



Mathematical Problem-Solving Ability Reviewed from Students' Learning Interest in Creative Problem Solving Learning Model Assisted by Liveworksheets

Sekar Yanuar Indasari^{a,*}, Kartono^a

^a Universitas Negeri Semarang, Sekaran Campus, Gunungpati, Semarang, 50229, Indonesia

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

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Abstract

This study aims to analyze the effectiveness of the Creative Problem Solving (CPS) learning model assisted by Liveworksheets, analyze mathematical problem-solving ability in terms of students' learning interest, and describe mathematical problem-solving ability in terms of students' learning interest in the Creative Problem Solving (CPS) learning model assisted by Liveworksheets. This research used a mixed-methods design; the design used was explanatory sequential in the form of a post-test-only control design. The study population was students of class VIII SMP Negeri 2 Getasan Semarang in the 2024/2025 academic year, spread over 4 classes. Quantitative research data were obtained from mathematical problem-solving ability tests and learning interest questionnaires. Quantitative data were analyzed using SPSS 25.0 software with the classical completeness test, two-proportion difference test, two-means difference test, and simple linear regression test. Qualitative research data were obtained through mathematical problem-solving ability tests and interviews. The results showed that the Creative Problem Solving (CPS) learning model assisted by Liveworksheets was effective on students' mathematical problem-solving ability. The description of students' mathematical problem solving ability in the Creative Problem Solving (CPS) model assisted by Liveworksheets in terms of students' learning interest is that students with high learning interest are able to fulfill the first, second, third, and fourth indicators, and tend to be able to fulfill the fifth indicator, students with moderate learning interest are able to fulfill the first and second indicators, tend to be able to fulfill the third indicator, and tend not to be able to fulfill the fourth and fifth indicators, students with low learning interest are unable to fulfill the first, third, fourth, and fifth indicators, and tend to be able to fulfill the second indicator.

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1. Introduction

Mathematics is a subject that has an important role in everyday life and is taught from primary education to higher education. Therefore, everyone who participates in education will recognize and study mathematics (Dalimunthe, 2019). Mathematics has an important role in the development of science and technology as the basis of many other sciences, which can be seen from the great demand for mathematical abilities (Anwar, 2018). In learning mathematics, there are various important skills that students must have. One of these skills is mathematical problem solving ability. These skills include building new mathematical knowledge through problem solving, solving problems that arise both in mathematics and in other contexts, applying and adjusting various appropriate strategies to solve problems, and monitoring and reflecting on the process of solving mathematical problems (NCTM, 2000).

According to Branca in Putra et al. (2018), problem solving is considered the core of mathematics. Meanwhile, In'am (2014) stated that problem solving is a mental process where a person thinks critically and creatively to find ideas by following certain steps to overcome obstacles. Therefore, mathematical

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problem solving is a process in which a person attempts to use his knowledge, skills, and understanding to find solutions to problems encountered or given (Annizar et al., 2020). Mathematical problem solving ability is one of the abilities that must be possessed in learning mathematics. Problem solving skills are very important for every student to have because (a) problem solving is a general goal of teaching mathematics, (b) problem solving which includes methods, procedures and strategies is a core and main process in the mathematics curriculum, and (c) problem solving is a basic ability in learning mathematics (Sumartini, 2016). This is in line with research (Sari et al., 2019) which suggests that solving math problems can help students increase their analytical power and can help them apply that power to various situations.

Although these mathematical problem-solving skills have great significance, Indonesian students have not been very successful in mastering them. There is a record in the Programme for International Student Assessment (PISA) in 2023 of an assessment of learner achievement organized by the Organization for Economic Cooperation and Development (OECD), which involves examinations and questionnaire questions to 15-year-old learners in various countries called PISA. The evaluation covers subjects such as science, reading and math.

Table 1 Ranking of Students' Mathematics Proficiency in PISA Benchmarks in 2023

Rank	Country	Mean Score of Mathematics	Mean Score of Reading	Mean Score of Science
01	Singapore	575	543	561
02	Macao (China)	552	510	543
03	Chinese Taipei	547	515	537
...	...	...	...	...
	OECD Average	472	476	485
69	Indonesia	366	359	383

Overall, it can be seen that the math skills of students in Indonesia are below the global average level, with an average score of 366. When compared to the PISA results in 2018, the average score of students' math skills in Indonesia decreased by 5 points. From the PISA data, it can be clearly seen that the level of mathematical problem solving skills of students in Indonesia has not fully developed. Indonesia itself has not achieved optimal achievement in this regard. Therefore, it can be concluded that there is still a need to improve mathematical problem solving skills in students.

From interviews conducted by researchers with mathematics teachers in September 2024 at SMP Negeri 2 Getasan located in Semarang Regency, information was obtained that students still had difficulty solving mathematical problems and using mathematics in solving everyday problems so that students showed unsatisfactory learning outcomes. Some prerequisite material also still has to be discussed repeatedly when entering new material. Students' interest in learning is also still lacking, because they think that math is a difficult subject so teachers always provide motivation to increase students' interest in learning.

Relation and Function is one of the mathematics materials that can see mathematical problem solving skills in terms of learning interest. Relation and Function material requires logical thinking, abstraction, understanding of concepts, and exploration of various methods of solution. One of the prerequisite materials of Relation and Function is set. A preliminary study was conducted at SMPN 2 Getasan, namely by giving questions about set material that measured the mathematical problem solving ability of students in all grade 8 and obtained the results that the percentage of students who could solve mathematical problem solving problems with 5 indicators was 21%. It can be said that the mathematical problem solving ability of students is still low. The following is a question from the preliminary study.

In a school, there are 60 students who join the dance club and 40 students who join the drama club. It turns out that there are 20 students who join both clubs.

- How many students only join the dance club?
- How many students only join the drama club?
- How many students join at least one of the two clubs?

Figure 1 Preliminary Study Questions

One of the student answers in Figure 2 below.

a) yang hanya mengikuti klub tari 60
b) yang hanya mengikuti klub drama 40

Figure 2 Learner's answer 1

Based on Figure 2, students have not been able to solve mathematical problems related to the set. Learners have not understood the problem well and have not been able to plan a solution. In addition, students experience errors in the problem solving process because they do not understand well the concept of set intersection and use it in real situations.

One of the student answers in Figure 3 below.

$$c) 60 + 40 + 20 = 120$$

Figure 3 Learner's answer 2

Based on Figure 3, students have not been able to understand the concept of sets and the principle of addition in the case of slices correctly. The learners are still not correct in terms of calculations.

Learners' mathematical problem solving ability can be influenced by internal and external factors. Internal factors include initial ability, intelligence level, attitude, motivation, talent, interest, and learning style. Meanwhile, external factors involve supporting infrastructure, learning environment, teacher's role, and learning methods. One of the causes of low mathematical problem solving ability is the lack of students' interest in mathematics (Ulya, 2015). In addition, Hidayat & Widjajanti (2018) stated that one of the internal affective factors that play an important role in the success of the mathematics learning process is students' interest in learning. Learning interest is one of the internal factors that influence the success of students. Interest is an internal motivation that encourages a person to carry out an activity, so that interest in learning is defined as an internal drive to carry out learning activities (Septiani et al., 2020). There are 4 aspects of learning interest, namely 1) feelings of pleasure, 2) attention, 3) active involvement in learning, and 4) student interest (Slameto, 2015: 180). According to Sapitri et al. (2019), there is a positive correlation between learning interest and mathematical problem solving ability, meaning that students with high learning interest tend to experience an increase in mathematical problem solving ability.

Mathematical problem solving is a crucial skill for learners in mathematics and science in Indonesia. The need to improve mathematical problem-solving skills in Indonesia is a top priority in the development of the education system. Therefore, efforts are needed to improve learners' mathematical problem solving skills by considering the factors that influence them. Therefore, it is necessary to develop a learning model that focuses on problem solving. One model that can be applied is Creative Problem Solving (CPS).

Creative Problem Solving (CPS) is a problem-based learning model that helps students identify problems, create solution ideas, and apply creative and innovative solution methods to find solutions to these problems (Partayasa et al., 2020). Learning with the Creative Problem Solving model uses several steps, namely problem orientation, students convey ideas about various possible strategies to solve problems, select and determine the most appropriate strategy, and implementation (Muslich, 2007). The indicators of mathematical problem solving ability in this study refer to the indicators proposed by Utari

Sumarmo (2012), which were adapted from the NCTM (2020) book. Utari Sumarmo formulated five indicators of mathematical problem solving ability, namely Identifying the sufficiency of data to solve the problem, create a mathematical model of a problem and solve it, select and apply strategies to solve mathematical problems and or outside of mathematics, explain or interpret results according to the original problem, and check the correctness of the results or answers, and apply mathematics meaningfully.

Worksheets are learning media consisting of material, summaries, and instructions that direct students in carrying out learning activities (Dachi & Perdana, 2021). Worksheets is used by teachers as a means to increase student involvement in the learning process, aiming to build basic skills in accordance with learning outcome indicators (Noprinda & Sholeh, 2019). Along with advances in technology and information in the field of education, E-Worksheets or Electronic Worksheets have emerged. This E-Worksheets is a learning tool that utilizes the internet, is arranged systematically in certain learning units, and is available in digital format (Sari et al., 2019).

Liveworksheets is a digital platform that converts printed worksheets into an interactive format and can also be accessed online (Fitriani et al., 2021). One of the advantages of Liveworksheets.com is its ability to create online E-Worksheets that help save time and allow the creation of E-Worksheets as needed. In addition, the resulting E-Worksheets can be easily accessed and worked on by students through their respective gadgets (Andriyani et al., 2020). Research by Amalia & Lestyanto (2021) showed that the use of Liveworksheets-based worksheets proved effective, with more than 80% of students achieving a score of 75 or more.

Based on the background that has been described, this research aims to: (1) Analyze the effectiveness of the implementation of the Creative Problem Solving (CPS) learning model on mathematical problem solving skills; (2) Analyzing the effect of learning interest on students' mathematical problem solving ability in the Creative Problem Solving (CPS) learning model assisted by Liveworksheets; and (3) Describing mathematical problem solving ability in terms of students' learning interest in the Creative Problem Solving (CPS) learning model assisted by Liveworksheets.

2. Methods

The research used a mixed method that integrates quantitative and qualitative aspects. The research design chosen was sequential explanatory design, where quantitative data was collected and analyzed at an early stage, and then followed by qualitative data collection to strengthen and provide further explanation of the results of the quantitative aspects of the research (Lestari, 2017). This research used a quantitative method with the True Experimental Design type method with the form of post-test only control design where there were two groups, each of which was randomly selected with one of the groups being treated.

Table 1 Posttest Only Control Design

Group	Sample	Treatment	Posttest
Experiment	R	X	O_1
Control	R	Y	O_2

Description:

R = Random selection of experimental groups and control groups

O_1 = Experimental group posttest

O_2 = Control group posttest

X = Learning treatment with Creative Problem Solving (CPS) learning model assisted by Liveworksheets

Y = Learning treatment with PBL learning model

Qualitative method in this research is to analyze and describe the mathematical problem solving ability of students in terms of learning interest in the Creative Problem Solving (CPS) learning model assisted by Liveworksheets.

This research was conducted at SMP Negeri 2 Getasan on Jl. Kyai Ageng Serang, Setugur RT.04/01, Jetak Village, Getasan District, Semarang Regency, Central Java 50774. The population in this study were all VIII grade students of SMP Negeri 2 Getasan in the 2024/2025 school year, totaling 112 students. Sampling using simple random sampling technique, and obtained two classes as samples, namely class VIII A as a control group given learning using Problem-Based Learning model, and class VIII B as an experimental group given learning using CPS model assisted by Liveworksheets.

The determination of research subjects was carried out using purposive sampling technique, based on the results of the mathematical problem solving ability test and the classification of interest in learning from the questionnaire in the experimental group. 6 students were selected as research subjects, namely 2 students with high learning interest, 2 students with moderate learning interest, and 2 students with low learning interest.

Data collection techniques used include tests, questionnaires, and interviews related to mathematical problem solving ability in terms of learning interest of SMP Negeri 2 Getasan students in learning relational and function material offline. Data analysis in this study includes analysis of initial data on students' mathematical problem solving ability, quantitative data analysis of the test results of mathematical problem solving ability, and qualitative data analysis.

The initial data analyzed were the preliminary study scores of VIII A and VIII B classes. Initial data analysis includes normality test, homogeneity test, and two mean similarity test with the help of IBM SPSS Statistics 26 software.

Quantitative data analysis is in the form of hypothesis testing, which consists of 4 hypotheses: (1) The test results of students' mathematical problem solving ability in the Creative Problem Solving (CPS) learning model assisted by Liveworksheets achieve classical completeness of more than 75%; (2) The proportion of students who complete the Minimum Criteria of Mastery Learning in the Creative Problem Solving (CPS) learning model assisted by Liveworksheets is more than the proportion of students who complete the Minimum Criteria of Mastery Learning in the PBL learning model; (3) The average test results of students' mathematical problem solving ability in the Creative Problem Solving (CPS) learning model is more than the average mathematical problem solving ability of students who use the PBL learning model; (4) Learning interest affects the mathematical problem solving ability of students in the Creative Problem Solving (CPS) learning model assisted by Liveworksheets.

Qualitative data analysis was conducted on the results of the learning interest questionnaire and interview results. This analysis includes data reduction, data presentation, and conclusion drawing. The results of interviews on mathematical problem solving ability were used to triangulate the results of the mathematical problem solving ability test, so that the level of mathematical problem solving ability could be described based on students' learning interests.

3. Results & Discussions

3.1. Initial Data Analysis

Initial data analysis was used as one of the references in sample selection by conducting normality tests, homogeneity tests, and similarity of the two average tests. The initial data analyzed was the preliminary study score data of class VIII A and VIII B. After conducting normality, homogeneity, and similarity of the two average tests on both classes, the data obtained followed a normal distribution, had the same variance (homogeneous), and showed no difference between the two classes.

3.2. The test results of students' mathematical problem solving skills in the Creative Problem Solving (CPS) learning model assisted by Liveworksheets achieved classical completeness of more than 75%

The analysis of mathematical problem solving ability test results begins with normality and homogeneity tests. Based on the analysis, the test scores of students' mathematical problem solving ability using CPS model assisted by Liveworksheets at SMP Negeri 2 Getasan were normally distributed and homogeneous. Furthermore, the classical completeness test was conducted to determine whether the students' mathematical problem solving ability in the experimental group could achieve classical completeness of more than 75% of the total students in the group. Data analysis began with the normality prerequisite test.

The calculation criterion used is to reject H_0 if $Z_{count} \geq Z_{table}$ where Z_{table} is obtained from the standard normal distribution with a probability of $0.5 - \alpha$ with $\alpha = 5\%$. From the standard normal list with a probability of $(0.5 - \alpha)$ and $\alpha = 5\%$, the value of $Z_{table} = Z_{0.5-0.05} = Z_{0.45} = 1.645$. Based on the calculation with the help of Excel, the value of $Z_{count} = 1.96299 \geq Z_{table} = 1.64$ is obtained, then H_0 was rejected, meaning that students who used Creative Problem Solving assisted by Liveworksheets achieved classical completeness on the mathematical problem solving ability test. This completeness is supported by the use of interactive learning tools, with students active in understanding concepts and compiling their knowledge. The Liveworksheets media makes the classroom atmosphere more interesting, not only relying on books and blackboards, and provides immediate feedback.

3.3. *Proportion of students who are complete in the mathematical problem solving ability of the Creative Problem Solving model assisted by Liveworksheets is more than the proportion of students who are complete in the mathematical problem solving ability of the Problem-Based Learning model*

The two-proportion test is used to test whether the proportion of students who are complete in the mathematical problem solving ability of the Creative Problem Solving model assisted by Liveworksheets is more than the proportion of students who are complete in the mathematical problem solving ability of the Problem-Based Learning model. Data analysis begins with prerequisite tests, namely normality test and homogeneity test.

Testing criteria are conducted by comparing the Z_{count} value with the Z_{table} value with a chance value $(0.5 - \alpha)$ and $\alpha = 0.05$. If the price of $Z_{count} \geq Z_{table}$ then H_0 is rejected. Referring to the standard normal table with a probability of $(0.05 - \alpha)$ with $\alpha = 5\%$, the value of $Z_{table} = Z_{0.5-0.05} = Z_{0.45} = 1.645$. Based on calculations with the help of Excel, the value of $Z_{count} = 2.35 \geq Z_{table} = 1.645$, $Z_{count} = 2.12132 \geq Z_{table} = 1.645$, then H_0 is rejected.

The results of the two-proportion t-test showed that the proportion of students' mathematical problem solving ability completeness with the Creative Problem Solving model assisted by Liveworksheets is more than the proportion of students' mathematical problem solving ability completeness using the Problem-Based Learning model. The difference in learning tools used in the class with the Creative Problem Solving learning model is Liveworksheets with interactive and interesting question displays. Liveworksheets allow learners to work on problems independently, provide immediate feedback, and improve their understanding. The use of Liveworksheets in learning has been proven to be effective in increasing students' engagement and understanding of concepts (Hidayati & Susanti, 2023).

3.4. *Average mathematical problem solving ability of students with the Creative Problem Solving model assisted by Liveworksheets is more than the average mathematical problem solving ability of students who use the Problem-Based Learning model*

The results of the two-mean t-test obtained that the average student in the class with the Creative Problem Solving (CPS) learning model assisted by Liveworksheets is more than the average student with the PBL learning model. In the class with Creative Problem Solving (CPS) learning model assisted by Liveworksheets obtained an average of 83.728 with the highest score of 96.4 and the lowest score of 55, while the class with PBL model obtained an average of 75.52 with the highest score of 93 and the lowest score of 62.5. The difference in the results of the mathematical problem solving ability test between the class with the Creative Problem Solving (CPS) learning model assisted by Liveworksheets and the PBL model class is because the CPS model has syntax and steps that emphasize aspects of creativity in finding solutions, exploring various possible answers, and reflecting on the solutions produced. The phases in CPS, such as understanding challenges, exploring data, finding problems, finding ideas, finding solutions, and acceptance encourage students to think more flexibly and innovatively in solving mathematical problems. This process is in accordance with the theory of creative problem solving which emphasizes the importance of divergent and convergent thinking in finding a more optimal solution (Treffinger et al., 2021).

3.5. *Learning interest affects students' mathematical connection skills in the Creative Problem Solving learning model assisted by Live Worksheet.*

The results of the simple linear regression test obtained. $R^2 = 0.643$, meaning that the mathematical problem solving ability of students with the Creative Problem Solving (CPS) learning model assisted by Liveworksheets is influenced by 64.3% learning interest while 35.7% is influenced by other factors such

as students' initial abilities, learning methods, learning environment, learning motivation and other factors. a. In line with research by Junaedi et al. (2023) shows that students who have mathematical problem solving skills with a high level of learning interest have been able to fulfill the indicators of Polya's stages, namely being able to understand the problem, develop strategies, implement strategies, and re-examine. Learners who have mathematical problem solving skills with a moderate level of learning interest have not been able to make conclusions and do not check back so that they can only fulfill three indicators. Learners with mathematical problem solving skills with a low level of interest in learning have not been able to complete problem solving from each stage correctly and correctly. It can be said that interest affects the mathematical problem solving ability of students.

3.6. Description of Mathematical Problem Solving Ability Viewed from Student Learning Interest in Creative Problem Solving Learning Model Assisted by Liveworksheets

3.6.1. Mathematical problem solving ability in terms of high learning interest

There are 2 research subjects who fall into the high learning interest category, namely subject ST-1 and subject ST-2. Subjects with high learning interest tend to have high mathematical problem solving ability as well. This can be seen from the mathematical problem solving ability test scores obtained by subjects in the high learning interest group tend to be higher than those of subjects in the medium and low learning interest groups.

(2) Diket : jika siswa meminjam 1 buku, biayanya Rp 5.000,00
 2 buku, biayanya Rp 8.000,00
 3 buku, biayanya Rp 10.000,00

Ditanya : a. Nilai $f(x)$ untuk $x=1$, $x=2$, dan $x=3$, buat tabel
 b. Fungsi $f(x)$ yg menunjukkan hubungan antara jumlah buku yang dipinjam dg biaya peminjaman
 c. Biaya jika ada siswa meminjam 2 buku

Jawab : a. $f(1) = 5.000$
 $f(2) = 8.000$
 $f(3) = 10.000$

x	f(x)
1	5.000
2	8.000
3	10.000

b. $f(x) = \begin{cases} 5.000 & \text{untuk } x=1 \\ 8.000 & \text{untuk } x=2 \\ 10.000 & \text{untuk } x=3 \end{cases}$

c. $f(2) = 8.000$
 Jadi, biaya jika siswa meminjam 2 buku adalah : Rp 8.000

Figure 4 Answers to Subject ST-1 from Indicator 2 Question Number 2

3. Diket
 - biaya pengiriman ke kota A Rp 200.000/barang
 - biaya pengiriman ke kota B Rp 250.000/barang
 - biaya pengiriman ke kota C Rp 300.000/barang
 - biaya pengiriman ke kota D Rp 350.000/barang

Ditanya
 - Biaya baru untuk mengirimkan barang ke kota C jika biaya naik 10%
 - Total biaya untuk mengirimkan 5 barang ke kota C

Jawab
 - Harga baru : $300.000 (10\% \times 300.000)$
 $= 300.000 + 30.000$
 $= 330.000$

- Total pengiriman 5 barang ke kota C = 5×330.000
 $= 1.650.000$

Figure 5 Answers to Subject ST-2 from Indicator 3 Question Number 3

3.6.2. Mathematical problem solving ability in terms of moderate learning interest

There were 2 research subjects who fell into the medium learning interest category, namely subjects SS-1 and SS-2. Subjects with moderate learning interest levels have mathematical problem solving abilities that

are between subjects in the high and low learning interest groups. This can be seen from the mathematical problem solving ability test scores obtained by subjects in the moderate learning interest group tend to be higher than those in the low learning interest group, but lower than those in the high learning interest group.

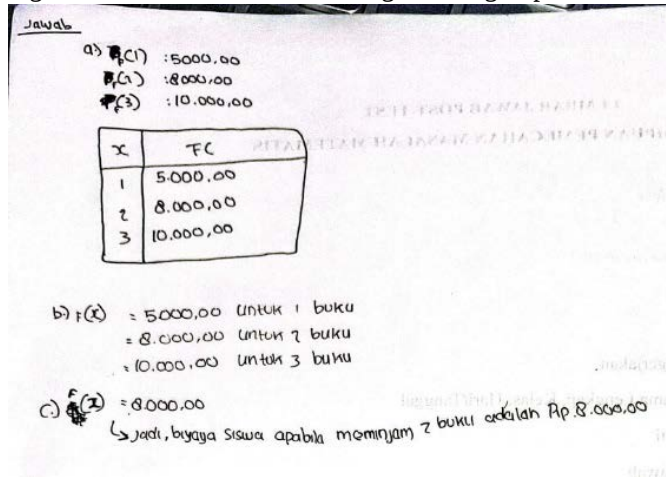


Figure 6 Answers to Subject SS-1 from Indicator 2 Question Number 2

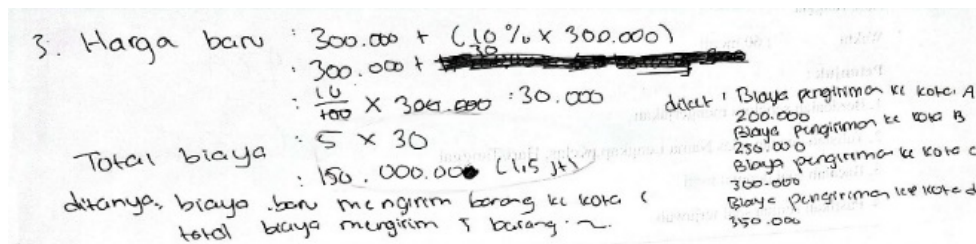


Figure 7 Answers to Subject SS-2 from Indicator 3 Question Number 3

3.6.3. Mathematical problem solving ability in terms of low learning interest

There were 2 research subjects who fell into the low learning interest category, namely subjects SR-1 and SR-2. Subjects with low learning interest levels tend to have low mathematical problem solving skills as well. This can be seen from the mathematical problem solving ability test scores obtained by subjects in the low learning interest group tend to be lower than subjects in the high and medium learning interest groups.

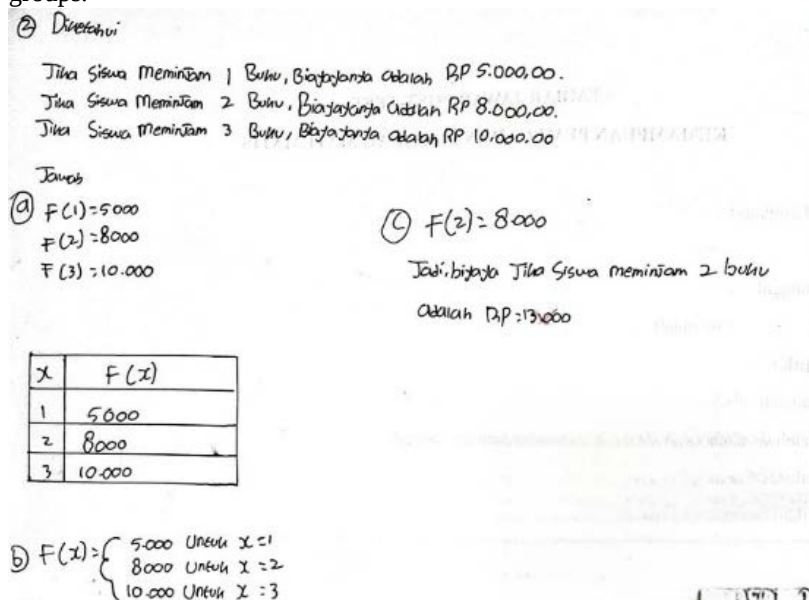


Figure 8 Answers to Subject SR-1 from Indicator 2 Question Number 2

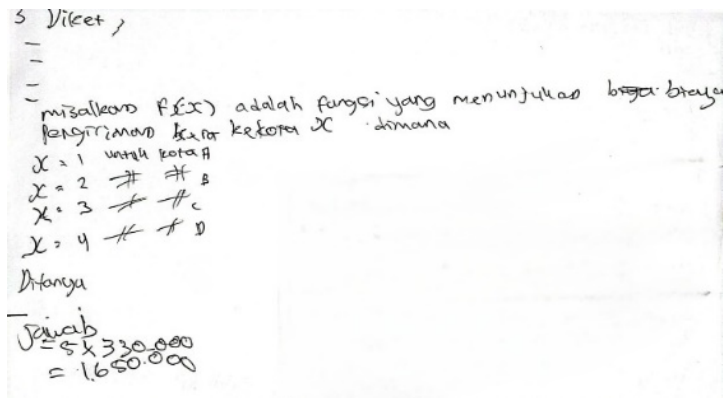


Figure 9 Answers to Subject SR-2 from Indicator 3 Question Number 3

4. Conclusion

Based on the research results, the following conclusions were obtained: (1) The Creative Problem Solving (CPS) learning model assisted by Liveworksheets is effective on students' mathematical problem solving skills characterized by the following results: (a) The mathematical problem solving ability of students in the experimental group with the treatment of Creative Problem Solving (CPS) learning model assisted by Liveworksheets is able to achieve classical completeness of more than 75% of the number of students in the experimental group; (b) The proportion of completeness of students' mathematical problem solving ability with the Creative Problem Solving (CPS) learning model assisted by Liveworksheets is more than the proportion of completeness of students' mathematical problem solving ability with the Problem-Based Learning learning model; (c) The average test score of students' mathematical problem solving ability with the Creative Problem Solving (CPS) learning model assisted by Liveworksheets is more than the average test score of students' mathematical problem solving ability with the Problem-Based Learning learning model; (2) Learning interest affects mathematical problem solving ability; (3) Description of mathematical problem solving ability in research subjects with high, medium, and low learning interest levels is as follows: (a) Learners with high learning interest are able to identify the elements known, asked, and the adequacy of the required elements, are able to formulate mathematical problems or compile mathematical models, are able to apply strategies to solve, are able to explain the results according to the initial problem, and tend to be able to use mathematics meaningfully; (b) Learners with moderate learning interest are able to identify the elements known, asked, and the adequacy of the required elements, are able to formulate mathematical problems or compile mathematical models, tend to be able to apply strategies to solve, tend not to be able to explain the results according to the initial problem, and tend not to be able to use mathematics meaningfully; (c) Students with low learning interest are not able to identify the elements known, asked, and the adequacy of the required elements, tend to be able to formulate mathematical problems or develop mathematical models, are unable to apply strategies to solve, are unable to explain the results according to the initial problem, and are unable to use mathematics meaningfully.

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