

THE EFFECTIVENESS OF LIVE WORKSHEETS-ASSISTED PROBLEM BASED LEARNING TO IMPROVE STUDENTS' MATHEMATICAL PROBLEM SOLVING ABILITIES

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ABSTRACT

This research was motivated by the low mathematical problem solving ability of students based on the results of field observations and the results of previous research. This study aims to determine the effectiveness of LKPD assisted by live worksheets with a problem-based learning approach to the mathematical problem solving ability of grade VIII students. The method used in this study is an experimental method with One-Group Pretest-Posttest Design by Sugiyono. The subjects in this study were 30 grade VIII students at MTs Al-Firdaus with low, medium to high categories. The research instrument used in this study was in the form of five description questions adjusted to indicators of problem-solving ability which were then calculated using the SPSS application. Based on the calculation of the comparison of pre-test and post-test values, it is found that the post-test value is greater than the pre-test value. In the pre-test students still have some errors in working on the problems given, while during the post-test few students make mistakes in solving problems. Based on the research conducted, it can be concluded that LKPD assisted by live worksheets with a problem-based learning approach is effective in improving the mathematical problem solving ability of grade VIII students, especially on the Pythagorean theorem material.

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INTRODUCTION

Education is one of the government's efforts to improve the quality of human resources in Indonesia. Especially in terms of academics, the government also requires 12 years of study starting with grade 1 at the elementary to high school levels. There are many lessons that educators give to their students, one of which is mathematics. Mathematics is a compulsory subject to study at every level of education. Starting from elementary school to college, at least there is material related to arithmetic to complete it. Mathematics is also associated with problems that exist in everyday life. One of the materials studied in mathematics is the Pythagorean theorem.

The Pythagorean theorem states that "In a triangle, the square of the hypotenuse is equal to the sum of the other sides." This theorem is used to determine the area of a flat build. The Pythagorean theorem can be expressed as $c^2 = a^2 + b^2$ if the right angle is in C (Rangkuti & Siregar, 2020). The sides and hypotenuse of triangles are related according to the Pythagorean theorem (Affaf, 2017).

There are skills that students need to have as a provision for the future if they want to improve the quality of education. Ability in problem solving is a very important ability and needed to understand and solve problems (Ariawan & Nufus, 2017). The purpose of mathematics education can be achieved largely through the use of problem-solving skills (Nurhayati et al., 2016). Problem-solving ability is one of the important components in mathematics education, students who have this ability will be more confident and can make better decisions when presented with real-world problems (Laila & Harefa, 2021). However, the reality in the field, based on the results of researchers' observations to schools that are places of research, students' problem-solving abilities still do not reach what was expected. This was reported based on the results of interviews with the mathematics teacher concerned. In addition, based on previous research conducted by Utami & Wutsqa, (2017) stated that the mathematical problem solving ability of students in junior high school is categorized as low. Similarly, the results of research conducted by Dwi Putra et al., (2018) that the mathematical problem solving ability of grade VII junior high school students is still low because they are not used to doing problem solving problems.

Seen the importance of problem-solving skills for students both for learning mathematics and their daily lives, therefore it is necessary to apply good approaches and teaching materials by teachers. One approach that can be used to instill problem-solving skills is a problem-based learning approach. According to Dewi & Wardani, (2019), a problem is given to students as part of a problem-based learning strategy, which aims to improve learning outcomes. This is in line with Eggen & Kauchak in (Marlina et al., 2018) argue that problem-based learning is an issue-centered strategy to build students in problem solving, self-regulation, and material.

In addition to using the right approach, of course, the right learning tools must be used as well. One of the details of the learning tool is LKPD. LKPD is a printed teaching material in the form of sheets of paper and contains information, summaries, and instructions for the implementation of learning tasks that students must complete by referring to the basic skills they must master (Prastowo, 2011). As time goes by, technology in the world is growing rapidly. 21st century learning refers to educational approaches that are relevant to the needs and demands of modern times. So that students are led to be skilled in using technology as learning tools such as computers, internet, mobile devices, and educational devices are used to facilitate more interactive, personalized, and connected learning.

Seeing the existing problems, the researchers developed Student Worksheets (LKPD) which initially only used printed LKPD to be technology-based. LKPD developed with the help of live worksheets with a problem-based learning approach to problem-solving skills. The effectiveness of the developed LKPD became the main focus in this study. Of course, if the LKPD product developed is effective for use, then this LKPD can be used in learning activities in schools. According to (Fakhrurrazi, 2018) effective change has certain results, implications, and advantages.

METHOD

The method used in this study is using an experimental method with One-Group Pretest-Posttest Design. Sugiyono, (2019) states that experimental research is a type of research that uses experiments to ascertain how independent variables affect dependent variables. Referring

to Sugiyono's presentation, the purpose of this study is to determine the effectiveness of LKPD assisted by live worksheets with a problem-based learning approach to the mathematical problem solving ability of grade VIII students. This research was conducted at MTs Al-Firdaus Cipatat-West Bandung. The subjects of this study were 30 grade VIII students with low, medium, to high categories based on the results of the final exam. The design of this study is as follows.

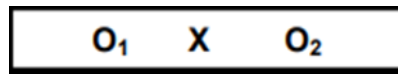


Figure 1. Research Design

The research instruments used are five explanatory questions related to the Pythagorean theorem which are adjusted to indicators of students' ability to solve mathematical problems. The data obtained is then calculated using SPSS. The data analysis used is a descriptive statistic analysis to determine the mean, standard deviation and variance values of the pretest-posttest results, then inferential statistical analysis is used to test the research hypothesis. The hypothesis formulated in this study is as follows.

H_0 : There is no difference between pre-test and post-test scores in students' mathematical problem-solving ability

H_1 : There is a difference between pre-test and post-test scores in students' mathematical problem-solving abilities.

RESULTS AND DISCUSSION

Results

The results of the effectiveness of LKPD products assisted by live worksheets were developed based on the results of the assessment of mathematical problem-solving ability tests on the Pythagorean theorem material which amounted to five description questions. The indicators and rubrics for assessing problem-solving abilities used are as follows.

Table 1. Indicators and Rubrics for Assessment of Mathematical Problem-Solving Ability

No	Troubleshooting Indicators	Score	Information
1	Identifying the Problem	3	Write down known and queried components completely
		2	Write down known and incomplete components
		1	Miswriting known and queried components
		0	Not writing down known and queried components
2	Planning for Troubleshooting	4	Write down the required formulas correctly and completely
		3	Write the required formula correctly but incompletely
		2	Write the required formula incorrectly but completely
		1	Writing the required formula incorrectly and incompletely
		0	Not writing down the required formula
3	Solving Problems According to	4	Write down the problem solution with

	Plan	correct and complete results
		3 Write down the problem solution with correct but incomplete results
		2 Write down the problem solution with the wrong but complete result
		1 Write down the problem solution with incorrect and incomplete results
		0 Not writing down the solution
4	Evaluating and Drawing Conclusions	3 Write conclusions correctly and completely
		2 Write conclusions correctly but incompletely
		1 Writing down incorrect conclusions
		0 Not writing down conclusions

Modification of (Amam, 2017)

Based on data collection through providing description questions with mathematical problem-solving ability tests both pre-test and post-test with SPSS calculations, the following outputs are obtained.

Table 2. Descriptive Statistical Analysis Pretest – Posttest

Statistika Deskriptif	Pre-test	Post-test
Mean	44,70	58,13
Median	45,50	60,00
Variance	285,528	167,223
Std. Deviation	16,898	12,931
Minimum	6	18
Maximum	70	78
Range	64	60

Based on table 2 it can be clearly seen that the highest pre-test score obtained by students is 70 and the lowest score is 0.6. The range of values is 64, the average is 44.70 with a median value of 45.50. As for the highest post-test score obtained by students is 78 and the lowest score is 18. The range of values obtained is 64, an average of 58.13 with a middle value of 60.00. Furthermore, a normality test is carried out with the aim of testing whether the sample comes from a normally distributed population or not. The hypothesis tested is formulated as follows :

H_0 : The sample comes from a normally distributed population

H_1 : The sample comes from a population that is not normally distributed

Test criteria : accept H_0 if sign. ≥ 0.05 and H_0 reject if sign. < 0.05 .

From the calculation results obtained in Table 3 below

Table 3. Normality Test

SCORE	CLASS	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
	PRETES	.090	30	.200*	.968	30	.486
	POS-TEST	.134	30	.175	.934	30	.062

Based on the table above, the normality test of students' mathematical problem solving ability on the Pythagorean theorem material before the use of LKPD assisted by live worksheets with a problem-based learning approach is $0.486 > 0.05$, it can be concluded that the sample comes from a normally distributed population. Furthermore, the mathematical problem solving ability of students on the Pythagorean theorem material after the use of LKPD assisted by live worksheets with a problem-based learning approach is $0.62 > 0.04$, it can be concluded that the data is normally distributed, because the two data are normally distributed, then a homogeneity test is carried out. The hypothesis tested is formulated as follows :

$$\begin{aligned}
 H_o & : \sigma_1^1 = \sigma_2^1 && \text{Variance of both groups Homogeneous} \\
 H_1 & : \sigma_1^1 \neq \sigma_2^1 && \text{Variance of both groups Homogeneous}
 \end{aligned}$$

Test criteria : accept H_o if sign. ≥ 0.05 and H_o reject if sign. < 0.05 .

From the calculation results obtained in Table 4 below.

Table 4. Homogeneity Test

		Levene			
		Statistic	df1	df2	Sig.
SCORE	Based on Mean	2.157	1	58	.147
	Based on Median	2.194	1	58	.144
	Based on Median and with adjusted df	2.194	1	56.487	.144
	Based on trimmed mean	2.164	1	58	.147

Based on the homogeneity test table above, it can be seen that the value of the sign obtained is $0.147 > 0.05$ so it can be concluded that the variance of the two groups is homogeneous.

From the calculation above, it is obtained that both groups are normally distributed and both groups have homogeneous variance. Next, a two-mean difference test was carried out. The hypothesis tested is formulated as follows :

$$\begin{aligned}
 H_o & : \mu_1 = \mu_2 && \text{There is no difference between pre-test and post-test scores in the mathematical problem-solving ability of students using LKPD} \\
 H_1 & : \mu_1 \neq \mu_2 && \text{There is a difference between pre-test and post-test scores in students' mathematical problem-solving abilities}
 \end{aligned}$$

Based on the results of data processing, results are obtained as in Table 5.

Table 5. Test the difference between two averages

Pair	Pos-Pre-test	Mean	s	t	df	Sign
		13,433	12,29	5,99	29	0,000

Table 6. The N-Gain Score

	N	Minimum	Maximum	Mean	Std. Deviation
NGain	27	-5.20	1.00	-.1687	1.41024
Valid N (listwise)	27				

From the table obtained a sign value of 0.000, then the sign value < 0.05 , then H_0 was rejected which means there is a difference between pre-test and post-test scores in students' mathematical problem solving abilities, because there is a difference between pre-test and post-test scores in students' mathematical problem solving abilities and the average post-test score is greater than the pre-test score, it is concluded that the use of liveworksheets-assisted LKPD with a problem-based learning approach is effective in improve students' mathematical problem-solving skills.

To show the improvement in giving pre-test and post-test questions, it is presented in the following figure.

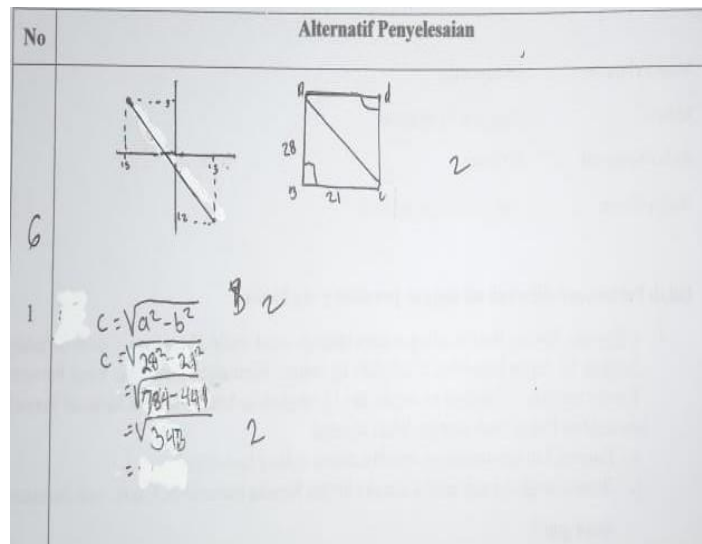


Figure 2. Answer to Pre-test Question No 1

Based on the picture above at the pre-test stage, it can be seen that students' ability to solve problems is still not good enough. In this pre-test students do not identify the problem correctly, students also have not solved the given problem, and students do not conclude the problem.

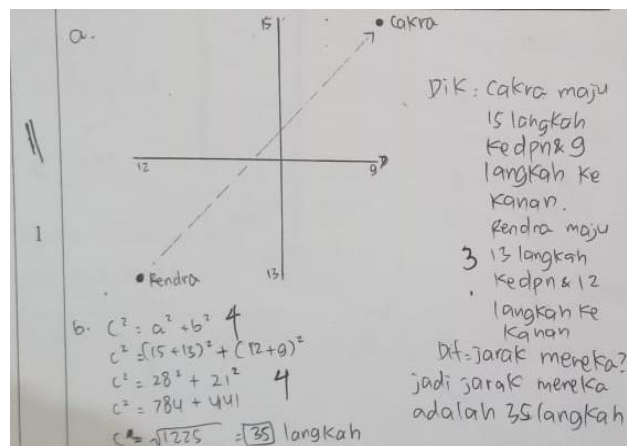


Figure 3. Answer to Post-test Question No. 1

Based on the picture of the answer to the post-test question above, it can be seen that students are able to solve question number 1 well. Students identify problems well, then students write a problem-solving plan, and students can solve problems as planned so as to get an answer conclusion.

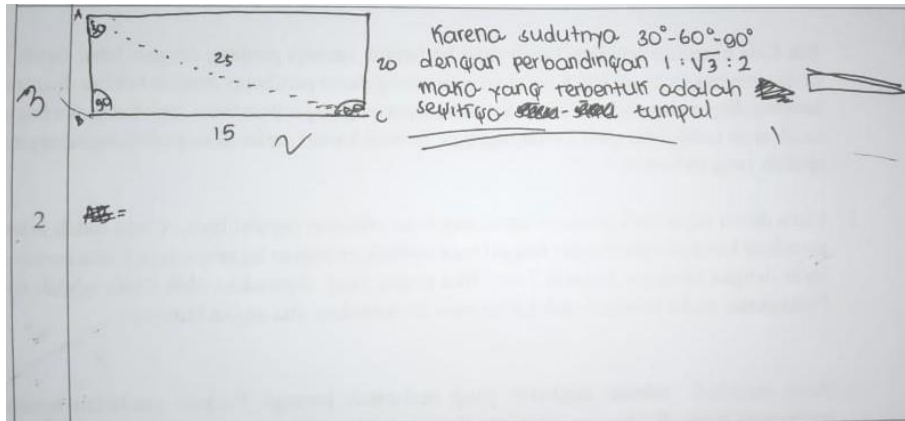


Figure 4. Answer to Pre-test Question No. 2

Based on the answer of one of the students above, students have difficulty in overcoming problems well. The answer from the student does not match the indicator of problem-solving ability, the student only describes the problem solving without a problem-solving design which results in concluding the wrong answer.

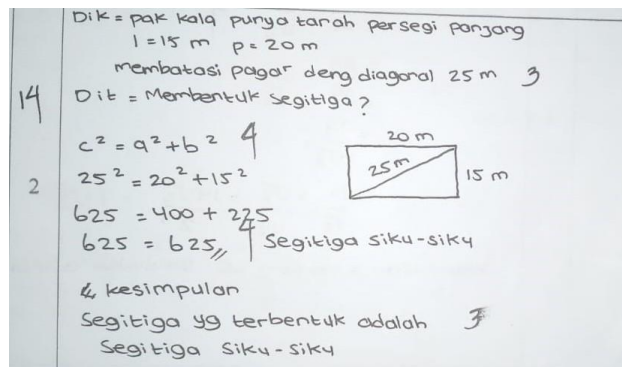


Figure 5. Post-test Answer Question No. 2

The picture above is the post-test answer to question number 2, it can be seen that students do not experience problems in solving problems. Students are able to write down all existing indicators starting with identifying problems, designing problem solutions by writing formulas, looking for answers with problem solving, then students can evaluate or make conclusions from the results of problem solving.

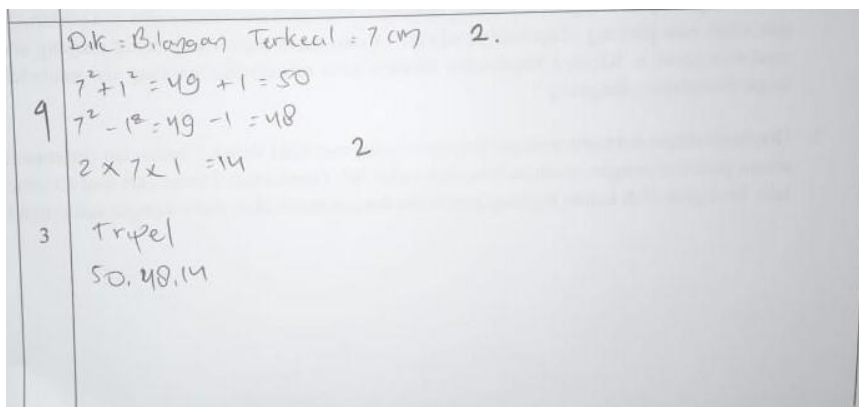


Figure 6. Answer to Pre-test Question No. 3

The picture above is the answer to pre-test question number 3, based on these answers students experience problems in solving the problems given. Students do not identify problems well, students also do not write a solution plan correctly so that they solve problems incorrectly and the results obtained are not right.

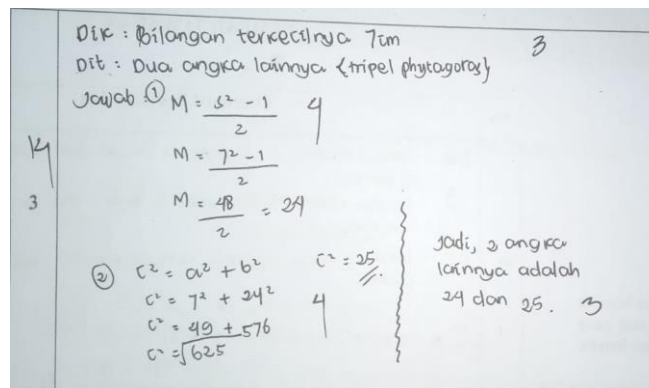


Figure 7. Answer to Post-test Question No. 3

In the picture above, it can be seen that students can solve problems well. Students are able to meet all problem-solving indicators by writing down the elements known and asked, compiling formulas that are relevant to the data provided, and solving problems with formulas prepared, and students are able to conclude the results of solving these problems.

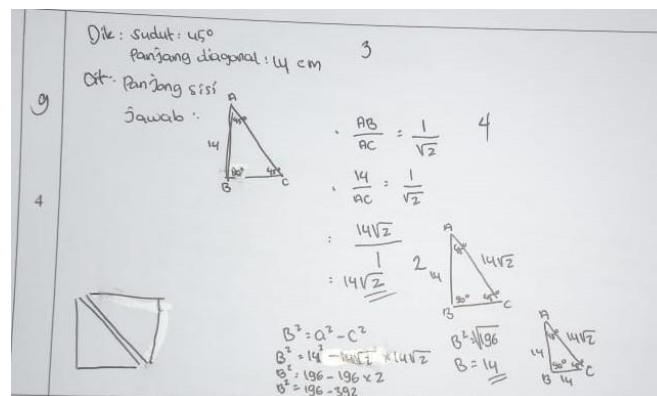


Figure 8. Answer to Pre-test Question No 4

From the picture of the answer to the pre-test question no. 4, it can be seen that the students did not solve the problems given properly. Students list the appropriate formula, but the process of working on the answer is not right so that students are less precise in concluding the right answer results.

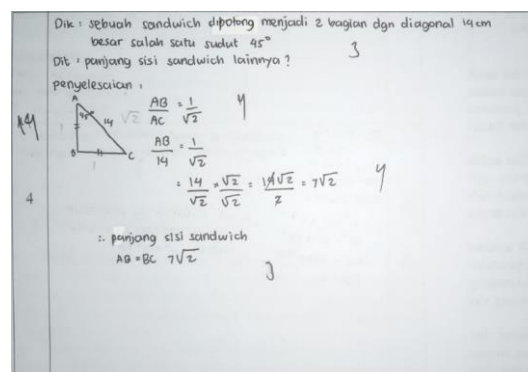


Figure 9. Answer to Post-test Question No. 4

From the picture above, it can be seen that students are able to do the problems given. Students are able to identify problems, write appropriate solving formulas, solve problems appropriately so that students can conclude correctly.

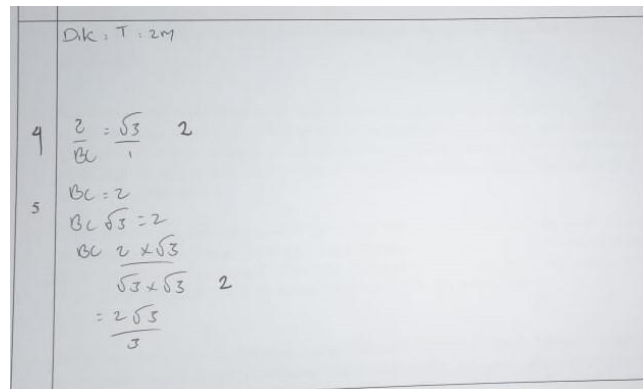


Figure 10. Answer to Pre-test Question No 5

Based on the results of the pre-test, it can be concluded that students have not been able to achieve good problem-solving skills. In working on problems given by students is not precise in identifying problems, students write inappropriate problem solving formulas so that students work on problems incorrectly.

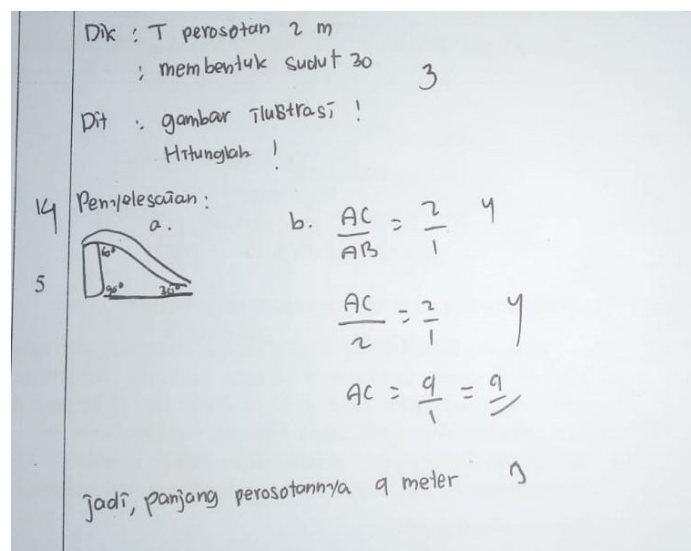


Figure 11. Answer to Post-test Question No. 5

From the picture above, it can be seen that students have been able to meet the indicators of problem solving ability well. Students can identify problems, write resolution plans, students are also able to solve problems given well, and students are also able to write conclusions from the problems solved. In question number 5, students are instructed to draw an illustration of the problem given and calculate the length of the slide by comparing known angles.

Discussions

The effectiveness of LKPD assisted by liveworksheets is reviewed from the results of mathematical problem-solving ability tests. The implementation of learning using liveworksheet-assisted LKPD using a problem-based learning approach was observed during six meetings by researchers. In this learning activity, students are divided into several study groups, each group consists of five students with low, medium, to high categories. Each step

of the activities contained in the LKPD assisted by liveworksheets developed is adjusted to the syntax in the problem-based learning approach. After completing six meetings of learning using LKPD assisted by liveworksheets developed by researchers, students were given problem-solving ability test questions. The questions given are of course adjusted to the existing problem-solving ability indicators.

Students' mathematical problem solving ability can be seen from the average score of students at the time of the pre-test, from these results it can be categorized that students' mathematical problem solving abilities are categorized as lacking. To raise the level of problem-solving ability, teachers need to try their best to achieve learning objectives (Chisara et al., 2018). According to Cahyani & Setyawati, (2016), to face real-life challenges, dexterity in solving problems is needed which is one of the important components. Seeing the importance of problem-solving skills, LKPD was given the help of liveworksheets with a problem-based learning approach as an effort to improve the problem-solving ability.

From the results data displayed about the effectiveness of using live worksheets-assisted LKPD with a problem-based learning approach, it can be explained that the use of live-worksheet-assisted LKPD can improve students' mathematical problem solving skills. This can be seen from the results of the hypothesis test that has been presented. Apart from the increase in average results, it can also be seen from the students' work on the problems given.

The mistakes made by students in working on mathematical problem solving skills during the pre-test include: (1) students do not identify problems well, (2) students write inappropriate problem solving plans, (3) students do not solve problems according to the problem solving plan, and (4) students do not write problem conclusions correctly. There are factors that cause students to make these mistakes, one of which is because students are not careful in reading the questions. This is in line with Ferryansyah & Anwar, (2020) which states that the main cause of students in doing questions is because they are not careful in reading the questions so that the information obtained is not appropriate and makes students wrong in their work. Furthermore, the mistake made by students is to write an inappropriate problem solving plan, Suraji et al., (2017) stated that students who master the indicators of designing problems are still low, this is because students cannot place formulas that match the given problems. The next mistake of students in solving problems is not solving problems according to plan, according to Nadhifa et al., (2019) in solving problems according to students' experience in finding solutions to the problems given. The main cause of students not being right in solving problems is because students do not understand the questions well and the planned solutions are not right (Novianti & Yuanita, 2020). And the last mistake made by students during the pre-test is not accurate in concluding, according to Nadhifa et al., (2019) the problem solving design determines the work on the problem as expected or not. This shows that before being able to conclude in advance, students must be able to plan solutions and solve problems well.

Then judging from the picture of the post-test results, students did not make too many mistakes in working on the problems given. When the post-test students can identify problems well, students have also written the right problem solving plan and solved the problem according to the plan, finally students can conclude the results of solving the problem properly and correctly.

Based on the post-test results, it was found that the application of liveworksheet-assisted LKPD with a problem-based learning approach was effective in improving students' mathematical problem solving abilities. This is in line with the results of Yusri's research, (2018) which states that the problem-based learning approach affects students' mathematical problem solving abilities. Similarly, the results of research by Putri et al., (2019) that there is

an influence between problem-based learning models on the mathematical problem solving ability of junior high school students.

CONCLUSION

After going through various trials starting from normality tests, homogeneity tests and hypothesis tests and also the exposure contained in the presentation of the discussion, the researcher concluded that the use of LKPD assisted by live worksheets with a problem-based learning approach was effective in improving the mathematical problem solving ability of grade VIII students in MTs Al-Paradise on the Pythagorean theorem material. Therefore, the use of LKPD assisted by liveworksheets with a problem-based learning approach is feasible to be applied in mathematics learning, especially for selected and essential materials in mathematics. The use of LKPD assisted by live worksheets and problem-based approaches is recommended to be used in other learning activities to further improve students' ability to learn.

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