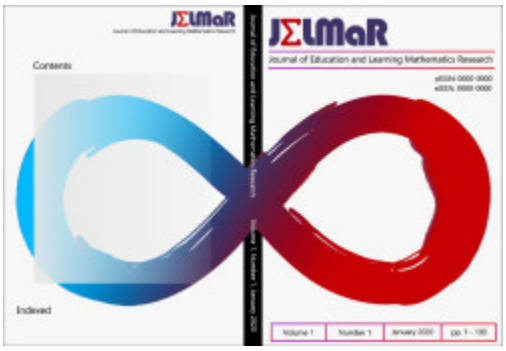

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Transforming Mathematical Problem Solving Through AI Tools: An Investigation of Photomath Integration in Problem-Based Learning

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***Abstract**: This study aims to determine the ability of problem solving through Problem Based Learning (PBL) on the material of the Three Variable Linear Equation System (SPLTV) assisted by Photomath. This research is qualitative descriptive research. The subjects of this research were students of class X SMA Srijaya Negara Palembang. Data collection was carried out using test, interview, and observation methods. Analysis of test data was carried out by describing the subject's ability in problem solving, and for data analysis, interviews and observations were carried out by data reduction. interviews and observations were done by data reduction, data presentation and conclusion drawing. The results showed that the subject's problem-solving ability was the subject's problem-solving ability is quite good by applying Problem Based Learning on SPLTV material assisted by Photomath can develop students' problem-solving skills. This can be seen from the students can understand the problem in the problem, make a mathematical model, solve the problem using Photomath, compile the answer conclusion from the steps that have been done and recheck the answer using Photomath.*
Keyword: problem solving skills, PBL, SPLTV, photomath

INTRODUCTION

Mathematical problem-solving skills are processes and strategies used by students (Ukobizaba et al., 2021), to find solutions or solutions to a problem to obtain the result or answer to the problem (Fatqurhohman, 2021), by applying their skills and knowledge (Faradiba & Alifiani, 2020). Problem-solving skills are very important for every student to have because they are the general purpose of teaching mathematics, including methods, procedures and strategies that are the core and main processes in the mathematics curriculum, and are the basic skills in learning mathematics and problem-solving skills help students think analytically in making decisions in daily life and help improve thinking skills critical in facing the new situation (Rahman, 2019).

However, in fact, problem-solving skills are still low because during the learning process students are inactive so that students find it difficult to understand the problems presented (Sakir & Kim, 2020), the results of the study (Nuraeni et al., 2020) show that 50.00% of students have problem-solving skills with a low category, students write what they know but do not write what is asked, Students can make a settlement plan and implement the settlement plan in accordance with procedures and can simplify the problem, but there are still students who make mistakes in calculating, and students do not check the answers again. In the SPLTV material, students also have low problem-solving skills because students are confused when modeling, eliminating repetitive ones and do not know the types of problems that have a solution and do not have a solution.

The cause of students' low mathematical problem-solving skills is due to the choice of inappropriate learning approaches or models, where teachers tend to use monotonous approaches or models with a teacher-centered learning focus (Tsegaw et al., 2021). The low ability of students in solving mathematical problems is not only caused by a lack of understanding of problems, but also due to the low interest in learning during the learning process (Lumbantoruan, 2022).

One of the learning models that can be used to develop problem-solving skills is Problem Based Learning. Problem Based Learning is a learning model that involves students in solving problems in context (Wulandari, 2024), a learning model that uses real problems encountered in the environment as a basis to gain knowledge and concepts through critical thinking and problem-solving skills (Berlian et al., 2023), the PBL learning model directs students to work independently using various learning resources.

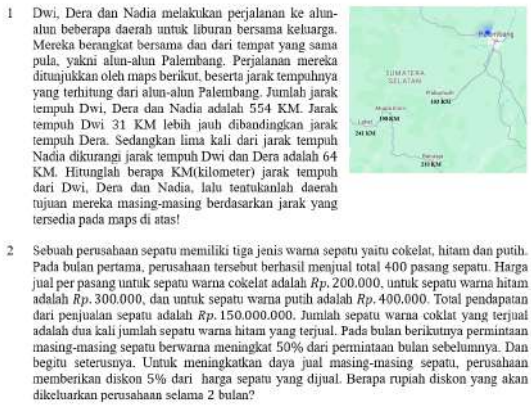
Along with technological advances that have brought about major changes in daily life. One of the changes is the use of Artificial Intelligence (AI). AI is a software or computer program that has a mechanism to learn, and use that knowledge to make decisions like humans do (Sajja, 2021). One of the AIs that can be used in math lessons, especially in SPLTV materials, is Photomath. Photomath provides various methods of solving SPLTV problems ranging from elimination, substitution, Cramer and Gauss-Jordan. With the completion of these various methods, students will have a deeper understanding of concepts such as variable substitution, elimination, and matrix manipulation used to solve SPLTV problems.

Previously, research on problem solving had been carried out (Saputra et al., 2023), but in previous research, two-variable linear equation system material was used, and did not use AI, so researchers were very interested in conducting research using three-variable linear equation system material with the help of Photomath. This research is titled "Problem Solving Ability Through Problem Based Learning on Photomath-Assisted SPLTV Material". Therefore, the purpose of this study is to determine the ability to solve problems through *Problem Based Learning* (PBL) in the material of the Three-Variable Linear Equation System assisted *by Photomath.* After conducting problem-based learning assisted *by Photomath,* students are expected to be able to understand the problem, prepare a solution plan, carry out the solution and check the answers.

METHOD

This research is a descriptive type of research with qualitative and quantitative approaches. This study aims to describe the ability of students to solve problems through *Photomath* in SPLTV questions using the PBL learning model. The research subjects consisted of 33 people with varying abilities, namely high, medium and low. This research was carried out in the 2024/2025 school year at Srijaya State High School, Palembang.

Data collection techniques are observation, tests and interviews. This observation uses an observation sheet instrument, the test will take place after the learning process, then the interview from the test results the researcher will find out the problem-solving ability when solving SPLTV questions. The test questions given are in the form of 2 questions related to the indicator of problem-solving ability of the three-variable linear equation system. The following are the test questions used in the research, namely:



1 Dwi, Dera dan Nadia melakukan perjalanan ke alun-alun beberapa daerah untuk liburan bersama keluarga. Mereka berangkat bersama dan dari tempat yang sama pula, yakni alun-alun Palembang. Perjalanan mereka dituujukkan oleh maps berikut, beserta jarak tempuhnya yang terhitung dari alun-alun Palembang. Jumlah jarak tempuh Dwi, Dera dan Nadia adalah 554 KM. Jarak tempuh Dwi 31 KM lebih jauh dibandingkan jarak tempuh Dera. Sedangkan lima kali dari jarak tempuh Nadia dikurangi jarak tempuh Dwi dan Dera adalah 64 KM. Hitunglah berapa KM(kilometer) jarak tempuh dari Dwi, Dera dan Nadia, lalu tentukanlah daerah tujuan mereka masing-masing berdasarkan jarak yang tersedia pada maps di atas!

2 Sebuah perusahaan sepatu memiliki tiga jenis warna sepatu yaitu cokelat, hitam dan putih. Pada bulan pertama, perusahaan tersebut berhasil menjual total 400 pasang sepatu. Harga jual per pasang untuk sepatu warna cokelat adalah *Rp.* 200.000, untuk sepatu warna hitam adalah *Rp.* 300.000, dan untuk sepatu warna putih adalah *Rp.* 400.000. Total pendapatan dari penjualan sepatu adalah *Rp.* 150.000.000. Jumlah sepatu warna coklat yang terjual adalah dua kali jumlah sepatu warna hitam yang terjual. Pada bulan berikutnya permintaan masing-masing sepatu berwarna meningkat 50% dari permintaan bulan sebelumnya. Dan begitu seterusnya. Untuk meningkatkan daya jual masing-masing sepatu, perusahaan memberikan diskon 5% dari harga sepatu yang dijual. Berapa rupiah diskon yang akan dikeluarkan perusahaan selama 2 bulan?

Figure 1. Test Questions

The quantitative data was obtained from the results of the written test as a reference to categorize students' problem-solving abilities in the material of the three-variable linear equation system. The following are the categories of problem-solving skills.

Table 1. Categories Problem-Solving Skills

Value	Category
$81 \leq x < 100$	Excellent
$61 \leq x < 80$	Good
$41 \leq x < 60$	Enough
$21 \leq x < 40$	Less
$0 \leq x < 20$	Very Less

(Purwaningsih & Ardani, 2020)

Quantitative data is used as a reference to select subjects from each category. The researcher makes the categorization by setting the criteria first. This study selects subjects that meet 3 criteria, namely written test results based on categories, students' willingness and teacher recommendations. Then for qualitative data obtained from observations and interviews based on indicators of problem-solving skills, from the data the researcher will describe the results.

RESULT AND DISCUSSION

The research was conducted in three meetings, consisting of two meetings for problem-based learning with the help of AI *Photomath*, and the last meeting for test activities. The learning stage consists of five stages of problem-based learning, namely student orientation to problems, organizing students to learn, guiding individual/group experiences, developing works and analyzing and evaluating the problem-solving process. The learning activities in each learning are illustrated in each of the following stages.

1. Orientation of students to problems

Student orientation activities to problems are carried out with the aim that students are able to identify problems in contextual problems in the form of known and asked, present problems in the form of mathematical models on contextual problems, identify whether the problem has a solution, solve problems using the chosen method, present conclusions from the problem, re-evaluate the answers that have been obtained. The following are the problems at the LKPD meeting 1.

Figure 2. Problems in LKPD Meeting 1

2. Organizing learners to learn

After providing examples of problems and opportunities to ask students, the researcher then asked students to form groups according to the division that had been determined. After that, the researcher distributed the LKPD meeting 1 to each group to be worked on together through group discussions.

Figure 3. Group Discussion and Usage *Photomath* In LKPD 1

Students work on LKPD meeting 1 by discussing with the group. During the LKPD work, students use *Photomath* to solve problems and the researcher provides guidance or guidance to students if they do not understand what is meant by the problem.

3. Mentoring individual/group experiences

The researcher gave time to all groups to work on the LKPD. Furthermore, the researcher guides students to identify problems in the questions. In the first step, students are guided to discuss in identifying problems in the problem. At this stage, students must write down what they know and ask in the question. At this stage, students are trained to understand the problem. The following are the results of the answers from the students.

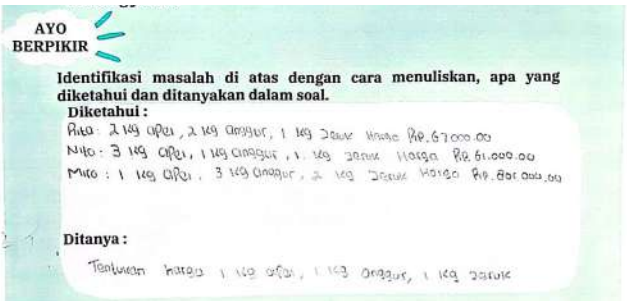


Figure 4. Answer to Question No.1 on the Problem Understanding Indicator

In picture 4, students write what is known by making from each fruit that Rita, Nita and Mira bought. Next, students make what they are asked. It can be seen from the results of the students' answers that the entire group has been able to identify problem 1.

In the next step, students are directed to make reasoning and mathematical models from problems. At this stage, it is in line with the indicators of preparing a completion plan. At this stage, students discuss in groups to make mathematical models so that they form equations. The following are the students' answers.

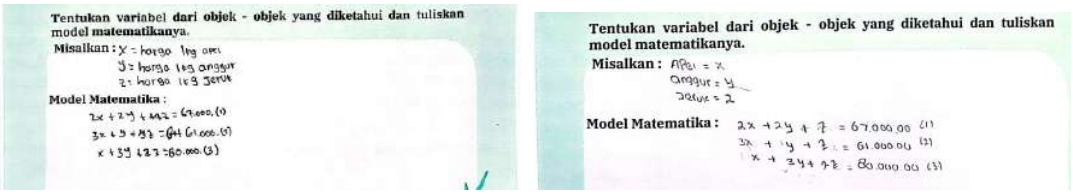


Figure 5. Answer to Question No.1 on the Indicator of Developing a Completion Plan

In figure 5 (a) the students have made the reasoning in the form of*x* the price of 1 kg of apple, in the form *y* of the price of 1 kg of wine and in the form of *z*the price of 1 kg of orange. However, in figure 5 (b) there are still students who are not right when making reasoning. The reasoning made is in the form of apples, in the form of grapes and in the form of oranges, *xyz*students do not add the word price of 1 kg, can be seen in figure 5 (b)

Nevertheless, students have been able to model from problem one, namely and. However, there are still students who write the number 1 as a coefficient, as can be seen in figure 5 students make with $2x + 2y + z = 67.000,3x + y + z = 61.000x + 3y + 2z = 80.0002x + 2y + 1z = 67.000$

Furthermore, the researcher directed students to use *the Photomath* application to find out if the problem had a solution, did not have a solution or had many solutions. The students were very enthusiastic when the researcher explained how to use *Photomath*. There was one student who asked if the *Photomath* application could solve the story problem without having to model it, so the researcher replied that the story problem could not be solved directly using *Photomath,* you had to make modeling first. After the researcher answered the question, the students proved by trying to do it by taking pictures of the questions in the LKPD, and it was proven that it could not be solved.

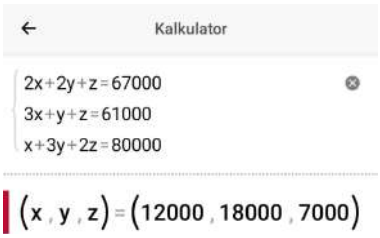
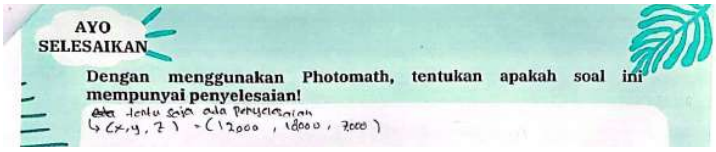


Figure 6. Result *Photomath* On Problem 1

In the picture above is the result of problem 1, which means that it is. The following are the answers from the students. $(x, y, z) = (12000, 18000, 7000)x12000, y$ adalah 18000 dan z adalah 7000)



Picture 7. Answer to Question No.1 on Use *Photomath*

At this stage, students have been able to understand that this problem has a solution. In this section, the answers from students vary, namely in the first group write that there is a solution, the second group writes that this problem has a solution and the third group writes that of course there is a solution. In the third group, write the results in the $(x, y, z) = (1.200, 1800, 7000)$*Photomath* application.

In order not to make them dependent, the researcher teaches students a coefficient comparison, so that they know why the problem has a solution, many solutions or no solutions. To prove that the problem does have a solution, students must prove it by using a coefficient comparison.

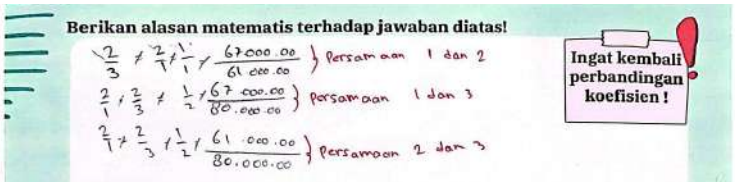


Figure Picture 8. Answer to Question No.1 on Coefficient Comparison

In the figure above, students make a comparison of coefficients starting from equations 1 and 2, then 1 and 3, then 2 and 3. The result of the coefficient comparison is that the sign is not the same as so that this problem has an exact solution. (≠)All groups were able to make a comparison of the coefficients of problem 1.

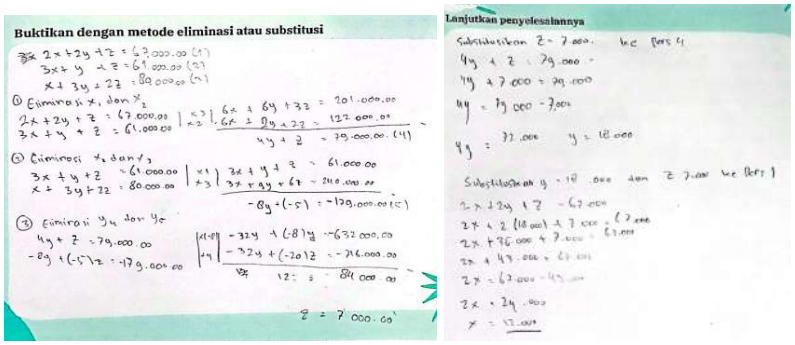


Figure 9. Answer to Question No.1 on the Indicator of Implementing Completion

The researcher asked students to observe the completion steps in the *Photomath* application , starting from choosing the method to be used. At this stage, it is in line with the indicators of implementing the solution. In the image above, students solve problems using a combined method. In problem 1, the first step that students do is to eliminate from equations 1 and 2 so that they get equation 4, then eliminate from equations 2 and 3 so as to get equation 5, then eliminate from equations 4 and 5 so as to get a score, after getting a score, after getting a score, students convert it to equation 4 so that they get a score, and the last step is for students to convert the value and to equation 1 so that they get a score. value. $xxyzzyyzx$However, there is one group that does not solve problem 1.

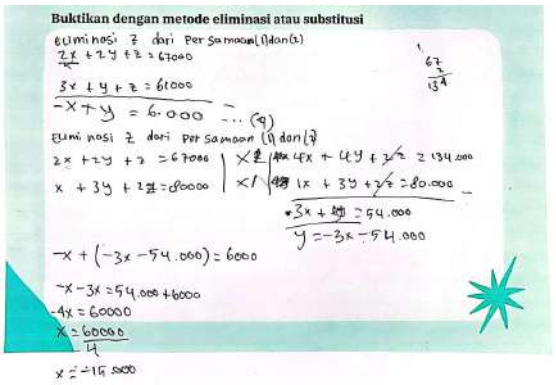


Figure 10. The answer to question No.1 on the indicator of implementing the settlement is not right

In the image above, students solve problems using a combined method. In problem 1, the first step that students do is to eliminate from equations 1 and 2 so that they get equation 4, that is, then eliminate from equations 1 and 3 so that they get . Furthermore, the participant reduced in both segments so that it became, but the student made a mistake he should have . Furthermore, it substituts the value to equation 4 so as to obtain the value . Because at the beginning there was a mistake so that the results were not suitable. The student did not continue to complete the problem because the results obtained were not in accordance with what was in $z - x + y = 6.000z3x + y = 54.0003xy = -3x - 54.000 - 54.000y = -3x + 54.000yx = -15.000$*Photomath*.

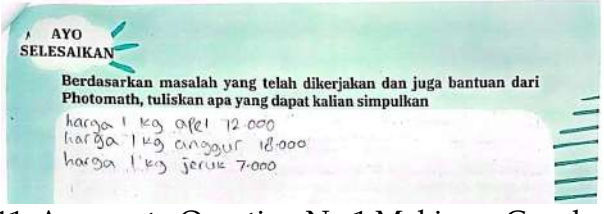


Figure 11. Answer to Question No.1 Making a Conclusion

Furthermore, students are directed to make conclusions. At this stage, it is in line with the indicator of rechecking the answer. In problem 1, students make a conclusion by writing down the price of 1 kg of fruit, then students enter the price, namely the price of 1 kg of apples 12,000, the price of 1 kg of grapes 18,000 and the price of 1 kg of oranges 7,000. However, there are also students who misunderstand when making conclusions, as can be seen from the image below.

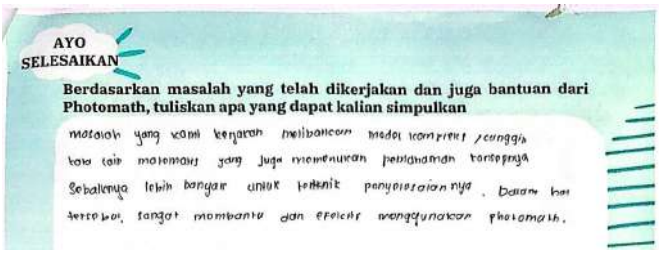


Figure 12 .Answer to Question No.1 Making Incorrect Conclusions

This student misinterpreted the statement. Students comment on the learning carried out while instructed is to make conclusions. Students wrote "the problem we are working on involves a computer/advanced model, in other words, mathematics that also finds an understanding of the concept. It is better to have more for the solving technique, in which case it is very helpful and effective to use *Photomath*". There are also students who do not draw conclusions from the problem.

Furthermore, the researcher guided students to solve problem two. Problem 2 is deliberately designed that there is no single solution that will result students later. From the students' answers, it can be seen that the whole group is able to identify problems and make models for problem 2.

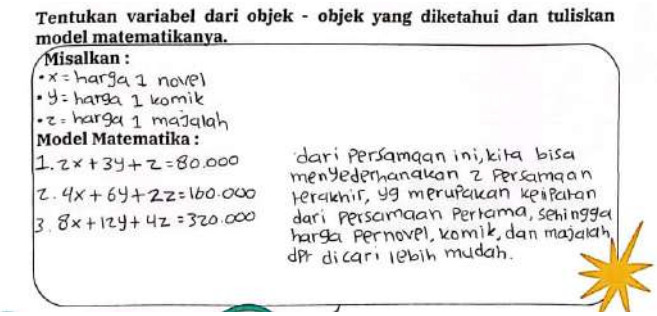


Figure 13. Answer to Question No.2 on the Indicator of Developing a Completion Plan

The next step is to use *the Photomath* application to find out if the problem has a solution, does not have a solution or has many solutions. The researcher directs students to open *the Photomath application*. The researcher told the students to prove by entering the equation into *Photomath*, so that the results came out so that the problem had a solution.

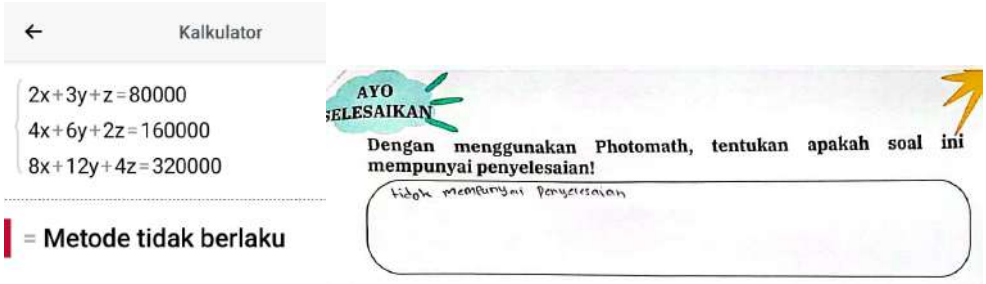


Figure 14. Answer to Question No.2 on Use *Photomath*

At this stage, students think why problem 1 has a solution while problem 2 does not have a solution. In problem 2, the results of equations 1 and 2, 1 and 3 and 2 and 3 are in the form of equal signs so that this problem has many solutions. With this coefficient comparison, students can understand why when using (=)*Photomath*, the results do not have a solution. All groups have understood that this problem has no solution.

At this stage, students solve problems by using the elimination method. The first step that students take is to eliminate from equations 1 and 2, then eliminate from equations 2 and 3. However, when eliminating from equations 2 and 3 it produces a value so that this problem has many solutions.$xxx0 = 0$

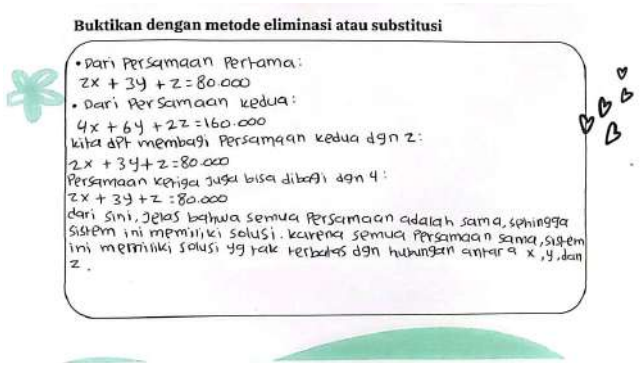


Figure 15. Answer to Question No.2 on the Indicator of Implementing Completion

However, there are also students who do not use the solution method. They use logic. In the second equation the student divides by 2 so that it becomes $2x + 3y + z = 80.000$, while in the third equation the student divides by 4 so that it becomes $2x + 3y + z = 80.000$. Furthermore, students explained that all equations are the same so that they have infinite solutions.

Furthermore, students are directed to make conclusions. At this stage, it is in line with the indicator of rechecking the answer. In question 2, students only wrote "no solution". However, the answer is not correct because the results of the coefficient comparison obtained many solutions. But there are also detailed students, as can be seen from the picture below. Students explained that this system of equations can be solved by relationships between variables, but cannot get the exact value of each variable. The meaning of the student's statement is that the value of these variables is unlimited.

4. Developing the work

The researcher provides opportunities for students to work together in groups in an effort to find solutions to the problems given. The researcher asked students to open the *Photomath* application again to check the results obtained to ensure that the results obtained were correct. The researcher asked students to discuss the results that had been obtained.

At this stage, the aim is to get students used to seeing, re-checking and observing the results of *Photomath answers*. Students subtitute the results that have been obtained into the initial equations, namely equations 1, 2 and 3 and the results are proven. However, there are also students who do not check the answers they get, which are as follows. In question 2, students write the word "cannot check the answer again because they do not have a solution". However, there are also students who do not answer.

5. Analyzing and Evaluating the Problem-Solving Process

After all the problems are solved, the students in their respective groups present solutions to the problems in front of the class orally. Researchers are welcome from other groups to ask questions and provide comments related to the solutions presented. The other group responded by questioning a different answer from the other group and discussing a more appropriate answer. After the presentation and discussion, the

researcher provided a more in-depth explanation of the concepts and theories related to the three-variable linear equation system. The researcher conveyed the definition, and types of questions.

In the closing activity, the researcher gave students the opportunity to ask questions about things they still did not understand. Then the researcher guides students in drawing conclusions about the three-variable linear equation system. After that, the researcher informed the material that would be discussed at the next meeting, and the researcher closed the learning by saying greetings.

Likewise, the second meeting was carried out with problem-based learning and photomath assistance. The problem in LKPD meeting 2 is a little more difficult to make a mathematical model because the information is comparative.

In the third meeting, a test consisting of 2 questions was carried out to see the students' problem-solving skills. The test uses three-variable linear equation system material, with questions that are arranged based on indicators of problem-solving ability and have been validated. The following is a solution to the problems of students.

Table 2. Test Result Percentage

Value	Frequency	Percentage	Category
$81 \leq x < 100$	9	27,2727%	Excellent
$61 \leq x < 80$	17	51,5152%	Good
$41 \leq x < 60$	3	9,09091%	Enough
$21 \leq x < 40$	4	12,1212%	Less
$0 \leq x < 20$	0	0%	Very Less
Sum	33		
Average	70,6229		
Category	Good		

It can be seen from the table above, that the average score obtained by students is 70.6229 which is categorized as good.

Analysis of Students' Answers to Question Number 1

NZA subjects were able to solve problem number 1 well and accurately, NZA was able to meet all four indicators of problem-solving ability. The following is the answer to question number 1 of the NZA subject.

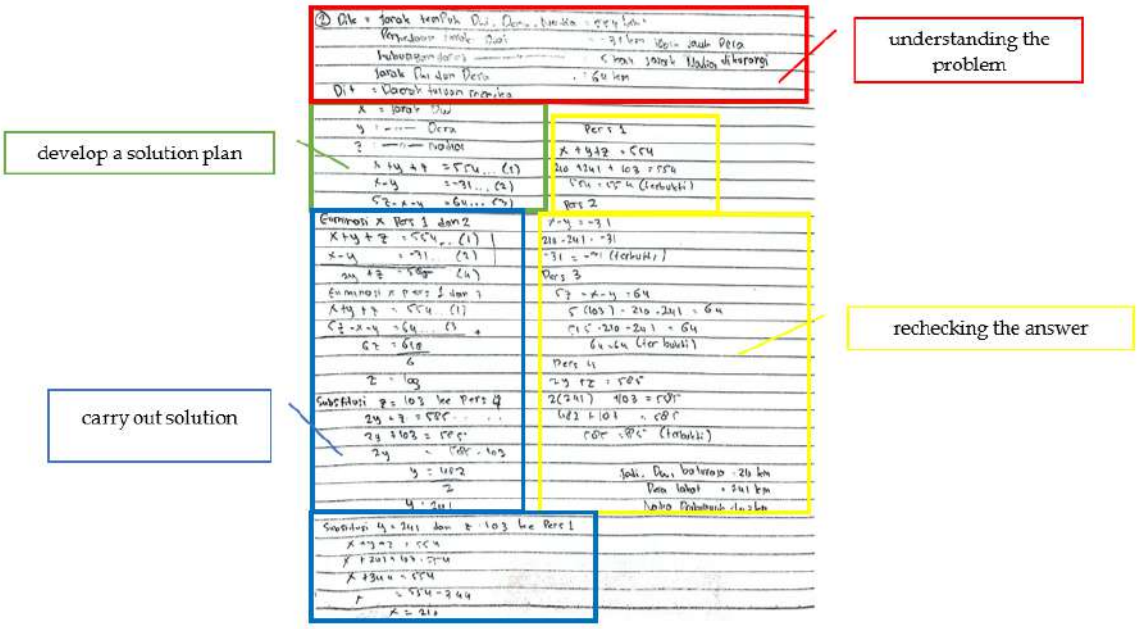


Figure 16. NZA Subject Answers to Question Number 1

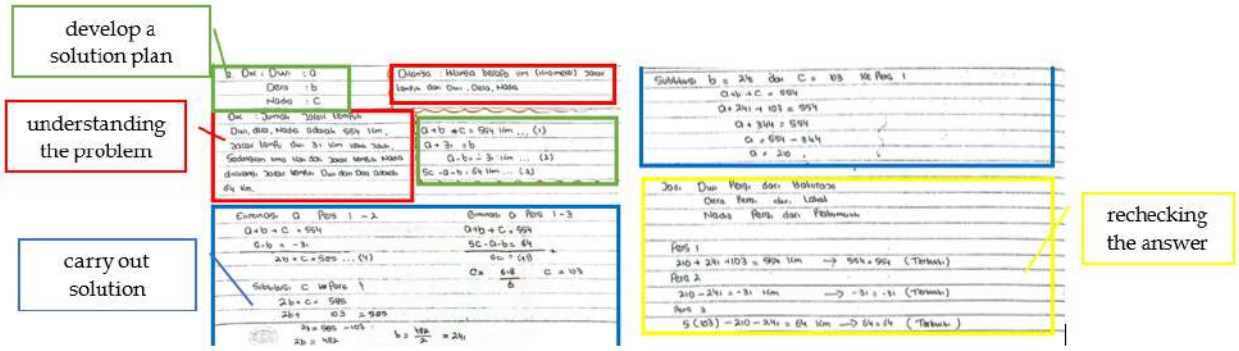


Figure 17. DAP Subject Answers to Question Number 2

In contrast to NZA, in the first indicator, DAP subjects only get a score of 2. This is because the subject of DAP wrote what was asked incompletely. The DAP subject wrote that he was asked with the word count how many km (kilometers of distance from Dwi, Dera and Nadia), the subject did not make the word determine the destination area of Dwi, Dera and Nadia. When interviewed, the subject was confident in the answer he wrote, the following are the results of the interview.

P : How do you make it known and asked about the problem in the question?
DAP : To make what is known, I first read the question and observe it, after that I can know where it is known. If I ask you what I see, I see in the last sentence
P : Are you sure of the answer to number 1 part known and asked?
DAP : Believe.
P : Why are you sure of the answer?
DAP : Because I followed the question.

In the indicator of preparing a solution plan for the subject of DAP, it got a score of 2, this is because when making the reasoning, the words were not complete. The DAP subject only wrote the words Dwi, Dera and Nadia, Dwi's mileage, Dera's mileage and Nadia's mileage. For subject modeling, DAP has made accurate and orderly. For the first equation the subject makes, in the second equation the subject subtracts and in both the segments that initially until become and the third equation. DAP subjects $= a = b = ca + b + c = 554b31a + 31 = ba - b = -315c - a - b = 64$do not understand when making reasoning, but subjects can when making modeling. The following is an excerpt of the results of the researcher's interview with DAP subjects.

P : How do you make a reasoning from the problem?
DAP : To make a reasoning I looked at the existing name.
P : Are you sure of the reasoning?
DAP : Believe.
P : Why can you be sure?
DAP : Because the question was Dwi, Dera and Nadia.

In the indicator, the DAP subject is solved using a combined method. The first step of the DAP subject is to eliminate from the equation and thus obtain the equation. Then eliminate from the equation and thus get the value of the variable. Next, it is subordinated to the equation so that the value. After getting a score of. The last step is that the subject contuses and to the equation so that the value is obtained.$a124a13cc4bbbc1a$

In the indicator of rechecking the answer, the DAP subject makes a conclusion and rechecks the answer by substituting the value to the equation and. However, the conclusion was incomplete because the subject did not add the distance traveled by Dwi, Dera and Nadia, but the subject did not realize that the conclusion was incomplete, the subject was confident in the answer. This is strengthened from the results of interviews with DAP subjects.1,23

P : Did you draw conclusions?
DAP : Create.
P : Are you sure of this conclusion?
DAP : Believe.

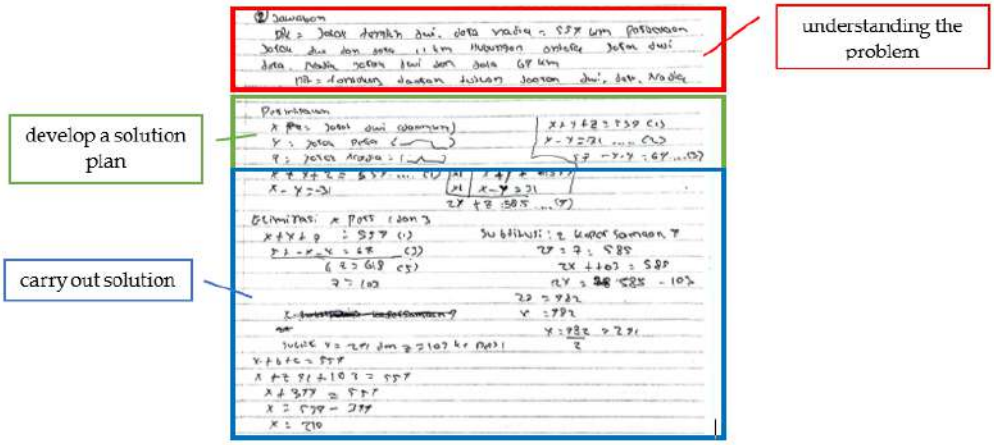


Figure 18. KW Subject Answer to Question Number 1

Next is the subject KW. In the first indicator, the subject KW makes it known completely, but the part that the subject asks is incomplete. The KW subject did not add how much distance Dwi, Dera and Nadia traveled. Subject KW did not realize that when writing this, this can be seen from the interview.

P : How do you make it known and asked about the problem in the question?
KW : From the question
P : Are you sure of the answer to number 1 part known and asked?
KW : Believe.
P : Why are you sure of the answer?
KW : Because I saw the question.

The subject made a reasoning in the form of a distance of Dwi (in KM), in the form of a distance of Dera (in KM) and in the form of a distance of Nadia (in KM). The subject KW has been correct in modeling it i.e. in the first equation, in equation two i.e. and in the third equation the subject makes the model.$xyzx + y + z = 554x - y = -315z - x - y = 64$

Subject KW did not draw conclusions and double-checked the answers. The subject lacks time so the subject does not make it, this can be seen from the interview.

P : Do you draw conclusions and double-check the answers?
KW : Not making.
P : Why don't you make a conclusion and don't double-check the answers?
KW : Because time was running out, I didn't make it.

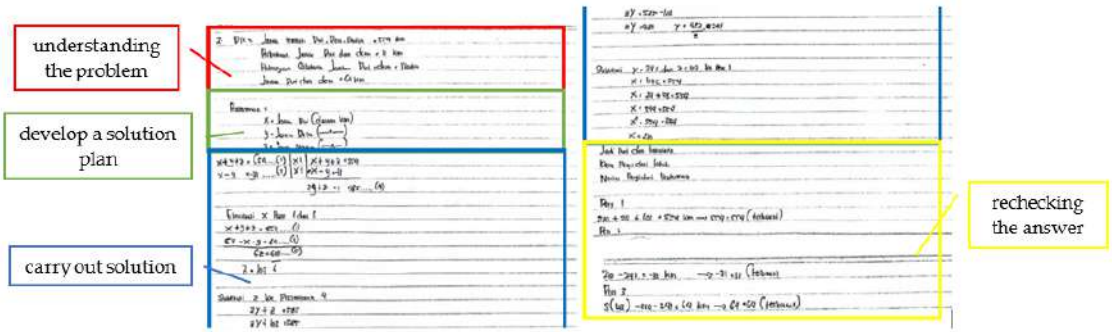


Figure 19. SA Subject Answer to Question Number 1

In the first indicator the subject of SA only makes known. In the part where it is known that the two subjects of SA misspelled, he wrote that KM should be KM. The subject 1131does not make known because the subject forgets.

P : How do you make it known and asked about the problem in the question?
HIS : I looked at the question and immediately wrote.
P : Are you sure of the answer to number 1 part known and asked?
HIS : Believe.
P : Why don't you make it asked?
HIS : I forgot.

In the indicator of compiling a solution plan, the subject of SA is not complete when making reasoning and when modeling the subject is incorrectly written on the equation1, he writes as it should. The following is a snippet of the results of the researcher's interview with the SA subject.$C54554$

P : How do you make a reasoning from the problem?
HIS : Asked about the distance between Dwi, Dera and Nadia.
P : Are you sure of the reasoning?
HIS : Believe.
P : Why can you be sure?
HIS : Because what was discussed was the journey from Dwi, Dera and Nadia.
p : How do you construct a mathematical model to answer the problem?
HIS : See what is known.
P : Why is there in equation 2?$C54$
HIS : Owh, that's a misspelling 554

In the indicator, the completion of the SA subject uses a combined method. The first step of the subject SA is to eliminate from the equation and thus obtain the equation. Then eliminate from the equation and thus get the value of the variable. Next, it is subordinated to the equation so that the value. After getting a score of. The last step is that the subject contuses and to the equation so that the value is obtained.$x124x13zz4yyyz1x$

P : What method do you use to solve the problem?
HIS : Combined method.
P : Are you sure of the answer?
HIS : Believe.

In the indicator of rechecking the answer, the subject makes a conclusion and rechecks the answer by substituting the value to the equation and. However, the conclusion was incomplete because the subject did not add the distance traveled by Dwi, Dera and Nadia, but the subject did not realize that the conclusion was incomplete, the subject was confident in the answer. This is strengthened from the results of interviews with DAP subjects.1,23

P : Did you draw conclusions?
SA : Create.
P : Are you sure of this conclusion?
SA : Believe.

Analysis of Students' Answers to Question Number 2

NZA subjects were able to solve problem number 2 well and precisely, NZA was able to meet all four indicators of problem-solving ability. The following is the answer to question number 2 from the NZA subject.

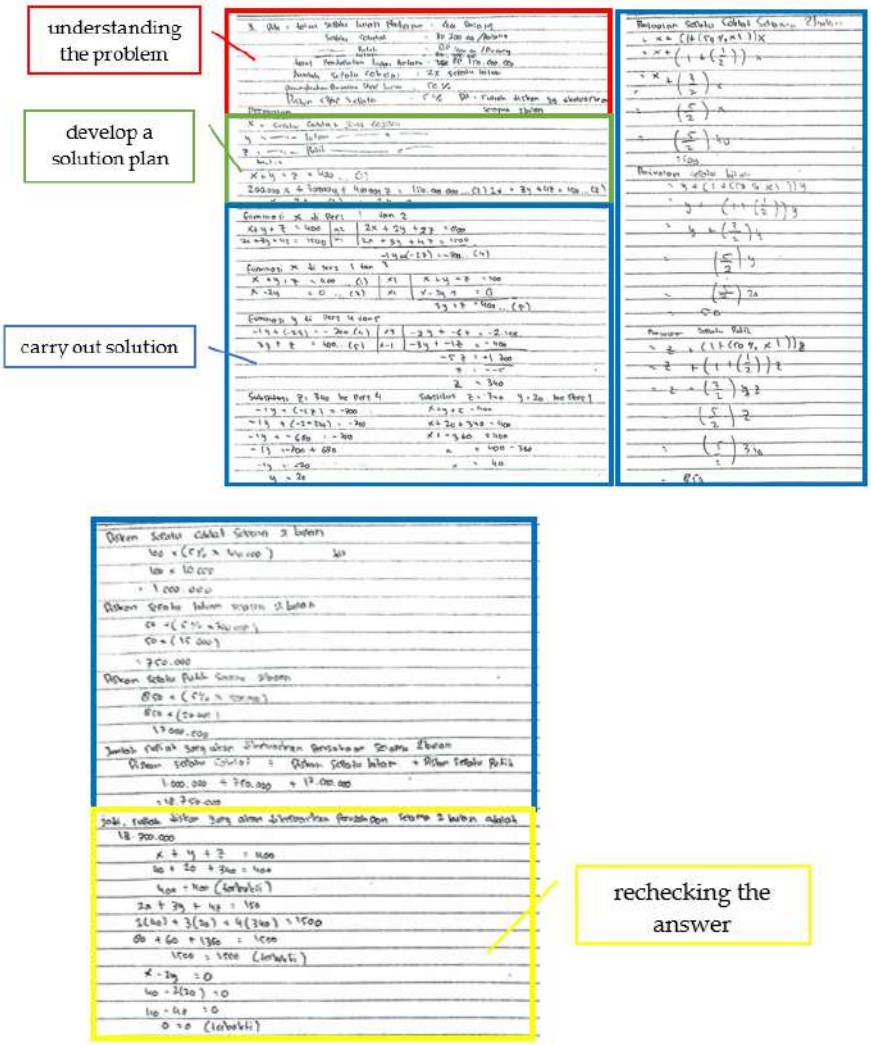


Figure 20. NZA Subject Answers to Question Number 2

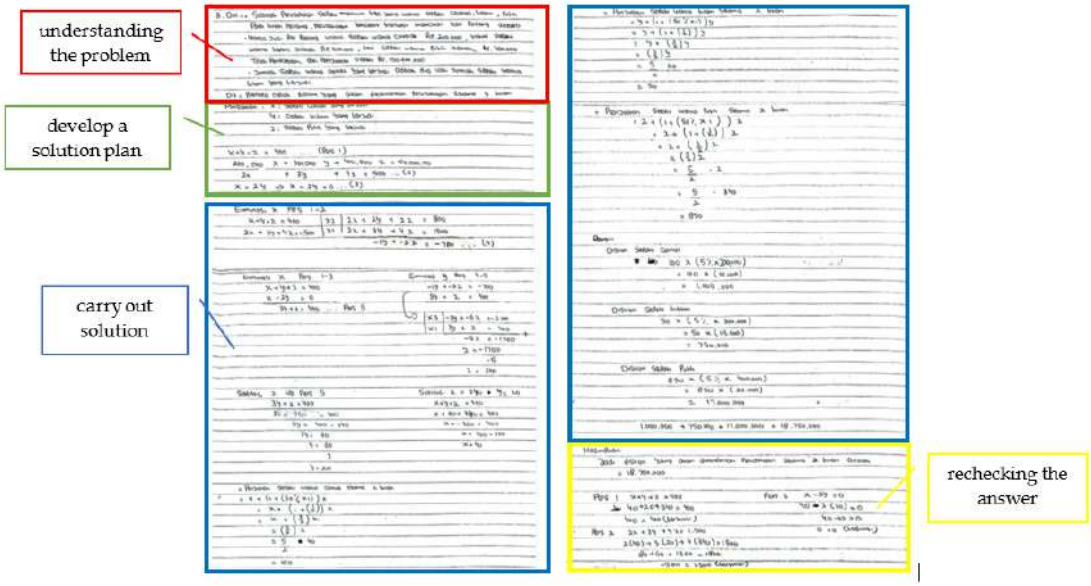
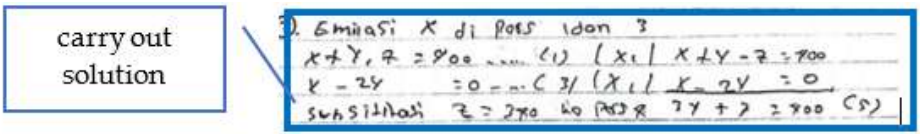


Figure 21. DAP Subject Answers to Question Number 2

Likewise with the DAP subject, it has fulfilled the first indicator This is seen from the DAP subject who understands the problem and writes down the information provided. The subject of DAP wrote that it was known in detail and asked. The DAP subject has also met the indicators of preparing a solution plan, this is because the subject can make reasoning and has been correct in making modeling of the problem. DAP subjects have also met the indicators of implementing solutions, subjects using a combined method. DAP subjects have also met the indicator of rechecking answers, this is because the subject makes conclusions and checks answers.



Picture 22. KW Subject Answer to Question Number 2

However, it is different from the subject of KW. In the first indicator, the subject of KW does not make known and asked. The subject of confusion when writing is known and asked, this can be seen from the interview.

P : How do you make it known and asked about the problem in the question?
KW : I was confused when I was known and asked.
P : Where is your confusion?
KW : Because there are discounts so I am confused.

KW subjects also do not make reasoning and do not make modeling. The following interview results are the following.

P : How do you make the reasoning and modeling of the problem?
KW : I immediately eliminated it without making a reasoning.
P : Why don't you do mathematical reasoning and modeling?
KW : Because time is running out, so I don't make it.

The KW subject only eliminates from equations 1 and 2. *x*Subject KW has run out of time to work on the problem. This can be seen from the results of the interview.

P : What method do you use to solve the problem?
KW : I use the combined method.
P : Why don't you solve the problem?
KW : Because I have run out of time.
P : If given time, how would you solve this problem?
KW : I'll look for the values of the x, y and z variables.
P : What will you do next?
KW : I don't know anymore, because I don't understand the problem.

Subject KW was unable to solve question number 3 because he had run out of time and the subject also did not understand the problem of the problem.

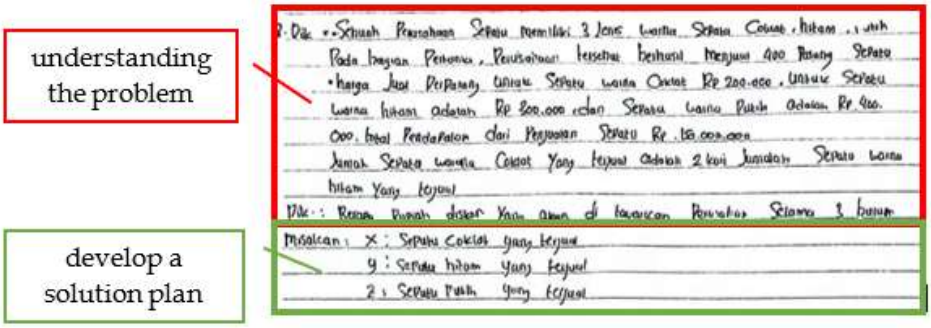


Figure 23. SA Subject Answer to Question Number 2

On the first indicator that the SA subject has met, he gets a score of 3. The subject of SA wrote that it was known and asked.

P : How do you make it known and asked about the problem in the question?
HIS : I looked at the question and immediately wrote.
P : Are you sure of the answer to number 1 part known and asked?
SA : Believe.

The SA subject is only making a reasoning. The SA subject does not make modeling of the problem. The subject was confused when modeling it because there were tens of thousands of numbers. The subject is also confused to solve the problem because there is an increase in sales demand and discounts from the price of shoes. This is reinforced from the results of the interview.50%5%

P : How do you make a reasoning from the problem?
SA : The reasoning is seen from the company's sales consisting of brown, black and white shoes.
P : How do you model the problem?
SA : I don't make models.
P : Why don't you create a mathematical model?
SA : Because the question is that there are tens of thousands and there are also percentage figures, so I am confused about modeling it.

Subject SA is unable to solve problem number 3. The subject is unable to meet the indicators of completing and rechecking the answers. The SA subject did not answer because he was asked about a discount for 2 months. In addition, SA subjects do not listen during learning and do not help when completing LKPD assignments.

Based on the results of the study, it can be concluded that the students' problem-solving ability in problem-based learning on the material of the three-variable linear equation system with the help of Photomath is relatively good. The causes of problem-solving skills are classified as good, among others, because students have difficulty understanding problems, inaccuracy when solving problems, do not understand basic concepts, lack of interest or motivation to learn, and lack of experience or practice in dealing with story problems.

Based on the results of tests that have been carried out using the Problem Based Learning learning model with the help of Photomath, it shows that the problem solving skills of students are classified as good. This can be seen from students being able to understand the problem in the problem, make a mathematical model, solve the problem using the right procedure, compile the answer conclusion from the steps that have been taken and recheck the answer. This is influenced because students actively participate in participating in learning by using Problem Based Learning and students also utilize Photomath as an aid during the learning process. However, there are still students who have difficulty understanding the problem, inaccuracy when solving problems and do not understand basic concepts.

Learning with the application of the PBL model improves problem solving skills significantly better than learning using lecture or direct learning (Oktaviana & Haryadi, 2020). The PBL learning model carried out by the teacher greatly influences the learning motivation of students in learning mathematics so as to improve problem solving skills (Payung et al., 2022). The PBL learning model makes students active in learning because students are required to work together in groups to work on LKPD (Adinia et al., 2022). This process encourages learners to think critically in identifying, analyzing and solving problems so that it can improve learners' problem solving skills. The use of contextual problems allows learners to apply the knowledge learned in real-life concepts.

During the learning process, students are very enthusiastic when using the Photomath application, so that the use of the Photomath application is effective in increasing students' interest in learning (Handayani, 2022) and the use of Photomath is

also effective on student learning outcomes (Hediyawati, 2024) because it helps students understand how the problem can be solved by providing a step-by-step solution so that students know the procedure or concept of working on SPLTV (Aisyah & Yahfizham, 2024). thus increasing students' interest in learning, then indirectly problem solving skills will increase, one of which is in the third indicator. Photomath also teaches students that not all SPLTV problems have solutions. However, the use of Photomath makes students dependent because students still make many calculation errors.

There are still students who have poor category problem solving skills because there are still students who are not careful in solving problems (Ruswati et al, 2018) because the problem is too long so that it makes students bored and tired so that it can interfere with students' concentration. Without full concentration, students tend to rush and are not careful in paying attention to the steps needed.

CONCLUSION

Based on the results of the study, it can be concluded that the application of Problem Based Learning to SPLTV materials assisted by SPLTV can develop problem-solving skills. This can be seen from students being able to understand the problems in the problem, create mathematical models, solve problems using Photomath, compile answer conclusions from the steps that have been taken, and check the answers again using Photomath. The use of Photomath as a tool in problem-based mathematics learning has a positive impact on students' ability to solve mathematical problems. The PBL learning model provides real and situational context in learning, while Photomath as a tool allows students to explore solutions, find out if the problem has a solution, and check the answers by substitution. Thus, learning that combines PBL with Photomath as a tool has the potential to develop mathematical problem-solving skills.

REFERENCES

Adinia, R., Suratno, S., & Iqbal, M. (2022). Efektivitas Pembelajaran Aktif Berbantuan LKPD Problem Solving Terhadap Keterampilan Pemecahan Masalah Dan Penguasaan Konsep Biologi Siswa Di Sekolah Kawasan Perkebunan Kopi. Jurnal Inovasi Pembelajaran Biologi, 3(2), 64-75.

Aisyah, N., & Yahfizham, Y. (2024). Studi Literatur: Analisis Kemampuan Berfikir Komputasi Menggunakan Software Matematika Photomath Tingkat SMA. Jurnal Arjuna: Publikasi Ilmu Pendidikan, Bahasa dan Matematika, 2(3), 147-155.

Berlian, M. R. R., Hapizah, H., & Susanti, E. (2023). Case Study: Learning Material-based on Model-Eliciting Activities to Enhance Problem Solving Abilities and Self Confident. Journal of Education and Learning Mathematics Research (JELMaR), 4(2), 158-170.

Faradiba, S. S., & Alifiani, A. (2020). Metacognitive blindness in mathematics problem-solving. Journal of Education and Learning Mathematics Research (JELMaR), 1(2), 43-49.

Fatqurhohman, F. (2021). Characteristics of students in resolving word problems based on gender. Journal of Education and Learning Mathematics Research (JELMaR), 2(1), 1-10.

Handayani, A. (2022). Efektivitas Penggunaan Aplikasi Photomath Dalam Meningkatkan Minat Belajar Siswa Kelas Viii Sekolah Menengah Pertama Negeri 2 Bajo (Doctoral dissertation, Institut Agama Islam Negeri (IAIN) Palopo).

Hediyawati, N. (2024). Efektivitas Penggunaan Aplikasi Photomath Pada Model Inkuiri Terbimbing Terhadap Hasil Belajar Peserta Didik (Doctoral dissertation, Universitas Siliwangi).

Lumbantoruan, J. H. (2022). Description of Difficulty of Semester VII Students of Mathematics Education Study Program in Complex Analysis Course. Journal of Education and Learning Mathematics Research (JELMaR), 3(1), 1-13.

Nuraeni, L., Suhendri, H., & Masruroh, A. (2020). Analisis Kemampuan Pemecahan Masalah Matematik Peserta Didik Kelas VIII SMP. Jurnal Ilmiah Pendidikan Matematika, Matematika Dan Statistika, 1(3), 159–171. https://doi.org/10.46306/lb.v1i3

Oktaviana, D., & Haryadi, R. (2020). Pengaruh model pembelajaran problem based learning (PBL) terhadap kemampuan pemecahan masalah mahasiswa. AKSIOMA: Jurnal Program Studi Pendidikan Matematika, 9(4), 1076.

Payung, Z., Kusuma, Y., & Cahya, E. (2022). Pembelajaran Matematika dengan Bantuan Mathematica dan Photomath Software Untuk Meningkatkan Problem Solving Matematika Mahasiswa Calon Guru Sekolah Dasar. Elementary Journal: Jurnal Pendidikan Guru Sekolah Dasar, 5(1), 48-54.

Purwaningsih, D., & Ardani, A. (2020). Kemampuan Pemecahan Masalah Matematis Materi Eksponen Dan Logaritma Ditinjau Dari Gaya Belajar Dan Perbedaan Gender. AKSIOMA: Jurnal Program Studi Pendidikan Matematika, 9(1), 118–125. https://doi.org/10.24127/ajpm.v9i1.2632.

Rahman, M. M. (2019). 21st century skill'problem solving': Defining the concept. Rahman, MM (2019). 21st Century Skill "Problem Solving": Defining the Concept. Asian Journal of Interdisciplinary Research, 2(1), 64-74.

Ruswati, D., Utami, W. T., & Senjayawati, E. (2018). Analisis Kesalahan Siswa SMP dalam menyelesaikan soal kemampuan pemecahan masalah matematis ditinjau dari tiga aspek. MAJU: Jurnal Ilmiah Pendidikan Matematika, 5(1).

Sajja, P. S., & Sajja, P. S. (2021). Introduction to artificial intelligence. Illustrated Computational Intelligence: Examples and Applications, 1-25.

Sakir, N. A. I., & Kim, J. G. (2020). Enhancing students' learning activity and outcomes via implementation of problem-based learning. Eurasia Journal of Mathematics, Science and Technology Education, 16(12), em1925.

Saputra, Y. P., Wulandari, N. P., & Hikmah, N. (2023). Kemampuan Pemecahan Masalah Matematika Siswa pada Materi Sistem Persamaan Linear Dua Variabel. Journal of Classroom Action Research, 5(1), 85–94. https://doi.org/10.29303/jcar.v5i1.2800

Tsegaw, T. N., Valcin, F., & Lambert, E. G. (2021). Successful teacher pedagogic practices for reducing mathematics anxiety and improve student outcomes in secondary students in Ethiopia. International Academic Journal of Social Sciences and Education, 2(2), 430-451.

Ukobizaba, F., Nizeyimana, G., & Mukuka, A. (2021). Assessment Strategies for Enhancing Students' Mathematical Problem-Solving Skills: A Review of Literature. Eurasia Journal of Mathematics, Science and Technology Education, 17(3).

Wulandari, I. (2024). Increasing Mathematical Problem-Solving Ability Through Models Problem-Based Learning on Cube and Block Material. Journal of Education and Learning Mathematics Research (JELMaR), 5(1), 85-91.