# ANALYSIS OF MATHEMATICAL PROBLEM SOLVING ABILITY OF CLASS X STUDENTS REVIEWED FROM LEARNING STYLE

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**Abstract:**
It is important to know students' mathematical problem solving abilities based on their learning styles to identify the most appropriate teaching method to maximize each student's learning potential. This research aims to analyze the mathematical problem solving abilities of class X IIS 1 MA Guppi Ralla students by considering three learning styles, namely visual, auditory, and kinesthetic. The approach used is a qualitative approach. The research subjects consisted of three students, representing various learning styles. Data was collected through learning style questionnaires, problem solving ability tests, and interviews. The data results were analyzed using data reduction, data display, and conclusion drawing. The results of this research indicate that the mathematical problem solving abilities of class X students at MA Guppi Ralla can be influenced by their learning style. Based on the analysis of problem solving abilities in three subjects representing visual, auditory, and kinesthetic learning styles, it can be concluded that students with a visual learning style have good mathematical problem solving abilities, especially in understanding problems, making plans, implementing plans, and looking back. Students with an auditory learning style also have good abilities in solving mathematical problems, although there is some difficulty understanding the problem carefully. Meanwhile, students with a kinesthetic learning style are also capable of solving mathematical problems, but they tend to be less careful in defining problems. Further research could explore how various teaching methods tailored to students' learning styles influence the improvement of their problem solving ability.

**Keywords:** Learning Style, Problem Solving Ability

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## ANALISIS KEMAMPUAN PEMECAHAN MASALAH MATEMATIKA SISWA KELAS X DITINJAU DARI GAYA BELAJAR

**Abstrak:**
Kemampuan pemecahan masalah matematika peserta didik berdasarkan gaya belajar mereka penting diketahui untuk mengidentifikasi metode pengajaran yang paling sesuai, sehingga dapat memaksimalkan potensi belajar setiap peserta didik. Penelitian ini bertujuan untuk menganalisis kemampuan pemecahan masalah matematika peserta didik kelas X IIS 1 MA Guppi Ralla dengan mempertimbangkan tiga gaya belajar, yaitu visual, auditorial, dan kinestetik. Pendekatan yang digunakan adalah pendekatan kualitatif. Subjek penelitian terdiri dari tiga peserta didik yang mewakili berbagai gaya belajar. Data dikumpulkan melalui angket gaya belajar, tes kemampuan pemecahan masalah, dan wawancara. Data hasil penelitian dianalisis melalui reduksi data, pemaparan data, dan penarikan kesimpulan. Hasil penelitian menunjukkan bahwa kemampuan pemecahan masalah matematika peserta didik kelas X di MA Guppi Ralla dapat dipengaruhi oleh gaya belajar mereka. Berdasarkan analisis kemampuan pemecahan masalah pada tiga subjek yang mewakili gaya belajar visual, auditorial, dan kinestetik, dapat disimpulkan bahwa peserta didik dengan gaya belajar visual memiliki kemampuan pemecahan masalah matematika yang baik, terutama dalam memahami masalah, membuat rencana, melaksanakan rencana, dan melihat kembali hasil kerja mereka. Peserta didik dengan gaya belajar auditorial juga memiliki kemampuan yang baik dalam pemecahan masalah matematika, meskipun ada sedikit kesulitan dalam memahami masalah secara teliti. Sementara peserta didik dengan gaya belajar kinestetik juga mampu dalam pemecahan masalah matematika, tetapi mereka cenderung kurang teliti dalam mendefinisikan permasalahan. Penelitian lebih lanjut dapat mengeksplorasi bagaimana berbagai metode pengajaran yang disesuaikan dengan gaya belajar peserta didik mempengaruhi peningkatan kemampuan pemecahan masalah mereka.

**Kata Kunci**: Gaya Belajar, Kemampuan Pemecahan Masalah

## INTRODUCTION

Education is an effort that aims to foster and develop humans in terms of their personality, both spiritual and physical. Education is also a process carried out to educate students from ignorance to knowledge and is also a process to guide students from wrong behavior to right behavior. Darmaningtyas (2015) believes that education aims to achieve a standard of living and progress in the future. Education must also be ready to obtain human resources with competent attitudes, knowledge, skills, and integrity. Syarifuddin (2015) said that education has a very positive impact on humans, and education can eradicate illiterate humans and increase creativity, skills, mental abilities, and so on. Educators must also ensure that learning can help students and produce meaningful knowledge.

Mathematics is a field of study that is studied by all students from elementary to high school and even college. All students need to study mathematics because it is knowledge that can help humans understand and solve social, economic, and natural problems. According to Reys (1998), mathematics is the study of patterns and relationships, ways of thinking with organizational, analytical and synthetic strategies, art, language, and tools for solving abstract and practical problems. Mathematics is the mother of all branches of knowledge and the foundation of all scientific research because most scientific and engineering problems require mathematics to solve them. It involves abstraction and logical reasoning, calculation of numbers, and observation of how objects move (Lee, 2017). Mathematics learning will be successful if the students can use the concepts, procedures and facts to explain a problem that occurs in daily life (Mariani, Tri, & Retno, 2018). Learning how to solve problems is essential to learning mathematics.

Problem solving abilities aim to train students to continue thinking and looking for solutions in solving problem solving problems in mathematics learning. In addition, problem solving will train students to think systematically. Based on the above, problem solving is also an important ability in mathematics (Amir, 2015). Analysis of mathematical problem solving abilities is a detailed observation effort of students' abilities in solving mathematical problems (Muqarrabin, Ismaimuza, Meinarni, & Sukayasa, 2024). A person's mathematical problem solving abilities can help solve various problems in life (Syahril, Maimunah, & Roza, 2021). Problem solving ability is a skill that needs to be possessed in the process of solving mathematical problems (Soebagyo, Umam, Istikharoh, & Suhendri, 2022).

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Problem solving is an ability that must be mastered so that students can develop an understanding of mathematics that allows them to see relationships between concepts and choose strategies to design solutions (Zulkipli & Ansori, 2018). Polya (1962) defined problem solving as a search for some action appropriate to attain an aim. Xiao, Barnard-Brak, Lan, and Burley (2019) states that it would be of great significance to study problem solving.

The results of the researcher's interview on January 31, 2023, with the Mathematics Teacher at MA Guppi Ralla stated that students had relatively high enthusiasm in participating in mathematics lessons, where students with high abilities helped explain the material to participants with low abilities who were divided into each group. So that students who do not yet understand the concepts are helped and also understand the mathematical concepts being studied. The teacher also added that in problem solving sometimes some students experience difficulties in solving problems; some students answer mathematical problems correctly but need help explaining the technique for solving them, and some students solve problems quickly and can explain techniques correctly. Adelia, Sinaga, and Nasution (2020) said that one of the reasons for the students' low mathematical problem solving ability is that students could not solve problem solving questions adequately.

Learning style is an important factor regarding the way students understand specific lessons. In this case, it is important for teachers to analyze students' learning styles so that they can carry out learning that suits the students. Learning style is an activity of thinking, processing, and understanding something that is preferred and has the characteristics of each person (Soebagyo, Umam, Istikharoh, & Suhendri, 2022). Learning styles consists of three, namely Visual, Auditory, and Kinesthetic. These three learning styles are always attached to every student, but usually, only one style is more dominant. Most students fail to understand lessons because they do not know how to learn. Therefore, learning style plays an important role in learning achievement, especially problem solving.

According to psychologist Dunn and Dunn (1978), learning styles also play a role in helping students to become effective problem solvers. Student learning styles affect the problem solving abilities (Kumalasari, Winarni, Rohati, Marlina, & Aulia, 2022). Students' problem solving abilities that are still lacking need to be studied further, especially when viewed from the perspective of different student learning styles. For this reason, further research needs to be conducted regarding students' problem solving abilities.

Based on the background description, the authors are interested in conducting research with the title "Analysis of Mathematical Problem Solving Ability of Class X Students Reviewed From Learning Style."

**METHODS**

This research uses a qualitative descriptive research approach. This research is located at MA Guppi Ralla, to be precise, Ralla, Tanete Riaja, Kec. Barru, Kab. Barru, South Sulawesi, Indonesia. The subjects used in this research were 3 students. The data collection techniques used were questionnaires, diagnostic tests, and interviews. Meanwhile, the research instruments used were student learning style questionnaires, problem solving ability tests, and interviews. There are three learning styles namely visual, auditory, and kinesthetic. The procedures used to collect data during the research were preparing instruments, filling out learning-style questionnaires, carrying out problem solving ability tests, conducting interviews, and documentation. In this research, the data validity test used was technical triangulation. Finally, data analysis techniques used are data reduction, data display, and conclusion drawing/verification.

**RESULTS AND DISCUSSION**

The following is the data from the grouping of learning styles of students X IIS 1 MA. Guppi Ralla.

**Table 1**. Learning Style Questionnaire Results of Class X IIS 1 MA Guppi Ralla Students

| Types of Learning Styles | The Number of Students |
|---|---|
| Visual | 7 |
| Auditory | 3 |
| Kinesthetic | 4 |
| Total | **14** |

Based on table 1, there are seven students with a Visual learning style, three with an Auditory learning style, and four with a Kinesthetic learning style. One student from each type of learning style is analyzed for their problem solving abilities as follows.

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## 1. Description of Problem Solving Ability Test Results and Interviews in View of Visual Learning Style (V)

a. Understanding the problem



Known:

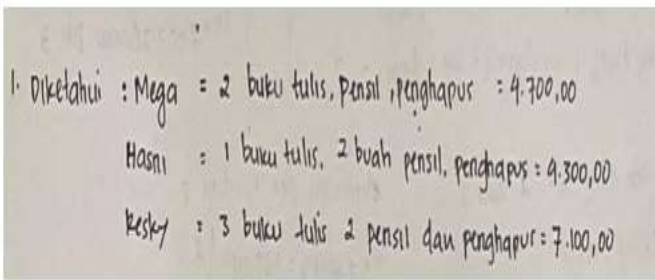Mega: 2 books, pencil, eraser = 4.700,00

Hasni: 1 book, 2 pencils, eraser = 4.300,00

Resky: 3 books, 2 pencils and eraser = 7.100,00

**Figure 1**. Visual Subject Answers

Based on figure 1, subject V, in the first indicator in expressing mathematical ideas is good. However, subject V still needs to completely write down the number of pencils and erasers in the first line, as well as in the second and third lines. Based on the interview, subject V understood what was known about the questions.
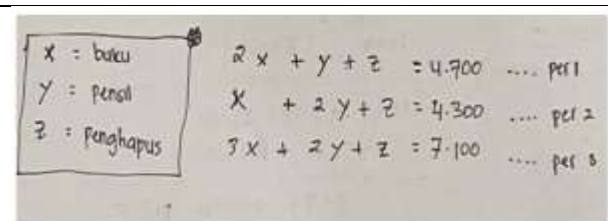
b. Devising a plan



$x$ = book

$y$ = pencil

$z$ = eraser

$2x + y + z = 4.700$ .... Eq 1

$x + 2y + z = 4.300$ .... Eq 2

$3x + 2y + z = 7.100$ .... Eq 3

**Figure 2**. Visual Subject Answers

Based on figure 2, it can be seen that subject V in this second indicator is able to understand the questions well and write the information according to what is contained in the questions. Subject V is able to write the mathematical models, although the writing still needs to be improved, for example: x should be the price of 1 book. Based on the interview, subject V understands that what is written as x is the price of 1 book, even though that is not what is written.

c. Carrying out the plan



Eliminate equations 1 and 2
$2x + y + z = 4.700$
$x + 2y + z = 4.300$ _____
$\qquad x - y = 400 \ldots\ldots eq\ 4$

Eq 4 and 5

$x - y = 400$
$-x - y = -2.400$ +
$-2y = -2.000$
$y = \dfrac{-2.000}{-2}$
$y = 1.000$

Substitute the value of $x = 1.400$, $y = 1000$ to eq 1

$2x + y + z = 4.700$
$2(1.400) + (1.000) + z = 4.700$
$2.800 + 4.000 + z = 4.700$
$\qquad z = 4.700 - 2.800 - 1.000$
$\qquad z = 900$



Eq 1 and 3

$2x + y + z = 4.700$
$3x + 2y + z = 7.100$ _____
$\qquad -x - y = -2.400 \ldots\ldots eq\ 5$

Substitute $y$ to *eq 4*
$x - y = 400$
$x - (1000) = 400$
$\qquad x = 400 + 1000$
$\qquad x = 1.400$

**Figure 3.** Visual Subject Answers

Based on the results of subject V students above, it can be seen that subject V is able to carry out problem solving plans. This can be seen from Subject V's ability to carry out strategies during the ongoing processes and calculations. Based on the formula, substitute the values of the variables x, y, and z correctly and get the correct final value.

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d.  Reflecting on the solution



So, book = 1.400
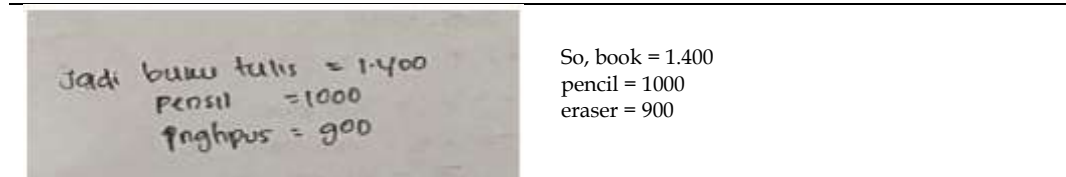pencil = 1000
eraser = 900

**Figure 4**. Visual Subject Answers

Based on the results of subject V students, it can be seen that subject V wrote down the things that had been done to solve the problem. Subject V could look back at the solution to the problem and look again by checking important information that had been identified at a glance. However, subject V did not check the calculations involved because he was sure that the answer obtained was correct. The conclusion still needs to be improved by writing, 'the price of 1 book is Rp1,400.00' and the price of one pencil and one eraser. However, based on the interviews conducted, subject V understood that what was meant by this conclusion was 'price.'

In the first indicator, subjects with this visual learning style can write down and explain the information they know and complete it correctly. So, subjects with this visual learning style can understand problems with problem solving abilities and describe them in other visual forms. This is in line with research conducted by Arsy, Rahmi, and Kurniati (2022) which obtained the results that students with a visual learning style could understand problems, as seen from how students correctly wrote what they knew in the questions.

In the second indicator, subjects with a visual learning style can understand questions well and write the information, and when solving problems, these subjects write answers neatly. Subjects with this visual learning style analyze by re-reading the questions and explaining the contents of the answers that have been written. This is in line with research conducted by Nurul (2022) that visual learning style subjects can analyze questions orally and in writing. So, subjects with this visual learning style can make plans.

In the third indicator, subjects with this visual learning style can correctly write the elimination equations for each equation, use the elimination formula, differentiate which elimination is from equations 1, 2, 3, etc. and explain the written information well. So, it is said to be able to complete problem solving skills with system of linear equations in three variables material. This is in line with research conducted by (Arsy, Rahmi, & Kurniati,

2022) which obtained results that students solved the problems in the questions correctly.

In the fourth indicator, subjects with this visual learning style can review the questions and recheck the work done based on the questions given. This subject can review each result written in the answer carefully, considering that the solution obtained is logical and can reflect on what has been done (Kolb, 1984). So, this subject can reflect on the solutions that have been done.

## 2. Description of Problem Solving Ability Test Results and Interviews in View of Auditory Learning Style (A)

a. Understanding the problem

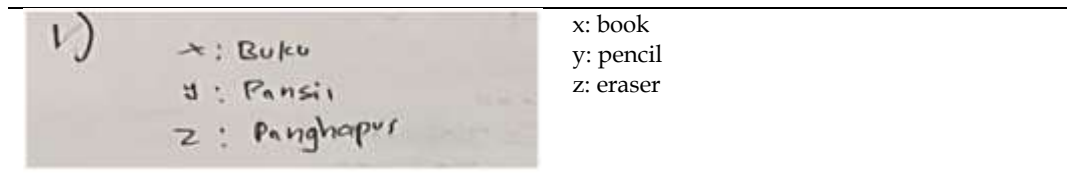

x: book
y: pencil
z: eraser

**Figure 5**. Auditory Subject Answer

Based on figure 5, it can be seen that subject A immediately wrote this first indicator in variable form without writing down what was known and asked in the question. Subject A also did not write down the details of variable x as the price of a book. However, in the interview, subject A understood that these variables were the price of goods.
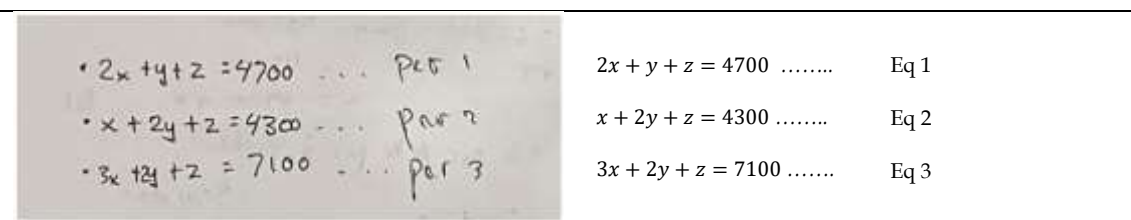
b. Devising the plan



$2x + y + z = 4700$ …….. Eq 1

$x + 2y + z = 4300$ …….. Eq 2
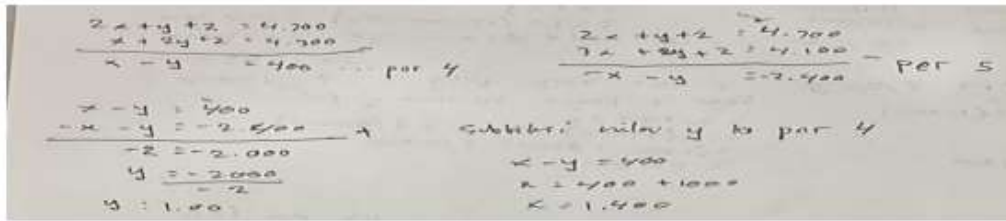
$3x + 2y + z = 7100$ ……. Eq 3

**Figure 6.** Auditory Subject Answer

Based on figure 6, subject A in this second indicator is able to understand the questions well and write the information clearly according to what is contained in them. Subject A wrote down the steps to make a plan well and neatly.

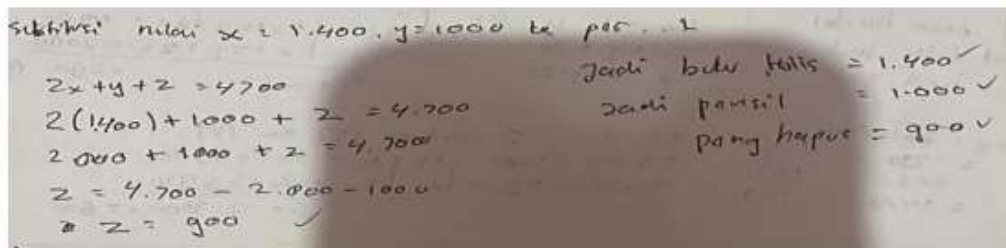*Lisnasari Andi Mattoliang[1]), Raoda Isti Ta'a[2]), Nursalam[3]), A. Sriyanti[4]), Suharti[5])*

## c. Carrying out the plan



$2x + y + z = 4700$
$x + 2y + z = 4300$
$\phantom{x + 2y + z} x - y = 400 \quad eq\ 4$

$x - y = 400$
$-x - y = -2.400$
$-2 = -2.000$
$y = \dfrac{-2.000}{-2}$
$y = 1.000$

$2x + y + z = 4.700$
$3x + 2y + z = 4.100$
$\phantom{3x + 2y} -x - y = -2.400 \quad\quad eq\ 5$

Substitute the value of $y$ to eq 4
$x - y = 400$
$x = 400 + 1000$
$x = 1.400$



Substitute the value of $x = 1.400$, $y = 1.000$ to eq 1
$2x + y + z = 4700$
$2(1.400) + 1000 + z = 4.700$
$2.000 + 1000 + z = 4.700$
$z = 4.700 - 2.000 - 1000$
$z = 900$

So, books = 1.400
pencil = 1.000
eraser = 900

**Figure 7**. Auditory Subject Answer

Based on the results of subject A students above, it can be seen that subject A is able to carry out problem solving plans. This can be seen from Subject A being able to carry out strategies during the ongoing processes and calculations. Based on the formula, entering the values of the variables x, y, and z correctly and getting the correct final value.

## d. Reflecting on the solution
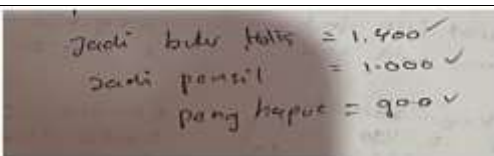


So, book = 1.400
pencil = 1.000
eraser = 900

**Figure 8**. Auditory Subject Answer

Subject A's results show that he wrote down the steps to solving the problem. The subject could then look back at the solution and check important

information that had been identified at a glance. However, the subject did not check the calculations involved because he was sure that the answer obtained was correct. Writing the conclusion also still needs to be completed, not just the book itself but also the price of the book.

In the first indicator, subjects with an auditory learning style are still less precise in writing down what they know in the questions. This subject, with an auditory learning style, admitted that the subject was still not thorough enough in understanding the questions. So, subjects with an auditory learning style are less capable, which can be seen from the way students write what they know in the questions. This is in line with research conducted by (Arsy, Rahmi, & Kurniati, 2022), which found that very few students could understand the problems in the questions.

In the second indicator, subjects with an auditory learning style can understand the questions well and are able to make plans and examples for each variable. So, subjects with an auditory learning style can make plans either verbally, in writing or in other auditory forms. This is in line with research conducted by (Arsy, Rahmi, & Kurniati, 2022), which obtained results showing that students could make plans to make examples in the questions.

In the third indicator, subjects with an auditory learning style can understand the questions well based on the questions given. This subject can eliminate and substitute each equation correctly. So this subject can carry out plans.

In the fourth indicator, subjects with an auditory learning style can review the questions and recheck the results based on the questions given. This subject can review each result written in the answer carefully. So, this subject can look back at the results that have been done.

**Description of Problem Solving Ability Test Results and Interviews in View of Kinesthetic Learning Style (K)**
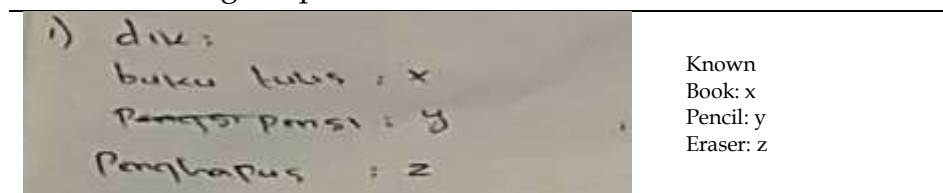
a.  Understanding the problem



Known
Book: x
Pencil: y
Eraser: z

**Figure 9.** Kinesthetic Subject Answer

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Based on the interview results with subject K, subject K immediately wrote this first indicator in variable form without writing down what was known and asked in the question. Subject K also did not write down the details of variable x as the price of a book. However, in the interview, subject K understood that these variables were the price of goods.

b. Devising a plan

| | |
|---|---|
| $2x + 1y + 1z = Rp\ 4700.00$ | $2x + 1y + 1z = Rp4{,}700.00$ |
| $1x + 2y + 1z = Rp\ 4.300.00$ | $1x + 2y + 1z = Rp4{,}300.00$ |
| $3x + 2y + 1z = Rp\ 7.100.00$ | $3x + 2y + 1z = Rp7{,}100.00$ |

**Figure 10.** Kinesthetic Subject Answer

Based on the results of the subject K, it can be seen that they are able to make a solution plan. This can be seen from the ability to make detailed and sequential plans, as well as the ability to write a three-variable linear equation system model of the problem.

c. Carrying out the plan

Eliminate $y$ and $z$ eq 1 substracted by eq 2
So the results $x - y = 400$      eq 4

Eliminate $y$ and $z$ eq 3 substracted by eq 2, so $2x = 2800$. So, $x$ (book) price is 1400

Substitute $x = 1400$ to eq 4
then, $1400 - y = 400$
So, $y = 1400 - 400 = 1000$. So, the price of pencil is 1000

Substitute $x$ and $y$ to equation 2 to find the value of $z$
$x + 2y + z = 4300$
$z = 4300 - 1400 - 2000 = 400$
So, the price of eraser is 900.

**Figure 11.** Kinesthetic Subject Answer

Based on the results of the subject K students above, it can be seen that they are able to carry out problem solving plans, which can be seen from the ability to carry out strategies during the calculation process. Based on the three-variable linear equation system model created and solved by substituting the variable equations and getting the correct results.

d.  Reflecting on the solution

Based on the results of interviews with subject K student, it can be seen that subject K needed to write down the things that had been done to answer the problem. Subject K has not been able to look back at the solution to the problem, looking back by checking important information that has been identified at a glance. However, subject K did not check the calculations involved because he was sure that the answer obtained was correct.

In the first indicator, the subject with the kinetic learning style is still incomplete in writing the answer; for example, the problem is good, and the results written by this subject are correct. This subject, with a kinesthetic learning style, admitted that he was still not thorough enough in understanding the questions. So, it can be said that subjects with a kinesthetic learning style are capable but still less thorough in solving problems with problem solving abilities. This is in line with research conducted by (Arsy, Rahmi, & Kurniati, 2022), which obtained results that students were very good at understanding the problems in the questions.

In the second indicator, subjects with a kinesthetic learning style can understand the questions well and are able to make plans and examples for each variable. So it can be said that subjects with a kinesthetic learning style are able to make plans verbally, in writing or in other auditory forms. In the third indicator, subjects with a kinesthetic learning style can understand the questions well based on the questions given. This subject is able to eliminate and substitute each equation correctly. So it can be said that this subject is capable of carrying out plans. This is in line with research conducted by (Arsy, Rahmi, & Kurniati, 2022) which obtained results that students were good at implementing problem solving plans. In the fourth indicator, subjects with a kinesthetic learning style have not been able to review the questions and check again based on the questions given. This subject has not been able to look back carefully at all the results written in the answer, so it can be said that this subject has not been able to look back at the results that have been done.

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A teacher needs to recognize the learning style of each student. Knowing students' learning styles will help teachers in the learning process. Teachers can help students maximize mathematical problem solving and encourage students to construct knowledge in their minds based on their learning styles to influence students' logical thinking, analysis and creativity (Febrina & Hali, 2020).

The advantage of this research is that it can provide initial information in the form of data that represents the condition of students' mathematical problem solving abilities and learning styles. The subjects then interviewed provided helpful information, especially teachers, students, researchers, parents, and other education observers. Meanwhile, the drawback is that MA Guppi Ralla's problem solving abilities are limited. The impact of this research is that after obtaining information regarding the description of problem-solving abilities based on learning styles, it can be used as initial data to overcome the difficulties students face so that the handling is more appropriate.

**CONCLUSION**

This study aims to analyze the problem solving ability of class X students reviewed from learning style. Based on the research results and discussion, students with a visual learning style can solve problems by going through the stage of understanding the problem by knowing what is known and asking about it, explaining and writing a problem solving plan in their own words, and reflecting on the solution.

Students with an auditory learning style are able to solve problems by looking at them through the stage of understanding them. The students are able to write a solution plan and reflect on the solution by considering that the solution obtained is logical, asking themselves whether the question has been answered, and rereading the question.

Students with a kinesthetic learning style can solve problems by going through the stage of understanding the problem. The students can write a solution plan well even though they have yet to be able to reflect on the solution by considering whether this question has been answered or not, not rechecking the calculations which have been done. Based on these findings, this research suggests the need for more in-depth research on mathematical problem solving to explore the sources of teachers' difficulties and how these difficulties can be overcome. Further research could also explore how various

teaching methods adapted to students' learning styles influence the improvement of their problem solving abilities.

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