INFLUENCE OF THE LIVEWORKSHEET ASSISTED PROBLEM-BASED LEARNING MODEL ON STUDENTS' MATHEMATICAL LITERACY ABILITY

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ABSTRACT
Mathematical literacy ability is a person's ability to understand mathematical problems that exist in everyday life. This study aims to describe the effect of the LiveWorksheet-assisted problem based learning (PBL) model on students' mathematical literacy abilities in Trigonometry material. The sample of this study were 2 classes with a total of 64 high school students in class X. This quantitative research method used data analysis techniques with the 3-test which had previously passed the analysis prerequisite tests, namely the normality test and homogeneity test. The results showed that the effect of the LKS-assisted PBL model had an effect on the mathematical literacy skills of class X students. This was indicated by the average problem-based learning model assisted by LKS obtaining an average value of 89.125 and the control class obtaining an average value of 83.218 so that it has a difference of 5.907 . Thus, it can be said that the class that applies the LKS-assisted problem-based learning model obtains a greater average score. $t_{count} = 3.669 > t_{table} = 2.000$, so this causes H_0 to be rejected at a significance level of 0.05 and degrees of freedom $(dk) = n_x + n_y - 2 = 42$, then there is an effect of the PBL Model Liveworksheet on students' mathematical literacy abilities.
Keywords: Problem based learning, Live Worksheet, Mathematical Literacy

PRELIMINARY

Education is essentially an effort to transmit values, these values will become a guide and orientation in carrying out activities of daily life, education is used as a differentiator between past, present and future generations, more advanced or lower quality. Thus it can be said that the progress and decline of a nation's civilization is largely determined by the educational process carried out in a country. Republic of Indonesia National Education System Law No. 20 in 2003 section 1 which contains education is a conscious and planned form of creating an atmosphere in the learning process so that students are able to develop with significant potential to have values of intelligence, religion, self-control, skills and noble character that needed for social and state life.

Mathematics is a branch of science that has the most important factors in social life which has the potential to be able to develop various technological sciences and knowledge which will later be used for all activities from several related fields. The importance of the main factors in the world of mathematics, especially as a branch of science, can be seen from the high demand for mathematical skills that must be possessed, not just calculus(Rahmah, 2018).

The development of mathematics is not only from content or material but also learning in class. In addition, it is also important to improve students' abilities, one of which is mathematical literacy. This poses a big challenge in creating appropriate mathematics learning, so proper learning is needed so that mathematical literacy skills are explored. Around 2017, the government has formed a literacy movement called GLN. The six types of literacy are (1) numeracy, (2) digital, (3) language, (4) science, (5) culture and citizenship, (6) financial literacy. Mastery of the six literacy needs to be balanced with creativity, critical thinking, collaboration, and communication skills. Therefore, numeracy literacy is a part of the National Literacy Movement (GLN) (Suriyani & Wahyuni, 2021).

According to PISA in 2021 concerning Literacy cited by (Setiawan, 2021) ased on the results of the study, even though the questions given were standard or routine questions and relatively easy because they took levels 1 and 2. All research subjects felt overwhelmed and had difficulty interpreting and applying the formula they already knew in solving the given problem. The conclusion that can be drawn is that students' mathematical literacy skills in this study are still relatively low because students still find it difficult to deal with PISA questions at levels 1 and 2. This is quoted from (Wati et al., 2019) which states that mathematical literacy is a key ability based on PISA data, namely scientific literacy, reading literacy, and mathematical literacy. In this modern era, students are required to have high potential mathematical literacy with the aim of being able to compete with developed countries. Mathematical literacy skills in PISA are divided into three groups, namely the reproductive group, the connective group, and the reflective group. During the reproduction group, students were able to apply and represent in the form of solving a routine problem through the concept of calculating a program that was described in a simple way (Kusmaryono et al., 2020).

Mathematical literacy is important because mathematics is related to everyday life. Mathematical literacy can increase human capital where mathematical literacy can help someone understand the role or use of mathematics in everyday life (Aritonang & Safitri, 2021). However, mathematical literacy emphasizes that students' ability to analyze

effectively is able to provide reasons and communicate through the ideas students have when solving a mathematical problem at hand. This is in line with several research results which examine the importance of students' mathematical literacy abilities, while indicators of mathematical literacy include: 1). Formulate real problems in problem solving; 2). Formulate real problems in problem solving; 3). Interpret solutions in problem solving; 4). Evaluate solutions in problem solving (Prabawati, 2018).

Elated to the application of a problem-based learning model in one of the Vocational Schools that learning outcomes using the classical model show an increase from Cycles I to II with an average percentage of less than 74%, then the completeness of the classical degree is less than 39%. In cycle II, the average percentage of student learning creativity is less than 86%, the average percentage of student learning outcomes is less than 85%, and classical completeness is 100%. It can be seen that the application of a problem-based learning model assisted by media, namely Power Point, is able to increase creativity and through student learning outcomes (Haqiqi & Syarifa, 2021).

The problem-based learning model (PBL) is a series of teacher and student activities during the learning process by being given various problems to later determine solutions to be linked in social life (Prabawati, 2018). The PBL model is designed in a structured format in the form of problems related to applied mathematical concepts. Therefore, students not only receive information from the teacher, but the teacher must motivate and guide students to actively participate in learning during the process (Mayasari et al., 2018).

PBL is a constructive learning model whose purchases are stimulated by various problems that have been prepared by focusing on the process of learning activities. This approach is in accordance with innovative ideas, especially in the following fields: students acquire basic knowledge that is useful for problem solving, students learn actively and independently, realistically, and students are able to think critically and develop initiatives (Adelita et al., 2021). PBL is a learning model that is used in real problem-based learning by paying attention to the context needed so that students more easily understand the material being taught during certain learning processes by prioritizing thought processes (Masliah et al., 2023) . Then when using this learning model, students must prioritize the level of focus when problem solving activities take place (Paloloang et al., 2020). This is supported by Rusman's statement which was explained by (Elita et al., 2019) that PBL is a learning model concept that leads to problem solving through five stages, namely: (1) Orienting students to a problem, (2) Organizing students with learning activities, (3))

Guiding an investigation as a group or individually, (4) Presenting and developing the work, (5) Evaluating and analyzing the process of solving problems. after that, the PBL model can be collaborated with the help of technology, namely using the help of a website called liveworksheets.

Liveworksheets is a platform in the form of a website that provides services for educators to be able to use the available E-LKPD and make their own E-LKPD interactive online. Liveworksheet-based interactive worksheets here can provide variations in learning for students so that learning is not boring. Besides that, this interactive LKPD encourages students to be active in learning and provides convenience in learning that is carried out online (Fauzi et al., 2021). Liveworksheet is useful as a new technology used in education in the form of sound and video results. This LKPD is able to change student worksheets which were originally traditional/conventional based into interactive online worksheets because students can complete them online and send them directly to their teacher. The benefit for educators in this case is that it saves time and can be an encouragement to the surrounding environment because it is more efficient (Amalia & Lestyanto, 2021).

Based on the results of relevant research related to mathematical literacy skills, problem based learning and live worksheets focus more on social arithmetic material. However, there are still few who link it to the effect of mathematical literacy, so researchers plan to carry out new ideas. Previously, only a few researchers discussed the effectiveness of problem-based learning (proble based learning) assisted by liveworksheets on mathematical literacy skills. Therefore, the renewal of this research is this research. focuses on the ability to read mathematics of students who use Liveworksheets as a support in implementing this learning model. This research also applies in the post-pandemic period which requires learning to be done offline.

METHODS

This research conducted in one of the state senior high schools in East Jakarta for the 2022/2023 academic year. The instrument in this study is the test instrument. The data collection technique in this study was carried out by giving a trigonometry material description test which aims to see students' mathematical literacy abilities. This research basically uses a quantitative approach model with the Quasi-Experimental method. The researcher chose two different class samples at high school in Jakarta , including classes X MIPA 2 and X MIPA 4, where each class consisted of 32 students. Then the total sample used is 64 students. Of the 64 students, 1 student was taken each in the experimental class

and the control class with the highest score category. The researcher chose a sampling technique, namely non-probability sampling with a purposive sampling model.

The validation instrument in testing the feasibility of the test items was carried out by construct validation, namely lecturers and teachers. After being declared fit for use, the researcher conducted content validity on 160 students. Based on the results of the validation that has been carried out, 4 questions of description are feasible after being corrected and can be tested on students who have studied trigonometry material. The post-test instruments related to mathematical literacy are given, namely.

Table 1. Post-Test Instrument

No	Indicator	Question
1	Formulate real problems in problem solving	In the aviation communication center building, one can see the ends of a runway for SOEKARNO-HATTA airport, but which is being used horizontally with a depression angle of 53° and 14°. The shortest distance is 3000 meters. If sin 53°=0.8 and tan 14°=0.2, then determine the length of the runway.
2	Formulate real problems in problem solving	On Sunday, January 22 2023, Rifandra was traveling at the National Monument (MONAS). When Rifandra watched MONAS, he had the idea to calculate the distance he stood from the height of the national monument building. If the height of the Monas is 132 meters, Rifandra's viewing angle is 30°. Determine the distance between Rifandra and Monas.
3	Interpret solutions in problem solving	Budi is a grade 10 student who is 160 cm tall. Then Budi was given the task at 07.00 WIB by the mathematics teacher to stand on a flagpole with a distance of 15 m. but at 07.15 WIB Budi saw the top of the flagpole with an elevation angle of $60°$. Find the height of the flagpole that Budi sees.
4	Evaluate solutions in problem solving	A child whose height is 155 cm (measured to the eye) is standing 12 meters from a street lamp. If he sees the top of the street lamp with an elevation angle of 45°, how high is the street light?

In table 1 is the Post-test instrument given to students when carrying out research, which is validated instrument in testing the feasibility of the test items was carried out by construct validation, namely lecturers and teachers. After being declared fit for use, the researcher conducted content validity on 160 students. The results of the data test were run using winsteps obtained results.

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-------------------------------------------------------------------
|ENTRY   TOTAL  TOTAL            MODEL|  INFIT  | OUTFIT  |PT-MEASURE |EXACT MATCH|       |
|NUMBER  SCORE  COUNT  MEASURE   S.E. |MNSQ ZSTD|MNSQ ZSTD|CORR.  EXP.| OBS%  EXP%| Item  |
|------------------------------------+---------+---------+-----------+-----------+-------|
|    1    426    110   -1.95     .36|1.48  1.8|2.68  2.7| .50   .67| 82.2  86.7| I1    |
|    2    380    110    1.46     .24|1.11   .8|1.10   .6| .74   .77| 64.4  64.3| I2    |
|    3    394    110     .63     .25| .65 -2.8| .63 -2.8| .85   .76| 83.6  69.7| I3    |
|    4    406    110    -.15     .26| .81 -1.3| .82 -1.1| .80   .74| 82.2  73.0| I4    |
|------------------------------------+---------+---------+-----------+-----------+-------|
| MEAN   401.5  110.0    .00     .28|1.01  -.3|1.31  -.1|           | 78.1  73.4|       |
| S.D.    16.9    .0    1.26     .05| .32  1.8| .81  2.0|           |  7.9   8.3|       |
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Figure 1. Validity of the Question Test

Based on the processing of the validity data above using winsteps (figure 1), valid data is obtained, because it meets the MNSQ and ZSTD, namely 1.1 and 0.6. This is in line with previous researchers that the data is declared valid if the OUTFIT MNSQ is in the range $0.5 < MNSQ < 1.5$ and for the OUTFIT Z-STANDARD (ZSTD) value in the Winsteps application, the criteria are valid if the values obtained meet the range $-2 < ZSTD < +2$ (Ng et al., 2018; Ramadhani & Fitri, 2020). After the validity of the test using winsteps, then reliability is carried out, namely.

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--------------------------------------------------------------------
|               TOTAL                  MODEL     INFIT       OUTFIT  |
|               SCORE    COUNT  MEASURE ERROR   MNSQ  ZSTD  MNSQ  ZSTD |
|------------------------------------------------------------------|
| MEAN          14.6      4.0     6.12   1.42                       |
| S.D.           1.6       .0     2.16    .38                       |
| MAX.          16.0      4.0     8.08   1.94                       |
| MIN.           5.0      4.0    -7.36   1.02    .19  -1.4   .19  -1.4 |
|------------------------------------------------------------------|
| REAL RMSE   1.56 TRUE SD   1.50  SEPARATION  .97  Person RELIABILITY  .48 |
|MODEL RMSE   1.47 TRUE SD   1.59  SEPARATION 1.08  Person RELIABILITY  .54 |
| S.E. OF Person MEAN = .21                                         |
--------------------------------------------------------------------
Person RAW SCORE-TO-MEASURE CORRELATION = 1.00
CRONBACH ALPHA (KR-20) Person RAW SCORE "TEST" RELIABILITY = .72
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Figure 2. Question Test Reliability

Then from the processing data above (figure 2), it is stated that the reliability is 0.72 because the results exceed the reliability standard, which is 0.7. This is in line with previous research that the quality of the items in the test instrument used has fairly good reliability, namely 0.7 (Soeharto & Rosmaiyadi, 2018).
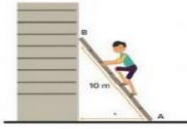
RESULT AND DISCUSSION

This Liveworksheet assisted learning is implemented in trigonometry material. Implementation of LKPD in learning is carried out for 6 (six) meetings with a duration of 90 minutes adjusting the learning schedule at school. The learning process is carried out using the Liveworksheet website and LKPD provided by the teacher in the core activities which begin with student orientation to problems. The teacher gives the LKPD link to students and directs students to open and carry out learning using the LKPD.

Figure. 3 Display of LKPD LiveWorksheet

Figure 3 is the LKPD Live Worksheet Display given to students when conducting research, where the results of research related to the application of the learning model influence the LKS-assisted problem-based learning model on students' mathematical literacy abilities, researchers can explain the results of calculations using Microsoft Excel so that homogeneity results are obtained as follows and test normality of data processing, namely.

1. **Homogeneity Test**

The results of the research through homogeneity test data processing using Microsoft Excel related to the results of students' answers using the PBL learning model assisted by liveworksheets and control, namely.

Table 2. Homogeneity Test of Experimental Class and Control Class

Class	N	s^2	F_{count}	F_{table}	Information
Experiment	32	16,629	0,216	0,548	Homogeneity
Control	32	76,821			

Based on the results of the homogeneity test (table 2), the F_{count} value is obtained 0,216 and F_{table} of 0.548 or it can be said $F_{count} < F_{table}$ so it can be concluded that H_0 is accepted, then the experimental class and the control class have the same or homogeneous variance. Based on the analysis of normality calculations in the experimental class, the significance level is 0.05 and n as many as 32 is obtained L_{count} of 0.018 and L_{table} of 0.157. Because $L_{count} = 0,018 < L_{table} = 0,157$, it can be concluded that the data is normally distributed. Based on the analysis of normality calculations in the experimental class, the significance level is 0.05 and n as many as 32 is obtained L_{count} of 0.143 and L_table of 0.157. Because $L_{count} = 0.035 < L_{table} = 0.157$, it can be concluded that the data is normally distributed.

Table 3. Homogeneity Test Results

Class	N	s^2	F_{count}	F_{table}	Information
Experiment	32	16,62903226	0,216463055	0,548807573	Homogeneity
Control	32	76,82157258			

Based on Table 3, it was found that the results of the calculation of the normality test for class X-2 as the Liveworksheet experimental class and class X-4 as the conventional class were normally distributed, it can be concluded that the classes used in this study came from classes that were normally distributed.

The data from the homogeneity test for the experimental class with n = 32 and the control class with n = 32 obtained an F_{count} of 0.216 and an F_{table} of 0.548 or it can be said that $F_{count} < F_{table}$ so that it can be concluded that H_0 failed to be rejected.

2. Normality Test

The results of the research through normality test data processing using Microsoft Excel related to the results of students' answers using the PBL learning model assisted by liveworksheets and control, namely.

Table 4. Normality

Class	Number of samples	Significance level	L_{count}	L_{table}	Information
Experiment	32		0,018	0,157	Normally
		0,05			distributed
Control	32		0,035	0,157	Normally
					distributed

Based on Table 4, it shows that the experimenta class and the Control class have the same or homogeneous variety.

3. t-test

The results of the research through t-test data processing using Microsoft Excel related to the results of students' answers using the PBL learning model assisted by liveworksheets and control, namely.

Table 5. t-test Results

t-test		Conclucion
t_{count}	t_{table}	Reject H_o
3,669	2,000	

Based on Table 5, it shows that there are differences in students' mathematical literacy abilities between class X-2 whose learning uses the Liveworksheet-assisted problem-based learning model and class X-4 whose learning uses conventional problem-based learning models at Senior High School. The data obtained from Table 5 shows that the value of $t_{count} = 3.669 > t_{table} = 2.000$, so this causes H_0 to be rejected at a significance level of 0.05 and with degrees of freedom (dk) $= n_x + n_y - 2 = 42$.

The results of this study indicate that the implementation of the Web liveworksheet is Problem Based Learning (PBL) in one of the junior high schools in the Gresik area related to the LKPD trials related to social arithmetic material was able to increase student activity in learning mathematics in the network with an average student activity of 84%. In addition, the majority of students' mathematical problem solving abilities (76.92%) are in the very good category (Khikmiyah, 2021).

Table 6. Percentage of Experimental and Control Class Values

Subject	Class								Total Score		Value percentage	
	Experiment				Control				Experiment	Control	Experiment	Control
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4				
S1	4	4	4	4	4	4	3	4	16	15	Very good	good

Calculation of the percentage value

$$PN = \frac{\text{Total Score}}{16} \times 100\%$$

The data table 6, the researcher also observed through the results of student answer sheets to get the results of data analysis through the research subject in the form of a written test namely.

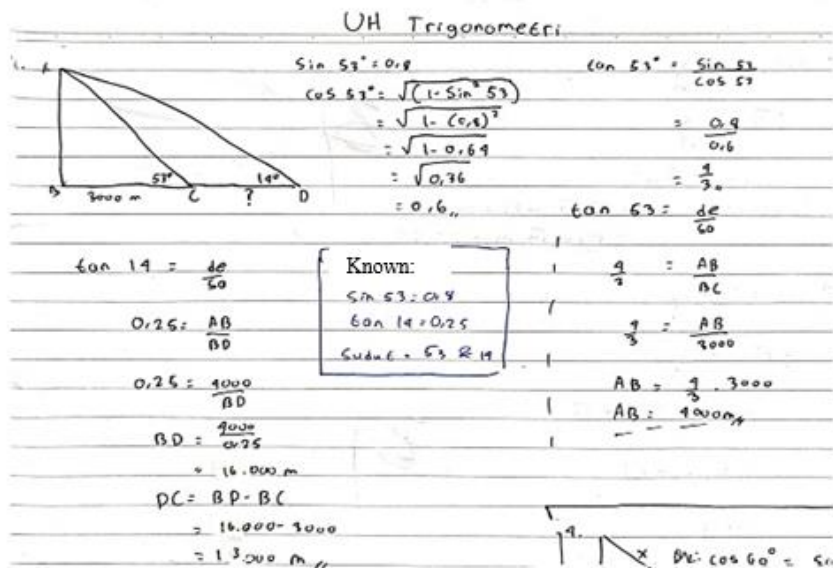## a. Formulate Real Problems In Problem Solving
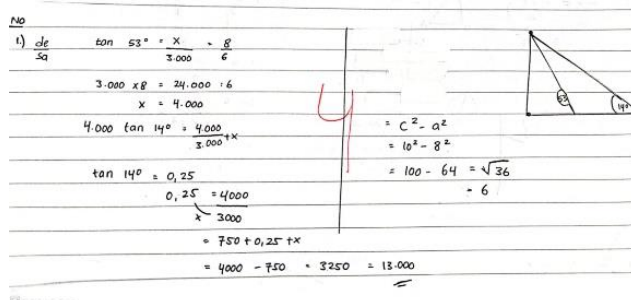
1. S1 Experiment

Figure 4. Answer Number 1

Based on the results of the subject's answers above (figure 4), the researcher can explain that S1 in the processing step for question number 1 is correct and correct because S1 uses the concept of trigonometry comparisons previously S1 made a simple illustration in the form of two right triangles which have different elevation angles, where the results obtained are discovered by S1 obtained DC=13,000 m.
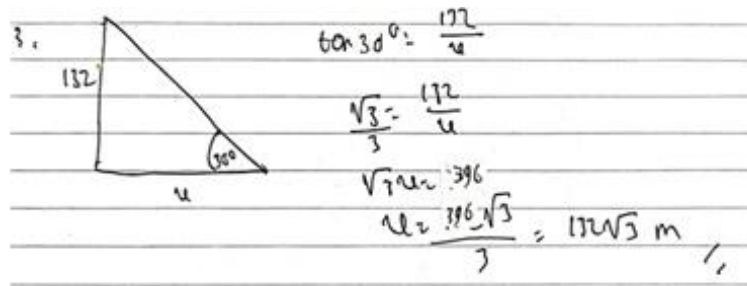
2. S1 Control

Figure 5. Answer Number 1

Based on the results of the subject's answers above (figure 5), the researcher can explain that S1 in the processing step for question number 1 is correct and

correct because S1 uses the concept of trigonometry comparisons previously S1 made a simple illustration in the form of two right triangles which have different elevation angles, where the results obtained are discovered by S1 obtained DC=13,000 m.
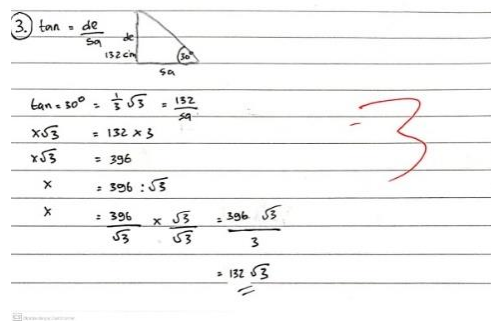
b. Using mathematics in problem solving

1. S1 Experiment

Figure 6. Answer Number 3

Based on the results of the subject's answers above (figure 6), the researcher can explain that S1 in the processing step of question number 3 is correct and correct because S1 uses the concept of trigonometry with an elevation angle of 30^0, previously S1 made a simple illustration in the form of a right triangle which has a large difference in elevation angles, where the results found by S1 obtained $13\sqrt{3}$ m.

2. S1 Control

Figure 7. Answer Number 3

Based on the results of the subject's answers above (figure 7), the researcher can explain that S2 in the processing step of question number 3 is correct and correct because S2 uses the concept of trigonometry with an elevation angle of 30previously S2 made a simple illustration in the form of a right triangle which has a large difference in elevation angles, where the results found by S2 obtained

$13\sqrt{3}$ m. However, there is a shortage of mathematical statement models so that for S2 the score obtained is 3.

c. Interpret solutions in problem solving
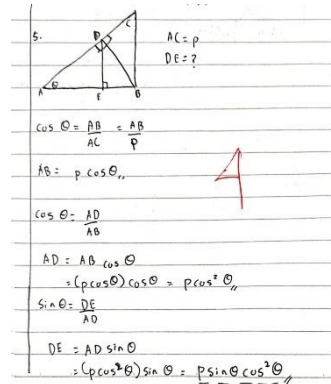
1. S1 Experiment

Figure 8. Answer Number 5

Based on the results of the subject's answers above (figure 8), the researcher can explain that S1 in the processing step of question number 5 is correct and correct because S1 uses the concept of trigonometry to find the length of DE, previously S1 made a simple illustration in the form of a right triangle, where the results found by S1 were obtained $P.\sin\theta.\cos^2\theta$.
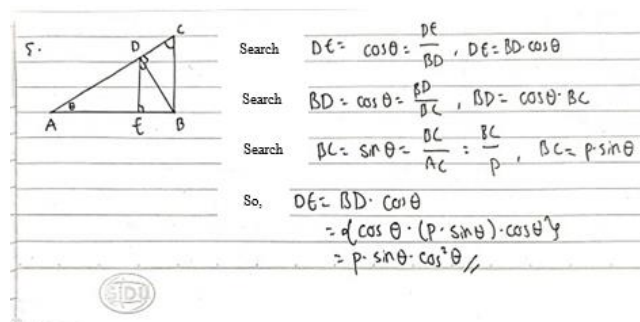
2. S1 Control

Figure 9. Answer Number 5

Based on the results of the subject's answers above (figure 9), the researcher can explain that S1 in the processing step of question number 5 is correct and correct because S1 uses the concept of trigonometry to find the length of DE, previously S1 made a simple illustration in the form of a right triangle, where the results found by S1 were obtained $P.\sin\theta.\cos^2\theta$.

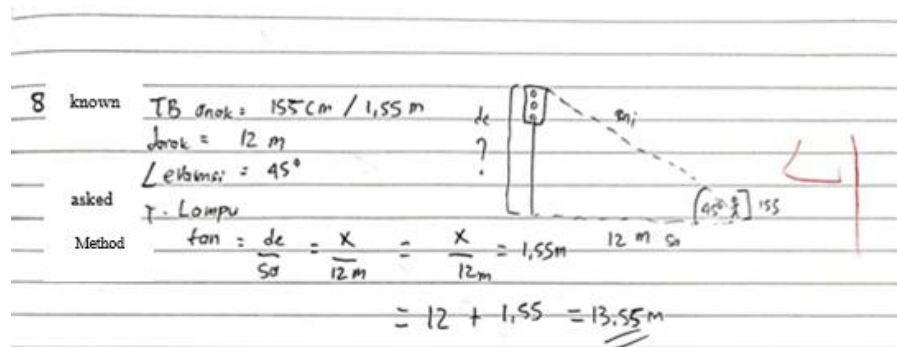### d. Evaluate solutions in problem solving

1. S1 Experiment

Figure 10. Answer Number 8

Based on the results of the subject's answers above (figure 10), the researcher can explain that S1 in the processing step of question number 8 is correct and correct because S1 uses the trigonometry concept of an elevation angle of **45⁰**, previously S1 made a simple illustration in the form of a lamppost opposite the height of a child who has a difference the elevation angle, where the result of the height of the lamppost found by S1 was 12 m, then added to the child's height of 1.55 m, it obtained 13.50 m.
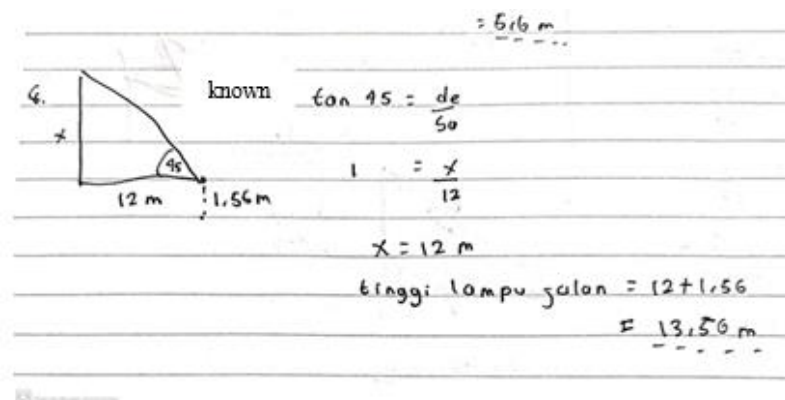
2. S1 Control

Figure 11. Answer Number 8

Based on the results of the subject's answers above (figure 11), the researcher can explain that S1 in the processing step of question number 8 is correct and correct because S1 uses the trigonometry concept of an elevation angle of **45⁰**,

previously S1 made a simple illustration in the form of a lamppost opposite the height of a child who has a difference the elevation angle, where the result of the height of the lamppost found by S1 was 12 m, then added to the child's height of 1.55 m, it obtained 13.50 m.

So it can be determined that, S1 is categorized as high because S1 has fulfilled all indicators of mathematical literacy ability because the results of student answer sheets are correct and explained in detail. Then for S2 it is categorized as moderate because S2 only partially fulfills the indicators of mathematical literacy ability and is still weak in the indicators section Using mathematics in problem solving because there is a shortage of mathematical statement models while for calculation indicators and conclusions the accuracy is correct, although there are several correct answers but still incomplete.

This is in line with the results of the study which found that during the implementation of this study, the time allocation given to the two groups, namely the experimental group and the control group, was the same. The only difference is the treatment given in this case is the learning model used. The experimental group uses the Problem Based Learning model assisted by Liveworksheet while the control group uses conventional learning. The use of the Liveworksheet-assisted PBL learning model is proven to improve and maximize student learning outcomes. The effect of PBL on the liveworksheet in the worksheet effect is due to the concept of PBL learning, namely real-life problems which are then presented in a liveworksheet with a simpler presentation online so that students can better understand the completion flow which is being decorated mathematically. This is shown by the average problem based learning model assisted by live worksheets obtaining an average value of 89.125 and the control class obtaining an average value of 83.218 so that it has a difference of 5.907 In addition to data processing, the researcher made a comparison of the literacy level of students using liveworksheets and class control that the literacy level of students using liveworksheets was able to present a mathematical model of the problem in a simple form, while for class control it was difficult to arrange the problem model mathematically. Thus, it can be said that the class that applies the liveworksheet-assisted problem-based learning model obtains a greater average value (Prabowo, 2021).

CONCLUSION

The results showed that the effect of the PBL model assisted by the liveworksheet had an effect on the mathematical literacy abilities of class X students, so this research could be used as a form of contribution from researchers to educators related to worksheets, namely liveworksheets which were able to provide changes in students' enthusiasm for learning in the concept of mathematical literacy. However, the obstacle faced by researchers is an unstable internet signal. The results of this study state that the problem-based learning model, especially the problem-based learning model assisted by Liveworksheet, can improve the quality, ability of students' mathematical literacy and be more effective.

This is shown by the average problem based learning model assisted by live worksheets obtaining an average value of 89.125 and the control class obtaining an average value of 83.218 so that it has a difference of 5.907 In addition to data processing, the researcher made a comparison of the literacy level of students using liveworksheets and class control that the literacy level of students using liveworksheets was able to present a mathematical model of the problem in a simple form, while for class control it was difficult to arrange the problem model mathematically. Thus, it can be said that the class that applies the liveworksheet-assisted problem-based learning model obtains a greater average value. the value of $t_{count} = 3.669 > t_{table} = 2.000$, so this causes H_0 to be rejected at a significance level of 0.05 and with degrees of freedom (dk) $= n_x + n_y - 2 = 42$, then there is the influence of Liveworksheet in the PBL model on students' mathematical literacy abilities.

Suggestions from this study are 1) teachers must adapt to any situation according to the conditions in the class, both with technology, infrastructure and the surrounding environment. 2) it is even more effective if there is an application or website that is easy to develop and directly integrated, for example Liveworksheet so that students directly work on LKPD directly on Liveworksheet.

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