interviews with 7th grade mathematics teachers at MTs Al-Asy'ariyah that during the learning process students were less involved in teaching and learning activities so that it had an impact on the level of students' understanding of the concepts in the material presented by the teacher. The cause of the low mathematical understanding/literacy of students is that students pay less attention to the teacher during the learning process, students often go in and out of class by reason of going to the bathroom, students discuss on their own about other topics, and not a few students sleep during the learning process. learn how to teach. In addition, observations from the side of students revealed that they found it difficult to understand the concepts and symbols that existed if they were only listeners.

In the process frequent math learning various problems were found can hinder student understanding in mastering the material. Problem such, as during learning less active students ask, express opinions or ideas except requested by the teacher and the lack of student's desire or interest in study math. This matter shown in difference students when the teacher gives questions, students just reading without any desire to solve problems in the matter (Hanum et al., 2019). Students in the learning process do not dare to put forward their arguments so that the learning process becomes passive and quickly boring. In addition to the lack of understanding of concepts and symbols, students find it difficult to concentrate if there are disturbances from their classmates/friends around them who do not pay attention to the teacher's explanation. (Atsnan et al., 2018)

This also causes low levels of mathematical literacy in students' cognitive abilities. Whereas mathematical problem-solving abilities in the mathematics learning process

are very important because students can develop ways of thinking that will be used as concepts and learn more mature so that students will be more independent. Mathematical problem-solving abilities can provide convenience for students to solve problems in everyday life (Rahmania et al., 2019). In this case, it is necessary to process an appropriate learning model or learning design in order to support students so that students are able to achieve learning objectives well.

The learning model applied at MTs Al-Asy'ariyah has not been able to build students' curiosity about learning and has not been able to make students actively participate in learning. According to (Mhakure & Mokoena, 2011) stated that the learning model is a plan or a pattern that is used as a guide in planning classroom learning or learning in tutorials and to determine learning tools including books, films, computers, curriculum, and others. In preparing the learning model, it is also necessary to observe the students. This is done so that the teacher can know the needs of the students.

The mathematical literacy ability of students is still very low. Because not a few students can only write down problem solving with direct answers without any process. Efforts to address problems related to learning activities in the classroom, and efforts to improve students' mathematical literacy skills, it is necessary to make efforts to improve and innovate in learning. One of the improvement efforts in order to improve students' mathematical literacy skills, the learning process must focus on the learning process of students and the breakdown of the stages of solving student problems.

According to (Mhakure & Mokoena, 2011) Problem Based Learning (PBL) is a learning model that presents contextual problems so as to stimulate students to learn. Students are able to present the results of their completion according to the stages and concepts of completion. In addition, students are also expected to be able to play an active role in channeling knowledge, ideas and receiving ideas from others. According to (Nasrulloh, 2020) Problem-based learning is closely related to the problems of everyday life. In addition to the selection of learning models, the level of difficulty of the material is also one of the factors that influence students' interest in learning. With the interaction between friends, both individually and in groups, they can develop positive attitudes towards learning mathematics so that they can improve students' mathematical literacy skills through peers.

This is in line with the results of research conducted by (Intan Purnama, 2020) on Students' Mathematical Literacy Ability in Problem-Based Learning (PBL) in Junior High Schools. The results of his research stated that the problem-based learning model was able to improve students' mathematical literacy skills in learning mathematics. PBL model is a learning model that applies contextual problems so that it stimulates students to learn to solve real-world problems. Application of the PBL model will introduce students to problems or cases that are relevant to teaching materials and require students to do all kinds of activities to solve problem (Tabun et al., 2020).

In its application, PBL provides the widest opportunity for students to investigate the problem at hand. This is in line with the four main educational pillars formulated by UNESCO (Sindhunata, 2000), namely learning to understand (learning to know), learning to implement or do (learning to do), learn to be yourself (learning to be), learn to work together or live in togetherness (learning to live together). Based on these pillars,

learning to understand does not mean only only memorize concepts or theories, but know the meaning of these concepts or theories. Learning not only results oriented, but the main orientation is the learning process. The learning process is also not just hearing and seeing to gather knowledge, but learning requires doing an activity with the aim of mastering certain competencies. By doing such activities, it will provide experience to solve the problems encountered. Problem solving can be done in collaboration with colleagues (Abdillah & Astuti, 2020).

This study uses a problem-based learning model as an intermediary to improve students' mathematical literacy skills. According to (Triyadi, 2018) states that the problem-based learning model is a learning model that solves problems in real life as the center of learning problems so that students can be stimulated to learn to solve these problems so that students can improve skills and present think critically in solving a problem. According to (Ermayeni et al., 2020) indicators of problem solving ability according to Polya are (1) understanding the problem, (2) planning a solution, (3) carrying out a solution, (4) re-checking the answers. Problem Based Learning (PBL) is a model learning where a problem, ask a question and facilitate education as the process of delivering material in progress learning.

Problem Based Learning will produce meaningful learning for student. Problem Based Learning makes students learn to solve a problem so that students will apply knowledge he has or trying to find new knowledge needed to solve the problem. Learning can be more meaningful and can be expanded when students dealing with a situation where the concept applied. Problem Based Learning can be also foster student initiative in work, internal motivation to learn, and can develop relationships interpersonal in individual work (Utami et al., 2019).

The Organization for Economic Cooperation and Development (OECD) states that mathematical literacy is the ability or capacity of an individual to formulate, use, and interpret mathematics into various contexts, including the ability to reason mathematically and the ability to use mathematical concepts, procedures, facts and functions to describe, explain and predict a phenomenon (Muhazir et al., 2020). Mathematical literacy is an ability to analyze, formulate and interpret a set of numbers and symbols or images to solve problems and apply them in everyday life. The literacy skills of students are needed in solving problems. According to (Khotimah & Nasrulloh, 2018, hlm. 80) Indonesian students' mathematical literacy ability is still low. Low results are possible Indonesian students are just used to it with routine problems such as solving math problems with formula. This low result is also due to not all teachers math in school know about math problems PISA models. Various efforts of the ministry of education to overcome this problem by providing literacy training/workshop mathematics and how to ask PISA model math problems to the math teacher (Dhewy & Ayuningtyas, 2019).

There is a need for encouragement to improve students' mathematical literacy skills in learning mathematics. Because mathematical literacy is a need for students to understand, continue mathematical concepts. This is also in accordance with Madya's explanation, namely the problem-based learning model that is closely related to mathematical literacy skills (Madyaratria dkk., 2019, hlm. 649). The purpose of this study

was to observe and analyze the improvement of students' mathematical literacy skills with the implementation of the problem based learning model.

METHODS

This research is a quasi-experimental research or can be referred to as a quasi-experimental. There are two variables in this study, namely the independent variable (problem based learning model) and the adjustment variable (learning achievement). The approach used is quantitative research. The research subjects are 7th grade students at MTs Al-Asy'ariyah. Which consists of 2 classes including 7-A class and 7-B class. Each class consists of 23 students. The population in this study were all 7th grade students at MTs Al-Asy'ariyah. The samples used in this study were class 7-A and class 7-B. Where class 7-B is given treatment using problem based learning learning model and class 7-A is not given treatment (using conventional learning model). The research design used in this research is Quasi-Experiment with Nonequivalent Control-Group Design.

This study uses two kinds of instruments, namely tests (pre test and post test) and learning media. This test is used to determine students' ability to solve problems in mathematics subjects according to the material that has been delivered in the form of decomposition. In the form of this test divided into two types, namely pretest and posttest. Learning media used to distinguish between the experimental class and the control class. In addition, learning media are also used to facilitate Problem Based Learning (PBL) learning models. While the questionnaire used to determine the level of student interest in learning. This research uses a closed questionnaire, where respondents can only choose one answer that has been provided by the researcher by means of a checklist (giving a check mark).

The instruments that have been compiled are then tested for validity and instrument reliability tests. Validity testing in this study was carried out by 2 validators, namely lecturers as material experts and mathematics teachers as media experts. Reliability test is used to measure the level of determination of an instrument. For the test and non-test instruments, an analysis was carried out by looking for a reliability index using the Cronbach Alpha formula with an interval of 95% confidence. The results of the validity test of the instrument to be used are showing an average value of 0.92, which means that the instrument is suitable for use without any revision. After the validity test is complete, the reliability test of a research instrument will be carried out. The reliability results with the help of SPSS 16.0 for windows show a significant value of 0.00 which means that the significant value is <0.05 so that the instrument is declared reliable.

Descriptive analysis is used to describe the characteristics of students' mathematical literacy test results in the control class and the experimental class both before and after being given treatment. The results of the descriptive analysis presented include the minimum value, maximum value, and the average value of students. Normality testing is used to show that the sample data used come from data that are normally distributed. The formula used to test normality in this study is the One-Sample Kolmogorov-Smirnov Test with the help of SPSS 16.0 for windows. In this study, the normality test was carried out on the results of the pre-test and post-test of students both in the control

class and in the experimental class. The results in the normality test showed a significance of 0.459. Where $0.459 > 0.05$ so it can be concluded that the data obtained in this research comes from a population that is normally distributed.

Homogeneity testing is used to determine whether or not there are homogeneous covariances in the experimental class. This homogeneity test was carried out on the results of the post test in the experimental class and the control class. This homogeneity test was carried out with the help of SPSS 16.0 for windows using the levene formula. The results of the homogeneity test showed a significance value of 0.056. Where $0.056 > 0.05$ so it can be concluded that there are homogeneous covariances. The effectiveness of the implementation of the problem based learning model on students' mathematical literacy skills was carried out using a paired sample test with the help of SPSS 16.0 for windows with a 95% confidence interval.

RESULT AND DISCUSSION

This study aims to observe and analyze the increase in mathematical literacy skills of students who are taught using a problem based learning model and students who are taught using a learning model that is used daily. The research activity was carried out in March 2021 at MTs Al-Asy'ariyah to be precise for 7th grade students on Data Presentation material. The data described is the data from the students' mathematical literacy test results obtained from the experimental class and the control class.

Where the experimental class uses a problem based learning model. While the control class uses a learning model commonly applied by teachers. The test data for students' mathematical literacy skills were carried out before and after being given treatment in both the control class and the experimental class. The following are the results of the pretest and posttest between the control class and the experimental class.

In the experimental class there was an increase in the average value before and after being given treatment, from 32.13 to 59.78. However, the control class also experienced an increase in the average score from 19.39 to 37.17. So the increase value between the experiment class and the control class is very different. The description above provides information that students' mathematical literacy skills can be increased by implementing the problem based learning model. This effectiveness test uses a paired sample at a significance level of 0.05. In the effectiveness test, a significance result of 0.001 was obtained. Until sig. Pair 1 < 0.05 , so it can be concluded that the problem-based learning model is very effective on students' mathematical literacy skills. In pair 2 obtained a significance of 0,001. So Pair 2 < 0.05 so it can be concluded that the use of conventional learning models is also effectively used for mathematical literacy skills in students.

The instrument in this research is a test. Where the test is used as a means of measuring the level of mathematical literacy ability of students. The instrument in this study was validated by one mathematics teacher and one lecturer. From the validation results, the experts stated that the instrument was suitable for use without revision. Furthermore, this research was conducted at MTs Al-Asy'ariyah for 7th grade students. This study used two classes, namely class 7-A as the control class and class 7-B as the

experimental class. The control group uses a learning model that is usually applied by mathematics teachers. Furthermore, the experimental group uses a problem based learning model. At the time of the pretest, the experimental class got the same minimum score as the minimum score in the control class, which was 0. This was because at the time of the pretest, nearly 30% of the students in the control class did not attend school and the other 30% only collected blank answer sheets. While in the experimental class there are 10% of students who collect answers in the form of blank paper. However, when viewed from the difference in the maximum value between the two classes. The experimental class has a greater maximum value than the control class. However, based on the observation of the consistency of the completion results in the control class is better than the experimental class.

The experimental class is more likely to show definite values while the control class has 70% of students using coherent completion steps, but unfortunately the level of accuracy of the control class is very low compared to the experimental class. The data collection process is carried out when students are able to solve problems in the pretest and posttest with the right and coherent concept.

The results of the assessment of the control class and the experimental class at the time of the pretest showed that students still did not understand how to solve problems using the correct concepts and sequences in the work. When viewed from the level of coherence and thoroughness in the process, students have not included things that help them answer questions such as being known, asked and answered. Although this is considered a trivial thing, things like this can improve the cognitive abilities of students quickly. After learning both the control class and the experimental class, the researcher gave a written test (posttest) to the students. If seen at a glance, the students' working eyes, especially the experimental class, show the working steps that are in accordance with the concept of data presentation.

Based on the results of the work of students in the posttest. Nearly 40% of students in the control class still cannot use the concept of presenting data properly. Most students in the control class prefer to use exact numbers compared to using problem solving steps. Almost 90% of students in the experimental class use concepts/steps in problem solving. However, most of the final results shown are incorrect thereby reducing the point in the assessment. The assessment process in this study is to give points for each step of the completion of students. The following is a diagram of improving students' mathematical literacy skills:

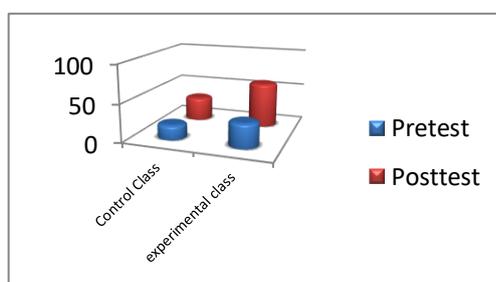


Figure 1. The results of increasing students' mathematical literacy

Based on the diagram above, the results show that the application of problem-based learning models is better than conventional learning models with the aim of improving students' mathematical literacy skills. This is also explained by Rahmania who stated that learning using a problem-based model can make it easier for students to solve mathematical problems thoroughly systematically (Rahmania et al., 2019). Based on calculations, it is known that the value of Pair 1 is sig. (2-tailed) = 0.000 i.e. sig.<0.05. So it can be concluded that there is a difference in the average value of student learning outcomes between the Pre Test and Post Test in the Experiment class. Where the Experiment class uses a Problem Based Learning (PBL) learning model or can be called a problem-based learning model. In Pair 2 the value of sig. (2-tailed) = 0.001 where it can be concluded that there is a difference in the average value of student learning outcomes between the pre-test and post-test of the control class. Based on calculations it can be stated that the application of the problem-based learning model is very effectively used to improve students' mathematical literacy skills. The results of this study are in line with the results of research conducted by (Intan Purnama., 2020) on Students' Mathematical Literacy Ability in Problem Based Learning (PBL) in Junior High Schools. Mathematical literacy is defined as one's ability to formulate, apply and interpret mathematics in a variety of contexts, including mathematical reasoning and use of mathematical concepts, procedures, facts and tools to describe, explain, and predict phenomena. Literacy mathematics helps one to recognize the role of mathematics in everyday life and make good decisions and constructive and reflective community involvement is needed (Dhewy & Ayuningtyas, 2019)

The results of his research stated that the problem-based learning model was very effective in improving students' mathematical literacy skills in learning mathematics. NCTM, mentioned that in learning mathematics, students are expected to have the ability to understand, solve problems, mathematical connections, and represent mathematical ideas. Mathematical representation ability can enrich students' mathematical knowledge because it can be used to solve everyday problems. Problem solving skills as basic skills learning in the 21st century becomes important in the process learning (Juwita & Ariani, 2020).

CONCLUSION AND IMPLICATION

Based on data analysis and discussion, it can guarantee that the implementation of problem-based learning models for 7th grade students effectively supports learning and can improve students' literacy skills towards learning materials. The results of calculations using paired sample t-test showed that sig. (2-tailed) was $0.000 < 0.05$. Thus, it can be said that H_0 is rejected and H_a is accepted, that is, there is a difference between the average pretest results and the average posttest results. Problem-based learning models have an influence on increasing the literacy skills of 7th grade students on data presentation material.

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