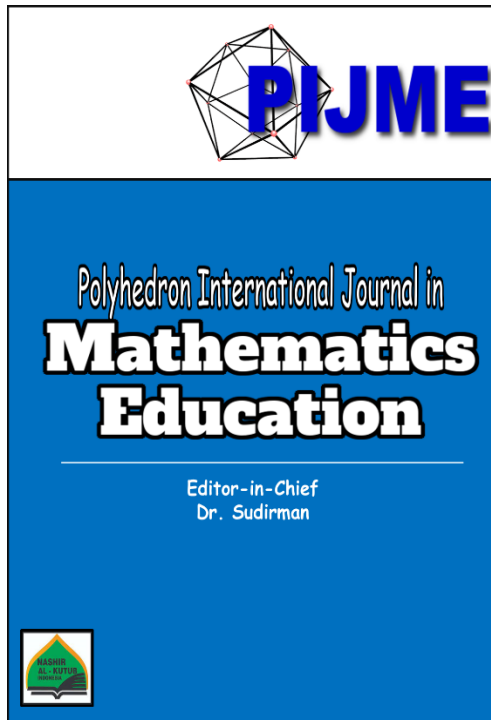


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Student Challenges Completing the Matrix Material Story Question

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Original Article

Student Challenges Completing the Matrix Material Story Question

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Abstract

This study aims to determine the difficulties faced by students in solving the matrix material story problem and the factors causing it. This study used a qualitative approach with research subjects in class XI, which consisted of three female students. Determination of research subjects using a purposive sample technique. Data collection techniques in this study used observation, interviews, documentation in the form of pictures and videos, and field notes. The results of this research are the difficulties faced by students in solving the matrix material story problems, namely: the steps for solving problems according to Polya, the material matrix, and the time. Factors that cause students difficulty in solving the matrix material story problems, namely: (1) students are not accustomed to using Polya's steps, (2) not writing stages 1 to 4 of Polya's steps because they are still confused about the placement of the stages, (3) not writing the explanations in the second stage, namely problem-solving planning, (4) not writing the fourth stage, which is checking the results again or verification, (5) students still have not mastered the matrix material because their learning has been using online or online, (6) calculation errors, (7) time in working on story problems with limited matrix material due to nourishing learning during the Covid-19 pandemic.

Keywords: Learning Difficulties, Problem Story, Matrix Material, Polya steps

1. Introduction

Mathematics is one of the subjects that must be studied from elementary school to university because mathematics has a very important role in other sciences. Suherman (Wulandari et al., [2018](#)) stated that mathematics is important because apart from being a science it also functions as a tool and mindset. This means that mathematics is considered a basic science to hone students' thinking abilities so that it can help students understand other subject areas.

In learning mathematics, problems that occur in everyday life are usually illustrated in the form of word problems. Word problems are a form of problem that is often presented in mathematics learning (Syahlan, [2017](#)). To solve word problems, students must have good mathematical abilities. The National Council of Teachers of Mathematics (NCTM) stipulates five abilities that students must have in learning mathematics, namely problem-solving, reasoning, communication, making connections, and representation (Rosita & Abadi, [2019](#)). In solving word problems, students are required to solve a problem with problem-solving skills.

Sumartini ([2016](#)) suggests that problem-solving is a process for overcoming difficulties faced by students. In mathematics, problem-solving is something that must be owned and mastered by students to solve the problems they face. By having good problem-solving skills, students can solve the problems they are facing in everyday life related to mathematics.

However, in reality, not all students can solve mathematical problems properly. This illustrates that students' mathematical problem-solving abilities are still low. The low ability of students' mathematical problem-solving can result in low student learning outcomes. This is evidenced by the results of the Program for International Student Assessment (PISA) survey in 2018 which stated that for the mathematics category, Indonesia was ranked 7th from the bottom (73) with an average score of 379 (PISA, [2018](#)).

The low ability of students' problem-solving resulted in students having difficulties in solving mathematical problems in the form of word problems. Shaleh Haji (Nurussafa'at et al., 2016) suggests that word problems are a modification of math problems related to the environment around students. Therefore, the current curriculum provides more math problems in the form of word problems. Rahardjo and Waluyati (Yuwono et al., [2018](#)) state that word problems are required to solve problems through their ability to understand, design, and solve these word problems. In addition, according to Kholishoh et al. ([2017](#)) in solving word problems requires good comprehension skills and skills, but in reality, students' comprehension abilities and skills in working on word problems are still low.

The matrix is material that is studied in class XI in the odd semester 2013 curriculum and is one of the materials that uses word problems. The matrix is a rectangular arrangement of numbers, variables, or parameters arranged in rows and columns delimited by brackets (Rosyadi et al., [2016](#)). The matrix is also used as a simple way to present an arrangement (table) of numbers denoted by indexed capital letters (Rosyadi et al., [2016](#)). Based on this description, this study focuses on the difficulties faced by students in solving word problems on matrix material.

2. Method

Types of research

This type of research used is qualitative. The qualitative research method is a research method based on the philosophy of postpositivism, used to research on natural object conditions, where the researcher is the key instrument, sampling of data sources is carried out purposively and snowballing, collection techniques are triangulation (combined), data analysis is inductive/ qualitative, and the results of qualitative research emphasize meaning rather than generalization (Sugiyono, [2015](#)).

Research Participants

The subjects in this study were female students at SMKN 1 Balongan for the 2020/2021 academic year. Determining the subject in this study used a simple purposive technique and suggestions from research informants, namely the class XI mathematics teacher. The subjects in this study were female students of class XI DPIB 2, and the samples needed in this study were 3 students.

Research Data and Instruments

In this study using story test results on the matrix material as a research instrument. The test results are used to find out what difficulties students face in working on word problems on matrix material.

Data collection technique

1) Observation

In this study, the researcher chose passive participatory observation. Observation is carried out by observing and recording directly from the research

object data. Observing the learning activities of class XI students at school, namely to observe students when working on word problems on matrix material.

2) Interview

The interview technique used in this study was an in-depth interview technique in the form of unstructured interviews. Unstructured interviews are free interviews where researchers do not use interview guidelines that have been arranged systematically and completely for data collection (Sugiyono, [2018](#)).

3) Documentation

Documentation was obtained when researchers conducted research in the form of photos, video recordings and other relevant documents. Photos and video recordings as a result of documentation obtained with the help of the camera on the researcher's cell phone as primary data. Meanwhile, documents in the form of books and school documents serve as secondary data if the secondary data is needed by the researcher.

4) Field Notes

Researchers use field notes so that every incident that occurs during the research process can be recorded neatly and to make it easier for researchers when collecting data.

Data analysis technique

1) Data Reduction

Reducing data means summarizing, choosing the main things, focusing on important things, and looking for themes and patterns, thus the reduced data will provide a clearer picture, and make it easier for researchers to carry out further data collection, and look for it. when needed (Sugiyono, [2018](#)). The stages in data reduction in this study are

- a) Correcting the work of class XI students who are the research subjects.
- b) The results of the work of students who are the subject of research are raw data that must be transformed into notes as material for interviews.
- c) The results of the interviews are simplified into a good and neat arrangement of language, then transformed into notes. This activity is carried out by processing the results of interviews with students who are the subject of research so that they become data that is ready for use.

2) Data Display (Data Presentation)

After the data is reduced, the next step is to display the data. The stages in presenting data in this study are presenting the results of the work of students who are the subject of research to be used as material for interviews and presenting the results of interviews with students.

3) Conclusion Drawing/Verification

The third step in qualitative data analysis according to Miles and Huberman is drawing conclusions and verification. The conclusion in qualitative research is a finding or description of an object that was previously dim or dark so that when examined it becomes clear, it can be in the form of a causal or interactive relationship, hypothesis, or theory (Sugiyono, [2018](#)).

3. Research Results and Discussion

Story test questions were tested on students to find out the difficulties faced by students in solving word problems on matrix material using the Polya step. This test will be held on Thursday 22 October 2020 from 10.00 to 11.30. The number of test

takers was 3 students. The following is the score of the test results of the three research subjects.

Table 1

Research subject

Number	Student Code	Test Score
1	S1	26
2	S2	22
3	S3	19

Based on Table 1, S1 as research subject 1 had a little difficulty in working on matrix word problems with Polya steps. Then for S2 as research subject 2, many experienced difficulties in working on matrix word problems with Polya steps. Furthermore, for S3 as a research subject, 3 also experienced many difficulties in working on matrix word problems with the Polya steps.

Student Difficulties in Matrix Material Based on Polya Steps

Figure 1

Interview with S1



The results of the researchers' observations of S1 who had the highest test scores showed that S1 worked on questions from number one to three using the Polya step. When working on matrix word problems, S1 looked relaxed and serious. Furthermore, based on the Researcher's interview (P) with S1 who has the highest test score can be seen in the interview transcript.

Question number 1

“Agung and Faris will buy cakes at the market. Agung bought 3 cubit cakes, 5 surabi cakes, and 8 brownies cakes. Meanwhile, Faris bought 8 cubit cakes, 3 surabi cakes, and 12 brownies cakes. Change the above statement into matrix form!”

The following is a picture and the results of the interview about number 1 with S1.

Figure 2
 Results Answer S1

1. Tahap 1
 Dik :
 Agung Membeli 3 kue cubit, 5 surabi dan 8 brownis
 Faris Membeli 8 kue cubit, 3 kue surabi, dan 12 kue brownis
 Dit :
 Ubahlah ke dalam bentuk matriks

Tahap 2
 Pembelian :
 Agung = A
 Faris = F
 kue cubit = x
 kue surabi = y
 kue brownis = z

Tahap 3
 Ubahlah ke dalam bentuk Persamaan linear

$$\begin{aligned} A &= 3x + 5y + 8z \\ F &= 8x + 3y + 12z \end{aligned}$$

$$\begin{cases} A = 3x + 5y + 8z \\ F = 8x + 3y + 12z \end{cases}$$

$$\begin{bmatrix} A \\ F \end{bmatrix} = \begin{bmatrix} 3 & 5 & 8 \\ 8 & 3 & 12 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix}$$

Jadi bentuk matriks dari Persamaan tersebut adalah

$$\begin{bmatrix} A \\ F \end{bmatrix} = \begin{bmatrix} 3 & 5 & 8 \\ 8 & 3 & 12 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix}$$

Q1.1 : Do you have difficulty working on questions number 1 to 3?

S1.1 : Yes, less time.

Q1.1 : For task number one, did you experience any difficulties?

S1.1 : Yes, at the proving stage, how do you do it?

P1.1 : In the proof stage you only change the answer in matrix form to the initial linear equation (reversed the work).

S1.1 : Oh I see.

Q1.1 : Do you understand the questions?

S1.1 : Yes.

Based on the results listed on the completion sheet and interviews, it can be concluded that S1 experienced difficulties in doing number 1. S1 could not complete the work due to lack of time and was still confused in doing the fourth stage of the Polya step, namely proving/checking the results again.

Question number 2

“Arman bought 5 pencils and 3 erasers, while Susi bought 4 pencils and 2 erasers, Arman's cashier paid IDR 11,500 while Susi paid IDR 9,000. If Dodi buys 6 pencils and 5 erasers, how much should he pay?”

The following is a picture and the results of the interview about number 2 with S1.

Figure 3

Results of S1 Answers to Question Number 2

2. Tahap 1
 Diketahui
 Arman membeli 5 Pensil dan 3 Penghapus
 Susi membeli 4 Pensil dan 2 Penghapus
 Arman membayar 11.500
 Susi membayar 9.000
 Dodi membeli 6 Pensil dan 5 Penghapus
 Dit : Berapa yang dibayar Dodi

Tahap 2
 Pembelian : Pensil = x Penghapus = y

Arman = A = 11.500
 Susi = S = 9.000
 Ubah SPL
 $A + 5S = 11.500 \dots \text{L1}$
 $4A + 3S = 10.000 \dots \text{L2}$
 $6A + 5S = 12.000 \dots \text{L3}$
 Eliminasi Pers L1 dan L2

$$\begin{array}{r} 5x + 3y = 11.500 \quad \times 2 \\ 4x + 3y = 10.000 \quad \times 3 \\ \hline 10x + 6y = 23.000 \\ 12x + 9y = 30.000 \\ \hline -2x = -7.000 \\ x = 3.500 \end{array}$$

 Substitusi x = 3.500 ke L1
 $3.500 + 5y = 11.500$
 $5y = 8.000$
 $y = 1.600$
 Jadi penyelesaian: $x = 3.500$ dan $y = 1.600$
 Substitusi x = 3.500 dan y = 1.600 ke L3
 $6(3.500) + 5(1.600) = 12.000$
 $21.000 + 8.000 = 12.000$
 $29.000 = 12.000$
 Tidak ada penyelesaian

Q1.2 : If number 2, is it difficult?

S1.2 : It's quite difficult, I don't know if the answer is correct or not.

Q1.2 : Look at the second stage, you wrote Arman = A = 11,500, what does that mean?

S1.2 : A is money paid by Arman.

Q1.2 : How about S?

S1.2 : S is the money paid by Susi.

Based on the results listed on the completion sheet and interviews, it can be concluded that S1 can do question 2 correctly but he has doubts about his answer.

Question number 3

"The parking attendants at Indramayu Mall are named Adam and Hud. Adam received IDR 17,000 from 3 cars and 5 motorbikes, while Hud received IDR 18,000 from 4 cars and 2 motorbikes. If Sholeh parks 20 cars and 30 motorcycles, how much money does he get?"

The following is a picture and the results of the interview about number 3 with S1.

Figure 4

Solving Problem Number 3 S1

3. Tahap 1
 Dik: Adam mendapat uang sebesar Rp. 17.000 - dari 3 buah mobil dan 5 motor

Hud mendapat uang sebesar Rp 18.000 dari 4 buah mobil dan 2 motor.
 Setelah memberikan 20 mobil dan 30 motor.
 Ditanya
 Berapa uang yang didapat setelah.
 Tahap 2
 Formulasi
 mobil = x motor = y
 Adam = A = 17.000
 Hud = H = 18.000
 skolah = H

$$\begin{aligned} A &= 3x + 5y \Rightarrow 17.000 = 3x + 5y \dots (1) \\ H &= 4x + 2y \Rightarrow 18.000 = 4x + 2y \dots (2) \\ S &= 20x + 30y \Rightarrow S = 20x + 30y \dots (3) \end{aligned}$$

Eliminasi Pers (1) dan (2)

$$\begin{array}{r} 17.000 = 3x + 5y \quad \times 4 \\ 68.000 = 12x + 20y \\ 18.000 = 4x + 2y \quad \times 3 \\ 54.000 = 12x + 6y \\ \hline 14.000 = 14y \\ y = 1000 \end{array}$$

$y = 1000 \Rightarrow 17.000 = 3x + 5(1000)$
 $17.000 = 3x + 5.000 = 3x$
 $12.000 = 3x$
 $4.000 = x$

Tahap 3

$$\begin{bmatrix} 17.000 \\ 18.000 \\ S \end{bmatrix} = \begin{bmatrix} 3x + 5y \\ 4x + 2y \\ 20x + 30y \end{bmatrix} = \begin{bmatrix} 3(4.000) + 5(1.000) \\ 4(4.000) + 2(1.000) \\ 20(4.000) + 30(1.000) \end{bmatrix} = \begin{bmatrix} 12.000 + 5.000 \\ 16.000 + 2.000 \\ 80.000 + 30.000 \end{bmatrix} = \begin{bmatrix} 17.000 \\ 18.000 \\ 110.000 \end{bmatrix}$$

Jadi uang yang di dapat sekolah Rp. 110.000,-

Q1.3 : Is it difficult for number 3 or not?

S1.3 : Difficult.

Q1.3 : Where is it difficult?

S1.3 : In the second and third stages, still confused.

Q1.3 : Confused about which part?

S1.3 : Location of placement.

Q1.3 : Why was number 3 not completed?

S1.3 : No time, time is up.

P1.3 : Do you understand the matrix material?

S1.3 : Yes.

P1.3 : Do you understand?

S1.3 : Don't understand, because the learning is online

P1.3 : Does the teacher explain the material?

S1.3 : No, just giving material.

Q1.3 : In what way do you give the material?

S1.3 : What's the app?

Q1.3 : Do you understand the Polya stage yet?

S1.3 : Still confused about the second and third stages.

Q1.3 : Do you understand the story questions?

S1.3 : Yes.

P1.3 : Do you understand?

S1.3 : No, if the questions are not the same as what is exemplified.

Based on the results listed on the completion sheet and interviews, it can be concluded that S1 can do problem number 3 correctly, but he has difficulty in placing the placement in the second and third stages.

Researcher Subject 2 (S2)

Figure 5

Interviews with S2



The results of the researchers' observations of S2 who have moderate test scores. Students work on questions from numbers 1 to 3 using Polya's steps but do not write down the stages. S2 when working on it looks restless and mostly looks right and left because they feel confused with some of the questions.

Researcher interview (P) with S2 who has moderate test scores.

Question number 1

"Agung and Faris will buy cakes at the market. Agung bought 3 cubit cakes, 5 surabi cakes, and 8 brownies cakes. Meanwhile, Faris bought 8 cubit cakes, 3 surabi cakes, and 12 brownies cakes. Change the statement above into matrix form!

The following is a picture and the results of the interview about number 1 S2.

Figure 6

Answer S2 on Problem Number 1

Nama : Juyyah
 Kelas : XI DPB 2
 Mapel : MTK

Tanggal : 22 Oktober 2020

Dik : - Agung membeli 3 kue cubit, 5 kue surabi, 8 kue brownis
 - Faris membeli 8 kue cubit, 3 kue surabi, 12 kue brownis
 Dit : - Ubahlah kedalam bentuk matriks

Penyelesaian

misal : Agung = A Kue cubit : x Kue brownis = z
 Faris = f Kue surabi : y

Jawab : Ubah kedalam bentuk persamaan

$$A: 3x + 5y + 8z$$

$$f: 8x + 3y + 12z$$

$$\begin{bmatrix} A \\ f \end{bmatrix} = \begin{bmatrix} 3x + 5y + 8z \\ 8x + 3y + 12z \end{bmatrix}$$

$$\begin{bmatrix} A \\ f \end{bmatrix} = \begin{bmatrix} 3 & 5 & 8 \\ 8 & 3 & 12 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix}$$

Jadi bentuk persamaanya adalah

$$\begin{bmatrix} A \\ f \end{bmatrix} = \begin{bmatrix} 3 & 5 & 8 \\ 8 & 3 & 12 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix}$$

Q1.1 : Do you have difficulty in doing the questions?

S2.1 : Some are difficult, and some are not.

Q1.1 : Is it difficult for number 1?

S2.1 : No.

Q1.1 : But why aren't Polya's stages written down?

S2.1 : Confused, afraid to enter the wrong steps.

P1.1 : But do you still remember how many Polya stages there are?

S2.1 : Remember, there are four.

- Q1.1 : What is the first one?
 S2.1 : The first stage is understanding the problem.
 Q1.1 : The second one?
 S2.1 : Planning settlement.
 Q1.1 : The third one?
 S2.1 : Carry out calculations.
 Q1.1 : The fourth one?
 S2.1 : Proof.
 Q1.1 : Why didn't you finish number 1 until the proof stage?
 S2.1 : Yes, still confused about how to prove it.
 P1.1 : Prove it by changing the final answer back to the initial equation form.

Based on the results listed on the completion sheet and interviews, it can be concluded that S2 had difficulty working on question number 1 with the Polya step, he did not write down stages one to four because he was still confused about entering the stages and he was still confused in the fourth stage (proof) on question number 1.

Question number 2

"Arman bought 5 pencils and 3 erasers, while Susi bought 4 pencils and 2 erasers, Arman's cashier paid IDR 11,500 while Susi paid IDR 9,000. If Dodi buys 6 pencils and 5 erasers, how much should he pay?"

The following is a picture and the results of the interview about number 2 with S2.
 Figure 7

Answer S2 on Problem Number 2

$$D = 6x + 5y \rightarrow D = 6x + 5y$$

$$\text{Mencari nilai } x$$

$$\begin{aligned} 11.500 &= 5x + 3y \quad \times 2 \\ 9.000 &= 4x + 2y \quad \times 5 \end{aligned}$$

$$\begin{aligned} 11.500 &= 10x + 6y \\ 45.000 &= 20x + 10y \\ \hline 27.000 &= 10x + 4y \\ 27.000 &- 10x + 4y \\ \hline 0 &= 2x \\ x &= 2000 \end{aligned}$$

$$\text{Masukan } x = 2000 \text{ ke persamaan}$$

$$\begin{aligned} 11.500 &= 5x + 3y \\ 11.500 &= 5(2000) + 3y \\ 11.500 &= 10.000 + 3y \\ 1.500 &= 3y \\ 500 &= y \end{aligned}$$

$$\text{Jadi, di dapat } x = 2000 \text{ dan } y = 500$$

$$\begin{bmatrix} A \\ B \\ C \end{bmatrix} = \begin{bmatrix} 5 \\ 4 \\ 6 \end{bmatrix} \quad \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 2000 \\ 500 \end{bmatrix}$$

$$\text{Masukan nilai } x \text{ dan } y$$

$$\begin{bmatrix} A \\ B \\ C \end{bmatrix} = \begin{bmatrix} 5 \\ 4 \\ 6 \end{bmatrix} \quad \begin{bmatrix} 2000 \\ 500 \end{bmatrix}$$

$$\begin{aligned} 5(2000) + 3(500) &= 11.500 \\ 4(2000) + 2(500) &= 9.000 \\ 6(2000) + 5(500) &= 14.500 \end{aligned}$$

$$\text{Jadi, uang yg harus dibayar Dodi Rp. 14.500}$$

- Q1.2 : Is it difficult for number 2?
 S2.2 : No.
 Q1.2 : Why are the stages not written down?
 S2.2 : Confused, forgot.
 P1.2 : Your answer is correct, all you have to do is give the stages, the same as the last step, namely the proof stage. To prove it, just substitute the x and y values into what equation?
 S2.2 : Go to the equation $D=6x+5y$.
 Q1.2 : Do you understand question number 2?
 S2.2 : Yes.

Based on the results listed on the completion sheet and interviews, it can be concluded that S2 had difficulty working on question number 2 because he was still confused about the four steps of Polya.

Question number 3

"The parking attendants at Indramayu Mall are named Adam and Hud. Adam received IDR 17,000 from 3 cars and 5 motorbikes, while Hud received IDR 18,000 from 4 cars and 2 motorbikes. If Sholeh parks 20 cars and 30 motorcycles, how much money does he get?"

The following is a picture and the results of the interview about number 3 with S2.

Figure 8

Answer S2 on Problem Number 3

5) Dik: Adam mendapat uang Rp.17.000, dari 3 mobil dan 5 motor
 Hud dapat mendapat uang Rp.18.000, dari 4 mobil dan 2 motor
 Dit: Berapa uang yg didapat sholeh?
 Penyelesaian:
 Misal: - Uang yg didapat Adam: A = 17.000
 - " " " " Hud: H = 18.000
 - " " " " Sholeh: S = ?
 - Harga parkir per mobil: x
 - " " " " per motor: y
 Jawab: A: $3x + 5y \rightarrow 17.000$
 H: $4x + 2y \rightarrow 18.000$
 S: $20x + 30y \rightarrow S$
 Cari nilai x dan y

$$\begin{array}{r} 17.000 : 3x + 5y \quad \times 4 \quad 68.000 : 12x + 20y \\ 18.000 : 4x + 2y \quad \times 3 \quad 54.000 : 12x + 6y \\ \hline 14.000 : 14y \\ y = 1.000 \end{array}$$

 Masukkan y = 2000 ke persamaan

$$\begin{array}{r} 17.000 : 3x + 5y \\ 17.000 : 3x + 5(2000) \\ 17.000 : 3x + 10.000 \\ 17.000 - 10.000 : 3x \\ 7.000 : 3x \\ x = 2.333,33 \end{array}$$

 Persamaan matriksnya

$$\begin{bmatrix} 3 & 5 \\ 4 & 2 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 17.000 \\ 18.000 \end{bmatrix}$$

$$\begin{bmatrix} 3 & 5 \\ 4 & 2 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 17.000 \\ 18.000 \end{bmatrix}$$

 Jadi uang yg di dapat sholeh Rp. 104.000,00

- Q1.3 : Do you have difficulty doing number 3?
 S2.3 : Yes.
 Q1.3 : Why is it difficult?
 Q2.3 : Is the final result of number 3 a comma (decimal)?
 P1.3 : No.
 S2.3 : I end up with a comma (decimal).
 P1.3 : Maybe you weren't careful enough, try to look again! Now in this section (the chili refers to the process of finding the value of y) how much is 68,000 minus 54,000?
 S2.3 : 14,000.
 Q1.3 : Why did you write 28,000?
 S2.3 : Writing error.
 Q1.3 : The result is 14,000, which means that the y value is 14,000 divided by 14 what is the result?
 S2.3 : Value of y = 1,000.
 Q1.3 : Why is Polya's stage not written down?
 S2.3 : Yes, I forgot, confused.
 Q1.3 : Confused why?
 S2.3 : Confused about entering stages one, two, and three.
 Q1.3 : How about the fourth stage?
 S2.3 : Easy, just prove it.
 P1.3 : Do you understand the matrix material?
 S2.3 : Yes, but I don't understand because the teacher only gives the material and doesn't explain it.

P1.3 : For matrix assignments, does the teacher give assignments in the form of word problems?

S2.3 : No.

P1.3 : Have you ever found word problems in math class?

S2.3 : Yes, in SPLDV.

Q1.3 : For the test (matrix word problems) is this difficult or not?

S2.3 : Not bad.

Based on the results listed on the completion sheet and interviews, it can be concluded that S2 had difficulty working on question number 3 using the Polya steps, he did not write down stages one to four of the Polya steps because he was still confused about the placement of the stages.

Research Subject 3 (S3)

Figure 9

Interviews with S3



The results of the researchers' observations of S3 had a low test score. Students worked on questions from number one to three using Polya's steps but did not write down stages 1 to 4. The S3 looked restless when working, mostly looked right and left, and asked a lot of questions while doing the test because they felt confused about some of the questions.

Interview Researcher (P) with S3 who has a low test score.

Question number 1

Figure 10

Answers S3 on Problem Number 1

Nama : Hasanah
 kelas : XI DPB 2
 1. Diketahui
 Agung memiliki 3 kue coklat, 5 sorabi dan 8 brownis
 Faris memiliki 8 kue coklat, 3 sorabi, dan 12 brownis
 Dit : nyatakan koefisien di atas dalam bentuk matriks
 Jawab

$$A = \begin{bmatrix} 3 & 5 \\ 8 & 3 \end{bmatrix}$$

$$F = \begin{bmatrix} 8 & 3 \\ 3 & 5 \end{bmatrix}$$

$$A^{-1} = \frac{1}{\det A} \begin{bmatrix} d & -b \\ -c & a \end{bmatrix}$$

$$A^{-1} = \frac{1}{3 \cdot 5 - 8 \cdot 8} \begin{bmatrix} 3 & -5 \\ -8 & 3 \end{bmatrix}$$

$$A^{-1} = \frac{1}{15 - 64} \begin{bmatrix} 3 & -5 \\ -8 & 3 \end{bmatrix}$$

$$A^{-1} = \frac{1}{-49} \begin{bmatrix} 3 & -5 \\ -8 & 3 \end{bmatrix}$$

$$A^{-1} = \begin{bmatrix} -\frac{3}{49} & \frac{5}{49} \\ \frac{8}{49} & -\frac{3}{49} \end{bmatrix}$$

Q1.1 : How do you do the test, are there any difficulties?

S3.1 : Yes.

- Q1.1 : In doing number 1, did you experience difficulties or not?
 S3.1 : Yes.
 Q1.1 : At what stage did you experience difficulties?
 S3.1 : At this stage (indicating stage 3, namely planning or calculating).
 Q1.1 : Why is Polya's stage not written down?
 S3.1 : Forgot.
 Q1.1 : How could you forget? How many stages of Polya are there?
 S3.1 : There are four.
 Q1.1 : What is the first stage? Do you remember?
 S3.1 : Understanding the problem.
 Q1.1 : Second stage?
 S3.1 : Make a plan.
 Q1.1 : Third stage?
 S3.1 : Implement the plan.
 Q1.1 : Fourth stage?
 S3.1 : Proof.
 P1.1 : You remember Polya's stage, why not write it down?
 S3.1 : Forgot.
 Q1.1 : In solving number 1, what do you mean by writing x,y, and z?
 S3.1 : x as cubit cake, y as surabi, z as brownies.
 Q1.1 : Why not write it down?
 S3.1 : Forgot.
 Q1.1 : Do you understand the concept of matrix multiplication yet?
 S3.1 : Understood.
 Q1.1 : But why can the answer be wrong?
 S3.1 : Forgot.
 P1.1 : Do you understand question number 1?
 S3.1 : Don't understand.

Based on the results listed on the completion sheet and interviews, it can be concluded that S3 experienced difficulties in working on question number 1, he did not write down stages one to four of the Polya steps and was still confused about making a problem-solving plan.

Question number 2

Figure 11

Answer S3 on Problem Number 2

2. Diketahui:
 Arman membeli 5 pensil dan 3 penghapus
 Susi membeli 4 pensil dan 2 penghapus
 Dik: Berapa uang yang dibayar dari
 Dik: Arman membayar 11.000
 Susi membayar 9.000

Jawab:
 $A = 5x + 3y \dots (1)$
 $S = 4x + 2y \dots (2)$
 $Eliminasi pers (1) dan (2)$
 $11.000 = 5x + 3y$
 $9.000 = 4x + 2y$
 $-1.000 = -x - y$
 $x + y = 1.000$
 $x = 1.000 - y$

Substitusikan nilai x dan y ke pers (1)
 $5(1.000 - y) + 3y = 11.000$
 $5.000 - 5y + 3y = 11.000$
 $-2y = 6.000$
 $y = -3.000$

Substitusikan nilai y ke pers (2)
 $4x + 2(-3.000) = 9.000$
 $4x - 6.000 = 9.000$
 $4x = 15.000$
 $x = 3.750$

Jadi uang yang dibayar dari Arman 11.000 dan Susi 9.000

Matris bentuk matriksnya

$$\begin{bmatrix} A \\ S \end{bmatrix} = \begin{bmatrix} 5x + 3y \\ 4x + 2y \end{bmatrix} = \begin{bmatrix} 11.000 \\ 9.000 \end{bmatrix}$$

- Q1.2 : Do you have difficulty doing number 2?

- S3.2 : No.
 Q1.2 : How much is 9,000 multiplied by 3?
 S3.2 : 27,000.
 Q1.2 : But why did you write 24000?
 S3.2 : Wrong calculation.
 Q1.2 : For question number 2, do you understand?
 S3.2 : Yes.
 Q1.2 : In question number 2 what is asked?
 S3.2 : What was asked was how much money was paid by Dodi.
 Q1.2 : Why is the example for number 2 not written down?
 S3.2 : Yes, not written down.
 Q1.2 : What do you write x as?
 S3.2 : Where?
 Q1.2 : This (pointing to the completion of S3 in number 2) what do you write x and y as?
 S3.2 : x as Arman.
 Q1.2 : Arman already exists as A, then what is x as?
 S3.2 : Pencil.
 Q1.2 : What is y as?
 S3.2 : Eraser.
 Q1.2 : What do you also write s as?
 S3.2 : Money paid by Susi

Based on the results listed on the completion sheet and interviews, it can be concluded that S3 had no difficulties in working on question number 2, but he did not write down Polya's steps, was confused at the problem solving planning stage (example), and made a mistake in counting.

Question number 3

Figure 12

Answer S3 on Problem Number 3

3. Diketahui
 Adam mendapat uang sebesar 17.000 dari 3 buku dan 5 motor
 Hedi mendapat uang sebesar 19.000 dari 4 buah motor dan 2 motor
 Sholeh meminjamkan 20 motor dan 30 motor
 Dit: Berapa uang yang didapat Sholeh?
 Jawab
 motor 4 buku x
 Adam: 17.000
 Hedi: 19.000

$$\begin{aligned} A &= 3x + 5y & \rightarrow 17.000 &= 3x + 5y \quad \dots (i) \\ H &= 4x + 2y & \rightarrow 19.000 &= 4x + 2y \quad \dots (ii) \end{aligned}$$

$$S = 20x + 30y$$

 eliminasi (i) dan (ii)

$$\begin{aligned} 17.000 &= 3x + 5y & \times 4 & \rightarrow 68.000 = 12x + 20y \\ 19.000 &= 4x + 2y & \times 3 & \rightarrow 57.000 = 12x + 6y \\ \hline & & & 11.000 = 14y \end{aligned}$$

$$y = 785,71$$

$$3x + 5y = 17.000$$

$$3x + 5(785,71) = 17.000$$

$$3x = 17.000 - 3.928,55$$

$$3x = 13.071,45$$

$$x = 4.357,15$$

 Substitusi nilai x dan y ke rumus

A	$3x + 5y$
H	$4x + 2y$
S	$20x + 30y$

A	3	5	x
H	4	2	y
S	20	30	

A	3	5	4.357,15
H	4	2	785,71
S	20	30	

A	$3(4.357,15) + 5(785,71)$
H	$4(4.357,15) + 2(785,71)$
S	$20(4.357,15) + 30(785,71)$

A	$17.000 + 3.928,55$
H	$16.000 + 1.571,42$
S	$87.143 + 23.571,3$

Jika Sholeh meminjamkan uang sebesar 110.000
 Pembelian

$$S = 20x + 30y$$

 Substitusi nilai x = 4.357,15 dan y = 785,71

$$S = 20(4.357,15) + 30(785,71)$$

$$S = 87.143 + 23.571,3$$

$$S = 110.714,3$$

 Terpenuhi

- Q1.3 : Do you have difficulty doing number 3?
 S3.3 : No, because question number 3 is almost the same as the example problem.
 Q1.3 : What do you mean by writing A, H, S?
 S3.3 : A as Adam, H as Hud and S as Sholeh.
 Q1.3 : Why not write it down?
 S3.3 : Forgot.
 P1.3 : Have you studied the matrix material?
 S3.3 : Yes.
 P1.3 : Do you understand?
 S3.3 : No.
 Q1.3 : Why don't you understand?
 S3.3 : Because the learning is online-based.
 Q1.3 : So?
 S3.3 : Do not understand, because the teacher only gives material and assignments.
 Q1.3 : In what form?
 S3.3 : Powerpoint.
 Q1.3 : What application do you use to provide material with the task?
 S3.3 : Whats app.
 P1.3 : Does the teacher not explain the material using the Zoom application?
 S3.3 : No.
 P1.3 : Does that mean you studied on your own?
 S3.3 : Yes.
 P1.3 : Is the assignment of matrix material in the form of word problems?
 S3.3 : No.
 P1.3 : Have you ever encountered word problems in learning mathematics?
 S3.3 : Yes, in SPLDV.
 Q1.3 : For all the questions tested, do you understand the questions?
 S3.3 : Understood, but the solution is still confusing.

Based on the results listed on the completion sheet and interviews, it can be concluded that S3 had no difficulty working on question number 3 with Polya's steps but he did not write down stages one to four of Polya's steps and he was also still confused in the second stage, namely, problem-solving planning proved by not writing the example in number 3.

Factors Causing Students' Difficulties in Completing Story Problems Matrix Material Based on Polya Steps

Overall, it can be seen that all research subjects, from S1 who received a high score, S2 who received a moderate score, and S3 who received a low score, experienced difficulty in working on story problems on the matrix material. The causes of students' difficulties in working on the matrix material word test using the Polya steps are almost the same. The following is a discussion of the factors causing the difficulties faced by students in working on matrix word problems using Polya's steps.

1. Causal factors at the stage of understanding the questions

The cause of the difficulties at stage 1 is that students are still confused in understanding the questions, and do not write down what is known and asked. The research subjects can be said to understand this matrix word problem because they already know what is known and asked in the matrix word problem. This is in line

with research (Yuwono, et al. [2018](#)) which reveals that in the stage of understanding the problem students are said to have reached this stage if students know what is known and are asked questions correctly.

2. Causal factors at the stage of making a problem-solving plan.

The cause of difficulty at stage 2 is due to wrong calculations, not writing examples, and not being able to make plans to solve problems. This is in line with research (Rofia'ah, et al., [2019](#)) which reveals the factors that cause errors in this step are the lack of accuracy and knowledge of the prerequisite material related to the problems provided, and the limited ability possessed by students in manipulating and construct the known and asked data to make a formula plan to be used in the next step, namely completing the plan. This is in line with the results of a study (Pirmanto, et al., [2020](#)) which revealed that the ability to plan completion was low, around 32%.

a. Causal factors at the stage of planning/calculation

The cause of the difficulty in stage 3 is that the research subject made a mistake in the previous stage and was wrong in doing the calculations. S2 and S3 experienced an error at this stage due to an error in the arithmetic operation and for S3 they still did not understand the matrix multiplication operation in number 1. This is in line with research (Rofia'ah, et al., [2019](#)) which revealed that errors in solving steps This plan is that students make mistakes in arithmetic operations due to lack of accuracy and lack of prerequisite skills such as multiplication and addition operations, or student errors in the previous steps.

b. Causal factors at the stage of proving or checking the results again

The proving stage is the easiest fourth step of Polya but the subjects in the study experienced difficulty in doing it and almost all of the research subjects did not write down the proof stage in working on the story problem matrix material test. In line with research (Rofia'ah, et al., [2019](#)) which shows the results of the percentage of errors in the re-examination step of 26.74% which is quite high and caused by students more than other errors. S1, S2, and S3 have difficulty doing the proof stage in number 1. S1 correctly completes the fourth stage in number 2 and S3 can complete correctly in number 3 but he does not write down the Polya stage (1 to 4).

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4. Conclusion

Based on the results of the research, the following conclusions can be drawn: (1) the difficulties faced by students in solving word problems on matrix material based on Polya's steps, namely: steps to solve problems according to Polya, matrix material, and time. (2) The factors that cause students' difficulties in solving word problems matrix material based on Polya steps, namely: (a) students are not used to using Polya steps, (b) do not write down stages 1 to 4 of Polya steps because they are still confused about the placement stages, (c) not writing examples in the second stage, namely problem-solving planning, (d) not writing down the fourth stage, namely checking the results again or proof, (f) students still have not mastered the matrix material because their learning is already using online or online, (g) math errors, (h) time in working on word problems on matrix material was limited due to nourishing learning during the Covid-19 pandemic.

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