UJME 13 (2) 2024: 185-198
UNNES JOURNAL OF MATHEMATICS EDUCATION
https://journal.unnes.ac.id/journals/ujme
ISSN: 2252-6927 (print); 2460-5840 (online)

Students' Mathematical Problem Solving Ability Reviewed from Learning Motivation through Problem Based Learning Model Assisted by Nearpod

Lina Zahrotul Wakhidah[a,*], Endang Retno Winarti[a]

[a] *Mathematics Department, Universitas Negeri Semarang, Sekaran Campus, Gunungpati, Semarang, 50229, Indonesia*

* *E-mail address: linazahrotulwakhidah@students.unnes.ac.id*

ARTICLE INFO

Article history:
Received 4 September 2023
Received in revised form 12 August 2024
Accepted 29 August 2024

Keywords:
Mathematical Problem Solving Ability; Learning Motivation; Problem Based Learning Model Assisted by Nearpod.

Abstract

This research aims to determine whether students' mathematical problem solving abilities through Problem Based Learning model assisted by Nearpod achieve classical learning completeness and are better than students' mathematical problem solving abilities through Problem Based Learning model, determine the effect of learning motivation on the students' mathematical problem solving abilities through Problem Based Learning model assisted by Nearpod, and describe the students' mathematical problem solving abilities reviewed from learning motivation through Problem Based Learning model assisted by Nearpod. The research method used was mixed methods with sequential explanatory design. The population of this research was students of class XI SMA Negeri 3 Demak in the academic year 2022/2023. The research subjects were taken from the experimental group, two students each from the high, moderate, and low learning motivation categories. The research results showed that the students' mathematical problem solving abilities through Problem Based Learning model assisted by Nearpod achieved classical learning completeness, students' mathematical problem solving abilities through Problem Based Learning model assisted by Nearpod better than the students' mathematical problem solving abilities through Problem Based Learning model, and there is the effect of learning motivation on students' mathematical problem solving abilities through Problem Based Learning model assisted by Nearpod. Description of the mathematical problem solving abilities of subjects with high learning motivation tend to meet all indicators of mathematical problem solving abilities, subjects with moderate learning motivation tend to meet three indicators of mathematical problem solving abilities, and subjects with low learning motivation tend to meet two indicators of mathematical problem solving abilities.

1. Introduction

Education is an effort to educate the nations generation by educating to change human life. Mathematics education is a science because basically mathematics education is a combination of education and mathematics. Mathematics education is said to be a science because education is a process that is pursued through logical thinking and scientific thinking, then it can be said that mathematics is also a science. So mathematics education is a combination of education, mathematics, and other sciences. This is cause mathematics education can be called a science.

Education has a very important role in supporting quality improvement and intellectual change as well as character. One of the objectives of managing and administering primary and secondary education is to build a foundation for the developing the potential of students to become knowledgeable, capable, critical, creative, and innovative human beings. This is in accordance with Permendikbud Number 22 Year 2016 concerning Process Standards for Primary and Secondary Education that the learning process in educational

To cite this article:
Wakhidah, L. Z. & Winarti, E. R. (2024). Students' Mathematical Problem Solving Ability Reviewed from Learning Motivation through Problem Based Learning Model Assisted by Nearpod. *Unnes Journal of Mathematics Education*, *13*(2), 185-198. https://doi.org/10.15294/ujme.v13i2.12690

units is held in an interactive, inspiring, fun, challenging, motivating students to participate actively, as well as providing sufficient space for initiative, creativity, and independence in accordance with the talents, interests, and physical development as well as psychological of students.

Mathematics learning has an important role in increasing students potential in the educational process at school. Currently, mathematics learning is directed to achieve all domains, not only the cognitive domain, but also the affective and psychomotor domains, including developing students mathematical power through innovation and implementation of various methods and approaches. Mathematics learning aims to develop all students mathematical abilities in obtaining maximum mathematics learning results. One of the important targets in achieve these learning results is to maximize learning in problem solving abilities. Given the importance of problem solving in mathematics learning, then these abilities will be supported by how to understand these abilities properly so that the desired goals are achieved.

Mathematics is a science that is part of every branch of science. Since kindergarten education, elementary, secondary to tertiary education, it has never been separated from studying mathematics. Mathematics even exists in the daily life of every human being whether they realize it or not. That is why mathematics subject is very important for every human being in taking education. In the context of the current era of globalization the specific abilities that are very needed from the human resources of a nation are thinking abilities which include the ability to reason logically, think systematically, critically, carefully, and creatively, as well as be able to communicate ideas, especially in solving a problem.

Problem solving is an effort made to solve the problems found. Problem solving is an intellectual activity to find solutions to problems faced by using the provision of knowledge that already have by students. Under these conditions problem solving is said to be a learning target, students must be able to solve mathematics problem related to the real world. Mathematical problem solving is a process carried out by students to solve a given problem by using their knowledge and understanding. The process of mathematical problem solving provides opportunities for students to play an active role in searching and finding information or data to be processed into concepts, principles or conclusions. So through the process of mathematical problem solving will make a learning experience for students.

Problems that are often encountered in a learning process are usually related to the abilities that students already have. One of the problems in mathematics learning is exploring mathematical problem solving abilities. A question can be categorized as a problem for students if the completion of the question showed existence a challenge that cannot be solved by routine procedures that already known by students (Bahri, 2020: 15). A question is categorized as a problem if students do not know the steps to solve the problem.

Mathematical problem solving ability is an ability in which students try to find a way out that is carried out in achieve goals, also requires readiness, creativity, knowledge, and abilities as well as their application in everyday life. Mathematical problem solving ability is one of the abilities that students must have, because problem solving provides great benefits to students in seeing the relevance of mathematics to other subjects, as well as in real life. Students are said to be able to solve mathematics problem if they can understanding the problem, choosing a right strategy, applying the strategy in solving the problem, and looking back on the solution as well as make conclusion from the answer obtained.

Good mathematical problem solving ability also influences to students mathematics learning results to be better and is also a general goal of teaching mathematics, because mathematical problem solving ability can help in solving problems both in other subjects or in everyday life. The lack of students mathematical problem solving ability also causes the teaching and learning process of mathematics to not achieve the expected learning results goal.

Mathematical problem solving ability is an integral part of mathematics learning which is very important in mathematics education. This is in accordance with the statement of NCTM (2000: 52) stating that the importance of mathematical problem solving because mathematical problem solving is an integral part of mathematics learning so that this cannot be separated from mathematics learning. Through mathematical problem solving students can learn to deepen their understanding of mathematics concepts by applying mathematics to a real problem that is done carefully (Nasution & Mujib, 2022: 41). Mathematical problem solving ability are not only needed to solve problems in mathematics, but are also needed by students to solve problems they experience in everyday life.

According to NCTM (2000: 52), indicators of mathematical problem solving ability are as follows: (1) build new mathematical knowledge through problem solving, (2) solve problems that arise in mathematics and in other contexts, (3) apply and adapt a variety of appropriate strategies to solve problems, and (4)

monitor and reflect on the process of mathematical problem solving. Meanwhile according to Polya (1988: 5), there are four steps to solving done in problem solving namely (1) understanding the problem, (2) devising a plan, (3) carrying out the plan, and (4) looking back.

Based on the results of observations in class XI SMA Negeri 3 Demak, the learning process carried out by the mathematics teachers at SMA Negeri 3 Demak by using the 2013 curriculum namely using the Problem Based Learning (PBL) model. Mathematical problem solving ability for some students is not optimal so that causing there are still student learning results that have not achieve the Minimum Completeness Criteria (MCC). This is also in accordance with the results of the mathematical problem solving ability preliminary test which consisted of 5 essay questions that have been given to students of class XI MIPA 6 and XI MIPA 5 SMA Negeri 3 Demak. Based on the results of the mathematical problem solving ability preliminary test that has been obtained the average value of students in class XI MIPA 6 was 65,87 and class XI MIPA 5 was 63,62. From the results showed that the students mathematical problem solving ability of SMA Negeri 3 Demak is not optimal.

Based on the results of interviews with one of the mathematics subject teachers at SMA Negeri 3 Demak said that the role and activeness of students in participating in learning is not optimal. Students tend to be passive in learning and many students have learning difficulties, as well as students are still not sure in working on the questions given by the teacher. Students still have difficulty identifying questions, determining what is known and asked, as well as determining the solution. This causes students to be unable to use their mathematical problem solving abilities optimally so that they experience difficulties when solving mathematics questions. Based on the results of interviews showed that the students mathematical problem solving ability of SMA Negeri 3 Demak is not optimal.

In addition, based on the results of interviews with one of the mathematics subject teachers at SMA Negeri 3 Demak said that each student has a different learning motivation which can be seen from the different enthusiasm of students when carrying out learning activities. Some students still have low learning motivation. This was shown by some students who paid little attention to the teachers orders, did not complete their assignments on time, depended on their friends when doing assignments, and gave up easily when they found difficult questions. Based on the results of interviews showed that the students learning motivation of SMA Negeri 3 Demak is not optimal.

The learning process at school will be successful if it is supported by psychological aspects related to student behavior in terms of doing tasks in the form of mathematical problem solving questions that require perseverance and tenacity in solving problems. The psychological aspect is the learning motivation. Learning motivation is one of the basic skills that is very important for students to have in the process of mathematics learning. Damanik (2021: 29) stating that learning motivation is a driving force for someone actions that gives learning spirit, direction, and behavior persistence. The learning process in the classroom can achieve its goals if inside students have good learning motivation. Students who have high learning motivation will be diligent in doing assignments, tenacious, and never give up in solving mathematics problems. Meanwhile students who have low learning motivation are not diligent in doing assignments, not tenacious, and easily give up in solving mathematics problems. High and low student learning motivation will affect learning results. Thus learning motivation needs to be applied and improved inside students so that to improve learning results optimally.

One learning model that is thought to be used to improve students mathematical problem solving ability is the PBL model. The PBL model is a learning model that is based on many problems that require authentic investigation namely investigations that require real solutions to real problems. Abidin (2014: 159) stating that the PBL model is a learning model developed to assist teachers in developing thinking abilities and problem solving skills in students while they study learning material. According to Trianto (2017: 12), the steps of the PBL model are as follows: (1) orientation students to the problems, (2) organizing students to learn, (3) guiding individual or group investigations, (4) developing and presenting the results of the work, and (5) analyzing and evaluating the problem solving process. In this case the PBL model acts as a channel that bridges students to explore their abilities in overcoming the problems given. Problems are used with the aim of providing challenges so that students have curiosity in solving a problem.

In order to increase student learning motivation, the application of the PBL model can be assisted by the use of Nearpod. Nearpod is an application for online and offline learning that allows teachers and students to interact directly or indirectly. Nearpod is a learning space application that provides interaction between students and teachers, where teachers can create a presentation that contains text, images, videos,

and even quizzes to be played together. This application provides a variety of interesting features that can be used to support mathematics learning activities, including the Nearpod Library, material simulations, various activities such as questions, quizzes, videos, and many other interesting features. Teachers can also design their own learning activities which include interesting and fun materials, questions, quizzes, and videos. This Nearpod application can help teachers make material presentations in an interesting, fast, and easy to understand manner (Fimala et al., 2022: 97). At Nearpod students can actively choose the learning material to be studied. Students can also learn by practicing the mathematical problem solving questions provided. Nearpod can be used to improve students mathematical problem solving ability and learning motivation in the learning process so that student learning results can be achieved optimally (Susanto, 2021: 2). The teachers role as a learning facilitator is always required to be able to apply and combine effective and creative learning processes. The use of Nearpod is expected to help teachers in the process of mathematics learning.

Based on the formulation of the problem above, the purpose of this research are as follows: (1) to test the mathematical problem solving abilities of class XI students through Problem Based Learning model assisted by Nearpod achieve classical learning completeness, (2) to test the mathematical problem solving abilities of class XI students through Problem Based Learning model assisted by Nearpod is better than the mathematical problem solving abilities of class XI students through Problem Based Learning model, (3) to test the effect of learning motivation on the mathematical problem solving abilities of class XI students through Problem Based Learning model assisted by Nearpod, and (4) to describe the mathematical problem solving abilities of class XI students reviewed from learning motivation through Problem Based Learning model assisted by Nearpod.

2. Methods

The research method used in this research was a mixed-methods. According to Sugiyono (2018), the mixed methods was a research method that combines or combines between quantitative methods and qualitative methods to be used together in a research activity so that obtained more comprehensive, valid, reliable, and objective data. Meanwhile according to Creswell (2016), the mixed methods was a research approach that combines or associates between quantitative methods and qualitative methods. The mixed methods research design used in this research was a sequential explanatory design. The quantitative research design used in this research was a true experimental design with the form of posttest-only control design. True experimental design was a design in quantitative research where researcher can control all external variables that affect the course of the experiment. The main characteristic of true experimental design was that the selection of samples from certain populations was carried out randomly in both the experimental and control groups (Sugiyono, 2018). The researcher used the form of posttest-only control design where there were two groups namely the experimental group and the control group. The experimental group was given the treatment of the Problem Based Learning model assisted by Nearpod, while the control group was given the treatment of the Problem Based Learning model that is commonly used by mathematics teachers. After being given the treatment, both groups were given mathematical problem solving ability posttest. The research design posttest-only control design can be described in Table 1.

Table 1. Research Design Posttest-Only Control Design

Group	Treatment	Posttest
Experimental Class	X	O_1
Control Class	Y	O_2

Description:

X : learning with Problem Based Learning model assisted by Nearpod

Y : learning with Problem Based Learning model

O_1 : the results of the experimental class mathematical problem solving ability posttest

O_2 : the results of the control class mathematical problem solving ability posttest

The population in this research were all students of class XI SMA Negeri 3 Demak for the academic year 2022/2023. Class XI SMA Negeri 3 Demak consisted of 12 classes namely 7 MIPA classes and 5 IPS classes. Sampling in this research using simple random sampling technique. In this research two sample classes were selected, where one class as the experimental group and one class as the control group. The

two groups were class XI MIPA 6 as the experimental group and class XI MIPA 5 as the control group. The experimental group was given the treatment of the Problem Based Learning model assisted by Nearpod, while the control group was given the treatment of the Problem Based Learning model. The research subjects were taken using a purposive sampling technique. In this research as many as 6 students were selected as subjects from the experimental group research sample who were given the Problem Based Learning model assisted by Nearpod consisting of 2 students from the high learning motivation group, 2 students from the moderate learning motivation group, and 2 students from the low learning motivation group. After obtained the questionnaire scores of students learning motivation, then an interpretation of the results of measuring student learning motivation is carried out by using category of learning motivation according to Azwar (2020: 149) shown in Table 2.

Table 2. Category of Learning Motivation

Category	Value Interval
High	Score $\geq \bar{x} + s$
Moderate	$\bar{x} - s \leq$ Score $< \bar{x} + s$
Low	Score $< \bar{x} - s$

Description:

$\bar{x}$ = score average

s = score standard deviation

The variables in this research are the students mathematical problem solving ability and learning motivation. Data collection techniques used in this research are test, learning motivation questionnaire, interviews, observation, and documentation. Test was used to collect data on mathematical problem solving ability after carried out learning by using the Problem Based Learning model assisted by Nearpod and learning by using the Problem Based Learning model. The questionnaire was used to measure students learning motivation in the experimental group which was then used to classify students into high, moderate, and low groups. The interview in this research was conducted in an unstructured manner which was used to obtain data regarding students mathematical problem solving ability reviewed from learning motivation. The observation was used to determine teacher performance when carrying out learning in class. The documentation was used to get a description of students mathematical problem solving ability reviewed from learning motivation. The instruments used in this research consisted of mathematical problem solving ability test instrument, learning motivation questionnaire, and interview guide instrument. Data analysis techniques in this research consisted of quantitative data analysis and qualitative data analysis. Quantitative data analysis consisted of initial data analysis of mathematical problem solving ability and data analysis of mathematical problem solving ability test. Initial data analysis of mathematical problem solving ability consisted of normality test, homogeneity test, and two averages similarity test. Data analysis of mathematical problem solving ability test consisted of normality test, homogeneity test, hypothesis 1 test namely the average test and the proportion test, hypothesis 2 test namely the two averages difference test and the two proportions difference test, and hypothesis 3 test namely the simple linear regression test. Qualitative data analysis consisted of data reduction, data display, and conclusion drawing. Data validity test in this research consisted of credibility, transferability, dependability, and confirmability.

3. Results & Discussions

3.1. Quantitative Data Analysis

Initial data analysis of mathematical problem solving ability was carried out before determining the research sample. Initial data analysis of mathematical problem solving ability consisted of the normality test, the homogeneity test, and the two averages similarity test. After carried out for the normality test, the homogeneity test, and the two averages similarity test in the two samples obtained the results that the initial data of mathematical problem solving ability of the two samples come from a population that is normally distributed, has the same variance (homogeneous), and there is no difference in the average mathematical problem solving initial ability between the two samples.

The data referred to in the quantitative research are the posttest scores of students mathematical problem solving ability in the experimental class and the control class. Before carried out to testing the hypothesis, the posttest data of mathematical problem solving ability obtained were first carried out for the normality

test and the homogeneity test. After carried out for the normality test and the homogeneity test in both classes obtained the results that the posttest data of mathematical problem solving ability of both classes come from a population that is normally distributed and has the same variance (homogeneous), so that can be continued with hypothesis testing.

Hypothesis 1 test was conducted to determine whether the mathematical problem solving abilities of class XI students through Problem Based Learning model assisted by Nearpod achieve classical learning completeness. Hypothesis 1 test in this research is the classical learning completeness test. Learning completeness in this research consisted of individual learning completeness and classical learning completeness. The individual completeness criteria in this research namely if the results of the students mathematical problem solving ability test achieve the Minimum Completeness Criteria (MCC) value namely 70. The classical completeness criteria in this research namely if more than 75% of the results of the students mathematical problem solving ability test achieve the Minimum Completeness Criteria (MCC) value namely 70. Hypothesis 1 test is carried out by using the one right side average test and the one right side proportion test. The average test is carried out by using the one right side test and the proportion test is carried out by using the one right side test. Hypothesis 1 test consisted of the average test and the proportion test. Based on the calculation results obtained the value of $t_{count} = 10.95$ and $t_{table} = 1.696$. Because $t_{count} = 10.95 > t_{table} = 1.696$ then H_0 is rejected. So, the mathematical problem solving abilities of class XI students through Problem Based Learning model assisted by Nearpod achieve individually learning completeness. Based on the calculation results obtained the value of $z_{count} = 3.25$ and $z_{table} = 1.64$. Because $z_{count} = 3.25 > z_{table} = 1.64$ then H_0 is rejected. So, the mathematical problem solving abilities of class XI students through Problem Based Learning model assisted by Nearpod achieve classically learning completeness. Based on the calculation results of the average test by using the one right side test and the proportion test by using the one right side test can be concluded that the mathematical problem solving abilities of class XI students through Problem Based Learning model assisted by Nearpod achieve classical learning completeness. This is in accordance with the results of research conducted by Musliha (2021: 68) which shows that the students mathematical problem solving abilities through Problem Based Learning model assisted by Nearpod achieve classical learning completeness. This is also in accordance with the results of research conducted by Widiawati & Nurmaningsih (2022: 12) which shows that the students mathematical problem solving abilities through Problem Based Learning model assisted by Nearpod achieve classical learning completeness. In addition, the results of research conducted by Auliya et al. (2023: 17) which shows that the students mathematical problem solving abilities through Problem Based Learning model assisted by Nearpod achieve classical learning completeness.

Hypothesis 2 test was conducted to determine whether the mathematical problem solving abilities of class XI students through Problem Based Learning model assisted by Nearpod is better than the mathematical problem solving abilities of class XI students through Problem Based Learning model. Hypothesis 2 test in this research is the two averages difference test and the two proportions difference test. Hypothesis 2 test is carried out by using the one right side two averages difference test and the one right side two proportions difference test. The two averages difference test is carried out by using the one right side test and the two proportions difference test is carried out by using the one right side test. Hypothesis 2 test consisted of the two averages difference test and the two proportions difference test. Based on the calculation results obtained the value of $t_{count} = 2.13$ and $t_{table} = 1.670$. Because $t_{count} = 2.13 > t_{table} = 1.670$ then H_0 is rejected. So, the average mathematical problem solving abilities of class XI students through Problem Based Learning model assisted by Nearpod is more than the average mathematical problem solving abilities of class XI students through Problem Based Learning model. Based on the calculation results obtained the value of $z_{count} = 1.78$ and $z_{table} = 1.64$. Because $z_{count} = 1.78 > z_{table} = 1.64$ then H_0 is rejected. So, the proportion mathematical problem solving abilities of class XI students through Problem Based Learning model assisted by Nearpod is more than the proportion mathematical problem solving abilities of class XI students through Problem Based Learning model. Based on the calculation results of the two averages difference test by using the one right side test and the two proportions difference test by using the one right side test can be concluded that the mathematical problem solving abilities of class XI students through Problem Based Learning model assisted by Nearpod is better than the mathematical problem solving abilities of class XI students through Problem Based Learning model. This is in accordance with the results of research conducted by Rahmadila (2021: 15) which shows

that the students mathematical problem solving abilities through Problem Based Learning model assisted by Nearpod is better than the students mathematical problem solving abilities through Problem Based Learning model. This is also in accordance with the results of research conducted by Yuniar (2022: 49) which shows that the students mathematical problem solving abilities through Problem Based Learning model assisted by Nearpod is better than the students mathematical problem solving abilities through Problem Based Learning model. In addition, the results of research conducted by Suryani et al. (2023: 21) which shows that the students mathematical problem solving abilities through Problem Based Learning model assisted by Nearpod is better than the students mathematical problem solving abilities through Problem Based Learning model.

Hypothesis 3 test was conducted to determine whether there is the effect of learning motivation on the mathematical problem solving abilities of class XI students through Problem Based Learning model assisted by Nearpod. The data used in hypothesis 3 test is obtained from the questionnaire scores of students learning motivation and the posttest values of students mathematical problem solving ability. The learning motivation data is obtained from the questionnaire scores of students learning motivation and the mathematical problem solving ability data is obtained from the posttest values of students mathematical problem solving ability. The students learning motivation which act as the independent variable is expressed by X and the students mathematical problem solving ability which act as the dependent variable is expressed by Y. Hypothesis 3 test in this research is the effect test of learning motivation on the mathematical problem solving abilities of class XI students through Problem Based Learning model assisted by Nearpod. Hypothesis 3 test in this research is carried out by using the simple linear regression test with the help of the SPSS 20.0 program. Before carried out the simple linear regression analysis test, first carried out the classic assumption test. To testing hypothesis 3 is carried out the series of tests which consisted of the linearity test, the relationship between two variables test, the regression coefficient significance test, the correlation coefficient significance test, and the simple linear regression equation form. Based on the calculation output results of the linearity test by using the SPSS 20.0 program in the Model Summary and Parameter Estimates table obtained the value of $sig = 0.000$. Because the value of $sig = 0.000 < 0.05$ then H_0 is rejected. So, the linear equation or there is relationship between learning motivation on the mathematical problem solving abilities of class XI students through Problem Based Learning model assisted by Nearpod. Based on the calculation output results of the relationship between two variables test by using the SPSS 20.0 program in the ANOVA table obtained the value of $sig = 0.000$. Because the value of $sig = 0.000 < 0.05$ then H_0 is rejected. So, there is the effect of learning motivation on the mathematical problem solving abilities of class XI students through Problem Based Learning model assisted by Nearpod. Because there is the linear relationship or the effect between the learning motivation variable and the mathematical problem solving ability variable then the linear regression model can be used. Based on the calculation output results of the regression coefficient significance test by using the SPSS 20.0 program in the Coefficients table obtained the value of *sig* (*constant*) $= 0.000$ and the value of *sig* (*learning motivation*) $= 0.000$. Because the value of $sig < 0.05$ then H_0 is rejected. So, the regression coefficient is significant. Because of the model linearity assumption and the regression coefficient significance are meet then the linear regression equation obtained can be used. Based on the calculation output results of the correlation coefficient significance test by using the SPSS 20.0 program in the Coefficients table obtained the value of $t_{count} = 9.731$ and $t_{table} = 1.697$. Because $t_{count} = 9.731 > t_{table} = 1.697$ then H_0 is rejected. So, the correlation coefficient is significant. Based on the calculation output results of the simple linear regression equation form by using the SPSS 20.0 program in the Coefficients table obtained the value of constant (a) is 45.505 and the value of regression coefficient (b) is 0.369. The regression equation for the both variables can be expressed in the following model with $\hat{Y}$ is mathematical problem solving ability and X is learning motivation namely $\hat{Y} = 45.505 + 0.369X$. Based on the calculation output results of the SPSS in the Model Summary table obtained the value of correlation coefficient between the learning motivation and mathematical problem solving ability variables (R) is 0.871 which shows the strong and positive relationship between both. The value of determination coefficient of the learning motivation on mathematical problem solving ability $(R\ square)$ is 0.759. This means that the effect of learning motivation on variations in the ups and downs of mathematical problem solving ability is 75.9% and the remaining 24.1% is influenced by other factors. Based on the series of analysis that have been conducted, it is obtained the conclusion that there is the effect of learning motivation

on the mathematical problem solving abilities of class XI students through Problem Based Learning model assisted by Nearpod. This is in accordance with the results of research conducted by Safitri (2021: 35) which shows that there is the effect of learning motivation on the students mathematical problem solving abilities through Problem Based Learning model assisted by Nearpod. This is also in accordance with the results of research conducted by Zahwa (2022: 26) which shows that there is the effect of learning motivation on the students mathematical problem solving abilities through Problem Based Learning model assisted by Nearpod. In addition, the results of research conducted by Lutvia (2023: 93) which shows that there is the effect of learning motivation on the students mathematical problem solving abilities through Problem Based Learning model assisted by Nearpod.

Based on the results analysis of the mathematical problem solving ability posttest obtained that the mathematical problem solving abilities of class XI students through Problem Based Learning model assisted by Nearpod achieve classical learning completeness, the mathematical problem solving abilities of class XI students through Problem Based Learning model assisted by Nearpod is better than the mathematical problem solving abilities of class XI students through Problem Based Learning model, and there is the effect of learning motivation on the mathematical problem solving abilities of class XI students through Problem Based Learning model assisted by Nearpod.

3.2 Selection of Research Subjects

After the data from the results of the mathematical problem solving ability test and the results of the learning motivation questionnaire were obtained, then the data were analyzed by the researcher and grouped based on the group of students learning motivation. Based on the calculation of the Likert scale of the learning motivation questionnaire, from 32 students in class XI MIPA 6 there were 6 students in the high learning motivation group, 22 students in the moderate learning motivation group, and 4 students in the low learning motivation group. The following is the grouping in the experimental group based on the score of filling out the learning motivation questionnaire obtained shown in Table 3.

Table 3. Results of Learning Motivation Questionnaire Analysis

Category	Value Interval	Total Students
High	Score ≥ 132.31	6
Moderate	$91.37 \leq$ Score < 132.31	22
Low	Score < 91.37	4

From these results two research subjects were taken that representing each group of students learning motivation so that six research subjects were obtained. Several aspects were considered by the researcher in selecting research subjects to carry out interviews including namely (1) the results of the students learning motivation questionnaire, (2) the results of the students mathematical problem solving ability test, (3) active during mathematics learning, (4) the selected students were able to communicate well and not be awkward so that able to explain opinions or ideas verbally or in writing, and (5) suggestions from the mathematics teachers in the class. The selected research subjects will carry out interviews. Based on the results of grouping the category of students learning motivation in the experimental group six research subjects were selected which are shown in Table 4.

Table 4. Research Subjects

No.	Student Code	Subject Code	Category of Learning Motivation
1.	E-8	S-1	High
2.	E-12	S-2	High
3.	E-4	S-3	Moderate
4.	E-5	S-4	Moderate
5.	E-28	S-5	Low
6.	E-27	S-6	Low

Taking two students from each category of learning motivation according to the research procedures that have been made. Students E-8 and E-12 were chosen as research subjects because obtained the test scores of mathematical problem solving ability which were considered able to representing of students with high learning motivation category. Students E-4 and E-5 were chosen as research subjects because obtained the test scores of mathematical problem solving ability which were considered able to representing of students with moderate learning motivation category. Likewise, students E-28 and E-27 were chosen as

research subjects because obtained the test scores of mathematical problem solving ability which were considered able to representing of students with low learning motivation category.

3.3 Qualitative Data Analysis

Learning motivation is an internal or external encouragement for students to make change in process or behavior that foster learning spirit, goal, and behavioral persistence. According to Yuwono (2021: 2), learning motivation is a conscious effort that realized to move or direct someone so that they are encouraged to do something so that a certain goal is achieved. Meanwhile according to Widodo (2021: 158), learning motivation is the overall driving force within students which give rise to learning activity, ensure the continuity of learning activity, and give direction to learning activity, so that the goal desired by the learning subject can be achieved.

Mathematical problem solving ability in this research is the ability of students in solve mathematics problems by using indicators of mathematical problem solving ability according to NCTM (2000) namely (1) build new mathematical knowledge through problem solving, (2) solve problems that arise in mathematics and in other contexts, (3) apply and adapt a variety of appropriate strategies to solve problems, and (4) monitor and reflect on the process of mathematical problem solving, as well as by using steps of problem solving according to Polya (1988) namely (1) understanding the problem, (2) devising a plan, (3) carrying out the plan, and (4) looking back. In this research, students in the experimental group were grouped into three groups namely the high, moderate, and low groups based on the results of the students learning motivation questionnaire.

3.3.1 Students Mathematical Problem Solving Ability with High Learning Motivation

Based on the results data from each research subject, students with high learning motivation namely S-1 and S-2 tend to have high mathematical problem solving abilities. Students in the high learning motivation group namely S-1 and S-2 were can to answer all questions from the 5 questions provided with 5 questions answered correctly. Based on the results of the qualitative analysis of the students mathematical problem solving abilities in the high learning motivation group obtained information that subject S-1 and subject S-2 can meet all indicators of mathematical problem solving abilities namely build new mathematical knowledge through problem solving marked by subject S-1 and subject S-2 are able to write down what is known and asked from questions correctly and completely, solve problems that arise in mathematics and in other contexts marked by subject S-1 and subject S-2 are able to write problem solving plans and formulas correctly, apply and adapt a variety of appropriate strategies to solve problems marked by subject S-1 and subject S-2 are able to carry out problem solving plans correctly so that to produce the correct answers, and monitor and reflect on the process of mathematical problem solving marked by subject S-1 and subject S-2 are able to looking back the results obtained appropriately and write conclusions from the answers obtained correctly in questions items numbers 1, 2, 3, 4, dan 5.

Based on the results of interviews conducted with subject S-1 and subject S-2 obtained information that learning motivation subject S-1 and subject S-2 have high levels of perseverance, tenacity, self confidence, and learning spirit. Almost every problem in question item can be solved well. Subject S-1 and subject S-2 are able to face various difficulties for each steps in complete their assignments and have confidence to solve questions with the various types of questions given. In addition, subject S-1 and subject S-2 have tenacity and consistent to try in complete assignments so that when subject S-1 and subject S-2 do not find answers from the problems faced, then subject S-1 and subject S-2 will try by using other methods to obtain answers that their according to already correct. Subject S-1 and subject S-2 are spirited and feel happy in learning activity. One of the results of the work of subject S-1 in question item number 1 with high learning motivation is shown in Figure 1.

Based on Figure 1. showed that subject S-1 is already able to understanding the question well marked by write down what is known and asked from question correctly and completely, able to write problem solving plan and the formula used to solve question number 1 correctly, able to carry out problem solving plan correctly so that to produce the correct answer, and able to looking back the result obtained appropriately and write conclusion from the answer obtained correctly. Based on the triangulation of the result of the written work of the mathematical problem solving ability test and the result of interview in question item number 1 can be concluded that subject S-1 can meet four steps of mathematical problem solving ability namely understanding the problem, devising a plan, carrying out the plan, and looking back.

So can be concluded that subject S-1 can meet four indicators of mathematical problem solving ability namely build new mathematical knowledge through problem solving, solve problems that arise in mathematics and in other contexts, apply and adapt a variety of appropriate strategies to solve problems, and monitor and reflect on the process of mathematical problem solving.

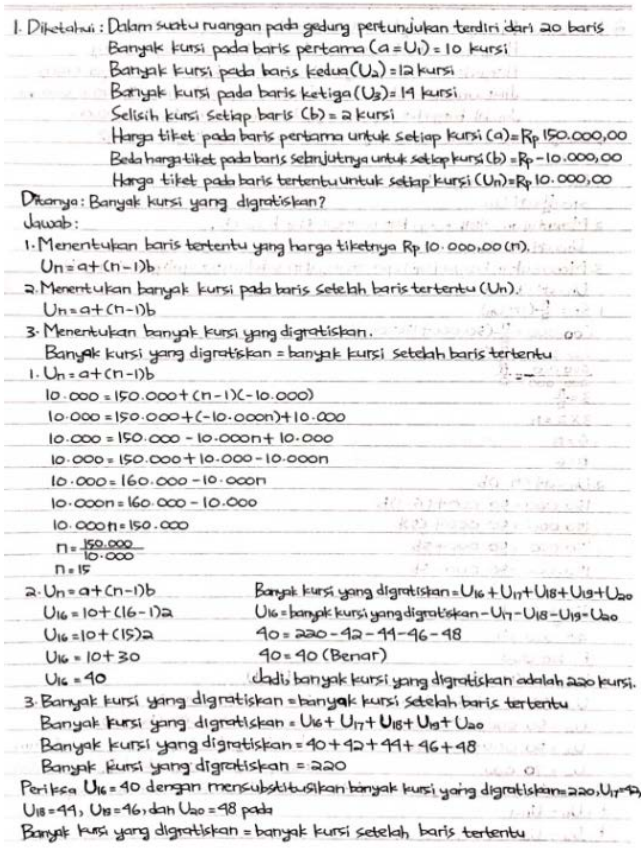
1. Diketahui : Dalam suatu ruangan pada gedung pertunjukan terdiri dari 20 baris
Banyak kursi pada baris pertama ($a = U_1$) = 10 kursi
Banyak kursi pada baris kedua (U_2) = 12 kursi
Banyak kursi pada baris ketiga (U_3) = 14 kursi
Selisih kursi setiap baris (b) = 2 kursi
Harga tiket pada baris pertama untuk setiap kursi (a) = Rp 150.000,00
Beda harga tiket pada baris selanjutnya untuk setiap kursi (b) = Rp -10.000,00
Harga tiket pada baris tertentu untuk setiap kursi (U_n) = Rp 10.000,00
Ditanya : Banyak kursi yang digratiskan?
Jawab :
1. Menentukan baris tertentu yang harga tiketnya Rp 10.000,00 (n).
$U_n = a + (n-1)b$
2. Menentukan banyak kursi pada baris setelah baris tertentu (U_n).
$U_n = a + (n-1)b$
3. Menentukan banyak kursi yang digratiskan.
Banyak kursi yang digratiskan = banyak kursi setelah baris tertentu
1. $U_n = a + (n-1)b$
$10.000 = 150.000 + (n-1)(-10.000)$
$10.000 = 150.000 + (-10.000n) + 10.000$
$10.000 = 150.000 - 10.000n + 10.000$
$10.000 = 150.000 + 10.000 - 10.000n$
$10.000 = 160.000 - 10.000n$
$10.000n = 160.000 - 10.000$
$10.000n = 150.000$
$n = \frac{150.000}{10.000}$
$n = 15$
2. $U_n = a + (n-1)b$
$U_{16} = 10 + (16-1)2$
$U_{16} = 10 + (15)2$
$U_{16} = 10 + 30$
$U_{16} = 40$
Banyak kursi yang digratiskan = $U_{16} + U_{17} + U_{18} + U_{19} + U_{20}$
U_{16} = banyak kursi yang digratiskan - $U_{17} - U_{18} - U_{19} - U_{20}$
$40 = 220 - 42 - 44 - 46 - 48$
$40 = 40$ (Benar)
Jadi banyak kursi yang digratiskan adalah 220 kursi.
3. Banyak kursi yang digratiskan = banyak kursi setelah baris tertentu
Banyak kursi yang digratiskan = $U_{16} + U_{17} + U_{18} + U_{19} + U_{20}$
Banyak kursi yang digratiskan = 40 + 42 + 44 + 46 + 48
Banyak kursi yang digratiskan = 220
Periksa $U_{16} = 40$ dengan mensubstitusikan banyak kursi yang digratiskan = 220, $U_{17} = 42$, $U_{18} = 44$, $U_{19} = 46$, dan $U_{20} = 48$ pada
Banyak kursi yang digratiskan = banyak kursi setelah baris tertentu

Figure 1. The Result of The Work of S-1 in Question Item Number 1

3.3.2 Students Mathematical Problem Solving Ability with Moderate Learning Motivation

Based on the results data from each research subject, students with moderate learning motivation namely S-3 and S-4 tend to have moderate mathematical problem solving abilities. Students in the moderate learning motivation group namely S-3 and S-4 were can to answer all questions from the 5 questions provided with 5 questions answered correctly. Based on the results of the qualitative analysis of the students mathematical problem solving abilities in the moderate learning motivation group obtained information that subject S-3 can meet all indicators of mathematical problem solving abilities namely build new mathematical knowledge through problem solving marked by subject S-3 are able to write down what is known and asked from questions correctly and completely, solve problems that arise in mathematics and in other contexts marked by subject S-3 are able to write problem solving plans and formulas correctly, apply and adapt a variety of appropriate strategies to solve problems marked by subject S-3 are able to carry out problem solving plans correctly so that to produce the correct answers, and monitor and reflect on the process of mathematical problem solving marked by subject S-3 are able to looking back the results obtained appropriately and write conclusions from the answers obtained correctly in questions items numbers 1 and 2. Meanwhile in questions items numbers 3, 4, and 5, subject S-3 can meet three indicators of mathematical problem solving abilities namely build new mathematical knowledge through problem solving marked by subject S-3 are able to write down what is known and asked from questions correctly and completely, solve problems that arise in mathematics and in other contexts marked by subject S-3 are able to write problem solving plans and formulas correctly, and apply and adapt a variety of appropriate strategies to solve problems marked by subject S-3 are able to carry out problem solving plans correctly so that to produce the correct answers, but not meet the indicators of monitor and reflect on the process of

mathematical problem solving marked by subject S-3 are not able to looking back the results obtained appropriately, but able to write conclusions from the answers obtained correctly. Based on the results of the qualitative analysis of the students mathematical problem solving abilities in the moderate learning motivation group obtained information that subject S-4 can meet all indicators of mathematical problem solving abilities namely build new mathematical knowledge through problem solving marked by subject S-4 are able to write down what is known and asked from questions correctly and completely, solve problems that arise in mathematics and in other contexts marked by subject S-4 are able to write problem solving plans and formulas correctly, apply and adapt a variety of appropriate strategies to solve problems marked by subject S-4 are able to carry out problem solving plans correctly so that to produce the correct answers, and monitor and reflect on the process of mathematical problem solving marked by subject S-4 are able to looking back the results obtained appropriately and write conclusions from the answers obtained correctly in questions items numbers 3 and 4. Meanwhile in questions items numbers 1, 2, and 5, subject S-4 can meet three indicators of mathematical problem solving abilities namely build new mathematical knowledge through problem solving marked by subject S-4 are able to write down what is known and asked from questions correctly and completely, solve problems that arise in mathematics and in other contexts marked by subject S-4 are able to write problem solving plans and formulas correctly, and apply and adapt a variety of appropriate strategies to solve problems marked by subject S-4 are able to carry out problem solving plans correctly so that to produce the correct answers, but not meet the indicators of monitor and reflect on the process of mathematical problem solving marked by subject S-4 are not able to looking back the results obtained appropriately, but able to write conclusions from the answers obtained correctly.

Based on the results of interviews conducted with subject S-3 and subject S-4 obtained information that learning motivation subject S-3 and subject S-4 have moderate levels of perseverance, tenacity, self confidence, and learning spirit. Almost every problem in question item can be solved enough well. Subject S-3 and subject S-4 are able to face various difficulties for each steps in complete their assignments and have confidence to solve questions with the various types of questions given. However, subject S-3 and subject S-4 are not consistent to try in complete assignments so that when subject S-3 and subject S-4 do not find answers from the problems faced, then subject S-3 and subject S-4 maybe will try by using other methods to obtain answers that their according to already correct. Subject S-3 and subject S-4 are enough spirited and enough feel happy in learning activity.

3.3.3 Students Mathematical Problem Solving Ability with Low Learning Motivation

Based on the results data from each research subject, students with low learning motivation namely S-5 and S-6 tend to have low mathematical problem solving abilities. Students in the low learning motivation group namely S-5 and S-6 were can to answer all questions from the 5 questions provided with 2 questions answered correctly. Based on the results of the qualitative analysis of the students mathematical problem solving abilities in the low learning motivation group obtained information that subject S-5 can meet three indicators of mathematical problem solving abilities namely build new mathematical knowledge through problem solving marked by subject S-5 are able to write down what is known and asked from questions correctly and completely, solve problems that arise in mathematics and in other contexts marked by subject S-5 are able to write problem solving plans and formulas correctly, and apply and adapt a variety of appropriate strategies to solve problems marked by subject S-5 are able to carry out problem solving plans correctly so that to produce the correct answers, but not meet the indicators of monitor and reflect on the process of mathematical problem solving marked by subject S-5 are not able to looking back the results obtained appropriately, but able to write conclusions from the answers obtained correctly in questions items numbers 1 and 2. Meanwhile in questions items numbers 3 and 4, subject S-5 can meet three indicators of mathematical problem solving abilities namely build new mathematical knowledge through problem solving marked by subject S-5 are able to write down what is known and asked from questions correctly and completely, solve problems that arise in mathematics and in other contexts marked by subject S-5 are able to write problem solving plans and formulas correctly, and monitor and reflect on the process of mathematical problem solving marked by subject S-5 are able to looking back the results obtained appropriately and write conclusions from the answers obtained correctly, but not meet the indicators of apply and adapt a variety of appropriate strategies to solve problems marked by subject S-5 are not able to carry out problem solving plans correctly so that to produce the not correct answers. In addition, subject S-5 can meet two indicators of mathematical problem solving abilities namely build new mathematical

knowledge through problem solving marked by subject S-5 are able to write down what is known and asked from question correctly and completely and solve problems that arise in mathematics and in other contexts marked by subject S-5 are able to write problem solving plans and formulas correctly, but not meet the indicators of apply and adapt a variety of appropriate strategies to solve problems marked by subject S-5 are not able to carry out problem solving plans correctly so that to produce the not correct answers and monitor and reflect on the process of mathematical problem solving marked by subject S-5 are not able to looking back the results obtained appropriately, but able to write conclusions from the answers obtained correctly in question item number 5. Based on the results of the qualitative analysis of the students mathematical problem solving abilities in the low learning motivation group obtained information that subject S-6 can meet three indicators of mathematical problem solving abilities namely build new mathematical knowledge through problem solving marked by subject S-6 are able to write down what is known and asked from questions correctly and completely, solve problems that arise in mathematics and in other contexts marked by subject S-6 are able to write problem solving plans and formulas correctly, and apply and adapt a variety of appropriate strategies to solve problems marked by subject S-6 are able to carry out problem solving plans correctly so that to produce the correct answers, but not meet the indicators of monitor and reflect on the process of mathematical problem solving marked by subject S-6 are not able to looking back the results obtained appropriately, but able to write conclusions from the answers obtained correctly in questions items numbers 3 and 4. Meanwhile in questions items numbers 1 and 2, subject S-6 can meet three indicators of mathematical problem solving abilities namely build new mathematical knowledge through problem solving marked by subject S-6 are able to write down what is known and asked from questions correctly and completely, solve problems that arise in mathematics and in other contexts marked by subject S-6 are able to write problem solving plans and formulas correctly, and monitor and reflect on the process of mathematical problem solving marked by subject S-6 are able to looking back the results obtained appropriately and write conclusions from the answers obtained correctly, but not meet the indicators of apply and adapt a variety of appropriate strategies to solve problems marked by subject S-6 are not able to carry out problem solving plans correctly so that to produce the not correct answers. In addition, subject S-6 can meet two indicators of mathematical problem solving abilities namely build new mathematical knowledge through problem solving marked by subject S-6 are able to write down what is known and asked from question correctly and completely and solve problems that arise in mathematics and in other contexts marked by subject S-6 are able to write problem solving plans and formulas correctly, but not meet the indicators of apply and adapt a variety of appropriate strategies to solve problems marked by subject S-6 are not able to carry out problem solving plans correctly so that to produce the not correct answers and monitor and reflect on the process of mathematical problem solving marked by subject S-6 are not able to looking back the results obtained appropriately, but able to write conclusions from the answers obtained correctly in question item number 5.

Based on the results of interviews conducted with subject S-5 and subject S-6 obtained information that learning motivation subject S-5 and subject S-6 have low levels of perseverance, tenacity, self confidence, and learning spirit. Subject S-5 and subject S-6 are not able to face various difficulties for each steps in complete their assignments and still have doubt to solve questions with the various types of questions given. In addition, subject S-5 and subject S-6 are not consistent to try in complete assignments correctly by using various methods when do not find answers from the problems faced. Subject S-5 and subject S-6 are less spirited and less feel happy in learning activity.

4. Conclusion

Based on the results of research and discussions of students mathematical problem solving abilities reviewed from learning motivation through Problem Based Learning model assisted by Nearpod the following conclusions are obtained: (1) the mathematical problem solving abilities of class XI students through Problem Based Learning model assisted by Nearpod achieve classical learning completeness, (2) the mathematical problem solving abilities of class XI students through Problem Based Learning model assisted by Nearpod is better than the mathematical problem solving abilities of class XI students through Problem Based Learning model, (3) there is the effect of learning motivation on the mathematical problem solving abilities of class XI students through Problem Based Learning model assisted by Nearpod, and (4) the description of the mathematical problem solving abilities of class XI students reviewed from learning

motivation through Problem Based Learning model assisted by Nearpod the following results are obtained: (a) students with high learning motivation tend to meet high mathematical problem solving abilities by meeting all indicators of mathematical problem solving abilities namely build new mathematical knowledge through problem solving, solve problems that arise in mathematics and in other contexts, apply and adapt a variety of appropriate strategies to solve problems, and monitor and reflect on the process of mathematical problem solving, (b) students with moderate learning motivation tend to meet moderate mathematical problem solving abilities by meeting three indicators of mathematical problem solving abilities namely build new mathematical knowledge through problem solving, solve problems that arise in mathematics and in other contexts, and apply and adapt a variety of appropriate strategies to solve problems, but not meet the indicators of monitor and reflect on the process of mathematical problem solving, and (c) students with low learning motivation tend to meet low mathematical problem solving abilities by meeting two indicators of mathematical problem solving abilities namely build new mathematical knowledge through problem solving and solve problems that arise in mathematics and in other contexts, but not meet the indicators of apply and adapt a variety of appropriate strategies to solve problems and monitor and reflect on the process of mathematical problem solving.

Based on the results of research of students mathematical problem solving abilities reviewed from learning motivation through Problem Based Learning model assisted by Nearpod, the suggestions that can be given by researcher are as follows: (1) mathematics teachers in class XI SMA Negeri 3 Demak can use the Problem Based Learning model assisted by Nearpod as an alternative learning model that can be used to improve mathematical problem solving abilities of class XI students on the material of arithmetic and geometric sequences and series and (2) mathematics teachers in class XI SMA Negeri 3 Demak can give learning motivation to students on each learning so that can improve students learning motivation.

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