



## Analysis of Student Errors in Solving SPLDV Story Problems Based on Visual Learning Styles

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### Abstract

This study aims to describe the types of errors and factors causing students' errors in solving SPLDV story problems from a visual learning style perspective. The type of research used is descriptive qualitative. The research subjects consisted of Class VIII at SMP Negeri 2 Malaka Barat who were identified as having a visual learning style. The research instruments were essay tests on SPLDV word problems and interview guidelines. Students error were analyzed using Kastolan's theory, which classifies errors into conceptual, procedural, and technical. The results showed that students with visual learning style still made various errors, including (1) conceptual errors, such as inability to construct mathematical models from word problems and misapplying elimination or substitution methods; (2) procedural errors, such as failing to write systematic solving steps and not completing problems until the final stage; (3) technical errors, such as miscalculations and mistakes in copying numbers or variables. The causes of errors came from internal factors (lack of conceptual understanding, inaccuracy, and difficulty in translating verbal information into symbolic form) and external factors (teaching methods with minimal visualization, uncondusive learning environment, and limited solving time). This study emphasizes that even students with a visual learning style are not free from errors in solving SPLDV word problems.

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### Introduction

Mathematics is a useful science in every aspect of life because almost all everyday problems can be modeled mathematically to find the right solution. Learning mathematics trains students to think systematically, analytically, and logically, thus forming the basis for other sciences, especially the exact sciences (Putra & Hartono, 2019). One of the subjects taught in junior high school is Two-Variable Linear Equation Systems (SPLDV). This subject covers coefficients, constants, variables, and the elimination, substitution, and mixed methods for solving contextual problems (Kurnia Wijaya & Setyaningsih, 2018).

Word problems are often used in SPLDV learning because they can train students to understand concepts and relate them to real life (Amelia, Susanto, & Fatahillah, 2016; Yusuf & Fitriani, 2020). However, many students still experience difficulties with SPLDV story problems, including not understanding the problem's meaning, difficulty converting contextual problems into mathematical models, and choosing the wrong solution strategy (Yusuf & Fitriani, 2020). One



approach to understanding student errors is to review their learning styles. Learning styles are the unique ways in which individuals absorb, process, and understand information.

The three common learning styles are visual, auditory, and kinesthetic (Simatur & Pratiwi, 2016; DePorter & Hernacki, 2016). Students with a visual learning style tend to absorb information through sight and find it easier to understand material with the help of graphics, images, or notes. Characteristics of visual learners include liking to take notes, finding it easier to remember by reading, paying attention to the teacher's expressions, and tending to be thorough and neat (Simatur & Pratiwi, 2016; Adhani, et.al, 2022). Therefore, in theory, they should be able to understand story problems and relate them to mathematical concepts. However, in reality, visual learners still experience difficulties in constructing mathematical models from SPLDV story problems and in choosing the appropriate solution strategies.

Observations at SMP Negeri 2 Malaka Barat show that the majority of students have a visual learning style, but they still often make mistakes in solving SPLDV problems. This shows that a visual learning style does not necessarily guarantee better problem-solving skills. Based on Kastolan's theory, student errors can be categorized into three types, namely conceptual errors, procedural errors, and technical errors (Khanifah, 2016). Error analysis is important to determine the types and causes of student errors so that teachers can design more appropriate learning strategies (Dewi & Kusri, 2016; Legutko in Wahyuni, 2017).

## **Method**

This study used a qualitative approach with a descriptive method. The purpose of the study was to describe the types of errors made by students in solving SPLDV story problems and to identify the factors causing these errors from the perspective of visual learning styles. The study was conducted at SMP Negeri 2 Malaka Barat, class VIII/A, in the odd semester of the 2024/2025 academic year, on December 6–7, 2024.

The research subjects were 10 students in class VIII/A who had a visual learning style. The subjects were determined based on the results of a learning style questionnaire distributed to all students. Of the 25 students, 10 were categorized as having a visual learning style. Next, three students were selected as the main subjects for further analysis based on the following criteria: completing all test questions, showing a variety of types of errors, and being recommended by subject teachers for their good communication skills.

The research instruments included a learning style questionnaire, SPLDV story questions test, and semi-structured interview guidelines. The questionnaire was used to determine students' dominant learning styles, while the test consisted of three SPLDV essay questions compiled based on Kastolan's error indicators and validated by experts. The interview guidelines were used to explore the factors causing students' errors in greater depth.

Data collection was conducted through written tests, semi-structured interviews, and documentation in the form of students' work and research notes. The research procedure consisted of three stages, namely: (1) the preparation stage, which included initial observation, obtaining permission, and preparing the instruments; (2) the implementation stage, which included administering the learning style questionnaire, selecting subjects, administering the SPLDV story questions test, checking the test results, and conducting interviews; and (3) the final stage, which included concluding the analysis of students' errors.

Data analysis was conducted using the Miles & Huberman model, which includes data collection, data reduction, data presentation, and conclusion drawing. Data were analyzed based on Kastolan's theory, which classifies student errors into three categories, namely conceptual errors, procedural errors, and technical errors.

## **Research Results and Discussion**

### ***Research Results***

This study aims to describe the types of errors made by students with visual learning styles in solving SPLDV story problems based on Kastolan's theory. Research data were obtained through written tests and interviews. The tests were used to identify students' errors in answering questions, while interviews were used to reinforce the analysis results by exploring the reasons behind the errors made. The error analysis focused on three main subjects (GV1, GV2, and GV3) selected based on the learning style questionnaire results, test-taking abilities, and teacher recommendations.

#### **1. Learning Style Questionnaire Results**

Of the 25 students in class VIII/A at SMP Negeri 2 Malaka Barat, 10 students were found to have a visual learning style based on the learning style questionnaire. From these 10 students, 3 students were selected as interview subjects, namely GV1, GV2, and GV3. The selection was based on:

- a. Able to complete all SPLDV test questions
- b. Showed a variety of errors
- c. Recommendation from the subject teacher

## 2. Analysis of Student Errors

### a. Subject GV1

Jawaban:

$$\begin{aligned} 1. 5x + 8y &= 17.000 & 2 \\ 2. 6x + 7y &= 16.500 & 2 \end{aligned}$$

$$+ 46y = 10200$$

$$307 + 35y = 82500$$

$$13y = 13500$$

$$y = 1500$$

$$5x + 8(1500) = 17000$$

$$5x + 12000 = (17000) 2$$

$$5x = 5000$$

$$x = 1000$$

$$11x + 5y = 11(1000) + 5(1500)$$

$$= 11000 + 7500$$

$$= 18500 \quad 2$$

Jadi, uang yang harus dibayar Agus adalah Rp. 18.500,00.

**Figure 1. GV1 Subject's Answer to Question Number 1**

Based on the answer above, it can be seen that GV1 made a conceptual error, namely, not understanding the information given and asked in the question. The subject made procedural errors, namely not writing down the variable substitution, not mentioning the solution method, and not systematically arranging the solution steps.

②  
 1.  $5x + 4y = 55$   
 2.  $x + y = 16$

$y = 16 - x$

Substitusikan ke Persamaan Pertama:

$3x + 4(16 - x) = 55$   
 $3x + 64 - 4x = 55$   
 $-x + 64 = 55$   
 $-x = 55 - 64$   
 $-x = -9$   
 $x = 9$   
 $y = 16 - 9$   
 $y = 7$

Mahanus Bekria selama 9 Jam dan 2  
 Ferdino Bekria selama 7 Jam.

Figure 2. GV1's answer to question number 2

Based on the answer above, it can be seen that GV1 made a conceptual error, namely not understanding the information known and asked in the question. Did not create an appropriate mathematical model or equation. Did not understand the relationship between variables in the question. The subject made procedural errors, namely writing down assumptions and initial mathematical sentences. The subject did not mention the solution method (substitution). The subject arranged the solution steps unsystematically. The subject made technical errors, namely errors in writing down the substitution form that did not match the initial assumptions.

3

$$\begin{aligned} 1. 4x + 2y &= 10000 & 2 \\ 2. 8x + 3y &= 13000 \end{aligned}$$

$$\begin{aligned} 1. 12x + 6y &= 30000 \\ 2. 16x + 6y &= 38000 \end{aligned}$$

Kurangi Persamaan kedua dan Persamaan Pertama :

$$(16x + 6y) - (12x + 6y) = 38000 - 30000$$

$$4x = 8000$$

$$x = 2000$$

Jadi harga sebuah ~~Pensil~~ <sup>Penghapus</sup> adalah ~~RP. 2.000~~ <sup>RP. 2000</sup>.

Substitusikan  $x = 2000$  ke dalam Persamaan pertama untuk menemukan  $y$  :

$$4(2000) + 2y = 10000 \quad 4$$

$$8000 + 2y = 10000$$

$$2y = 10000 - 8000$$

$$2y = 2000$$

$$y = 1000$$

Jadi harga sebuah Penghapus adalah ~~RP. 800~~ <sup>RP. 800</sup>. Untuk menemukan harga dari sebuah Pensil dan setiap buah penghapus :

$$4x + y = 4(2000) + 1000 = 8000 + 1000$$

Jawaban : Harga dari sebuah Penghapus dan setiap buah penghapus adalah ~~RP. 800~~ <sup>RP. 800</sup>. 2

Figure 3. GV1's answer to question number 3

Based on the answer above, it can be seen that GV1 made a conceptual error, namely not understanding the information given and asked in the question. Did not create an appropriate mathematical model or equation. Did not understand the relationship between variables in the question. The subject made procedural errors, namely not writing down the assumptions and initial mathematical statements. Not mentioning the solution method. Arranging the solution steps unsystematically. The subject made technical errors, namely errors in copying or rewriting numbers or variables.

b. Subject GV2

① harga kue bolu =  $x$   
 harga kue dadar =  $y$

$$\begin{aligned}
 1. \quad & 5x + 8y = 17000 \quad 1 \\
 2. \quad & 6x + 7y = 16500 \quad 2
 \end{aligned}$$

kalikan Persamaan Pertama dengan 6  
 dan Persamaan kedua dengan 5

$$\begin{aligned}
 + 48y &= 21020000 \\
 30x + 35y &= 8082500
 \end{aligned}$$

kurangi persamaan kedua dari  
 Persamaan Pertama

$$\begin{aligned}
 13y &= 195000 \\
 y &= 15000
 \end{aligned}$$

$5x + 8(15000) = 17000$   
 $5x + 120000 = 170000$   
 $5x = 50000$   
 $x = 10000$

jadi harga 1 kue bolu kukus = Rp 10.000,00  
 harga 1 kue dadar = Rp 15.000,00

$$\begin{aligned}
 & 11(10000) + 5(15000) \\
 &= 110000 + 75000 = 185000
 \end{aligned}$$

**Figure 4. GV2's answer to question number 1.**

Based on the answer above, it can be seen that GV2 made a conceptual error, namely not understanding the information given and asked in the question. The subject made a procedural error, namely not mentioning the method of solution (elimination). The subject did not write down the final conclusion of the result. The subject made a technical error, namely an error in performing the calculation.

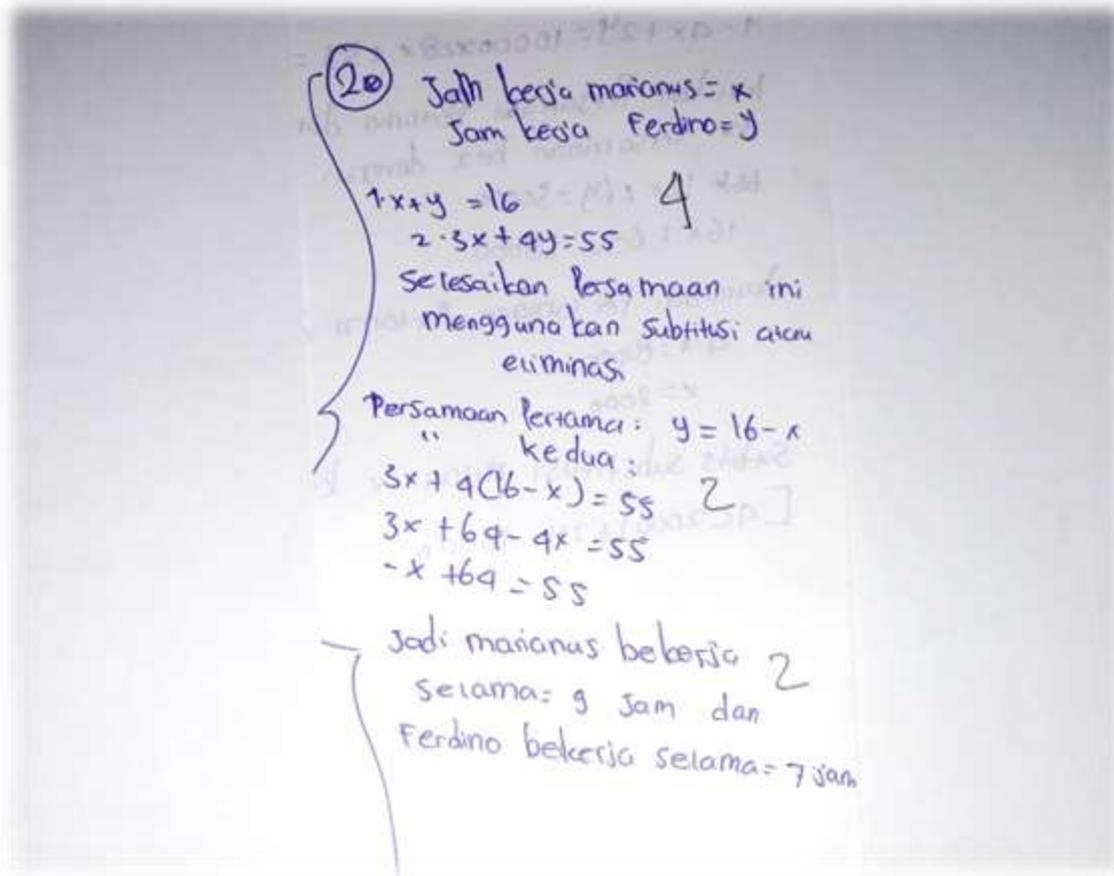


Figure 5. GV2's answer to question number 2

Based on the answer above, it can be seen that GV2 made a conceptual error, namely not understanding the information given and asked in the question. The subject made a procedural error, namely not completing the final form.

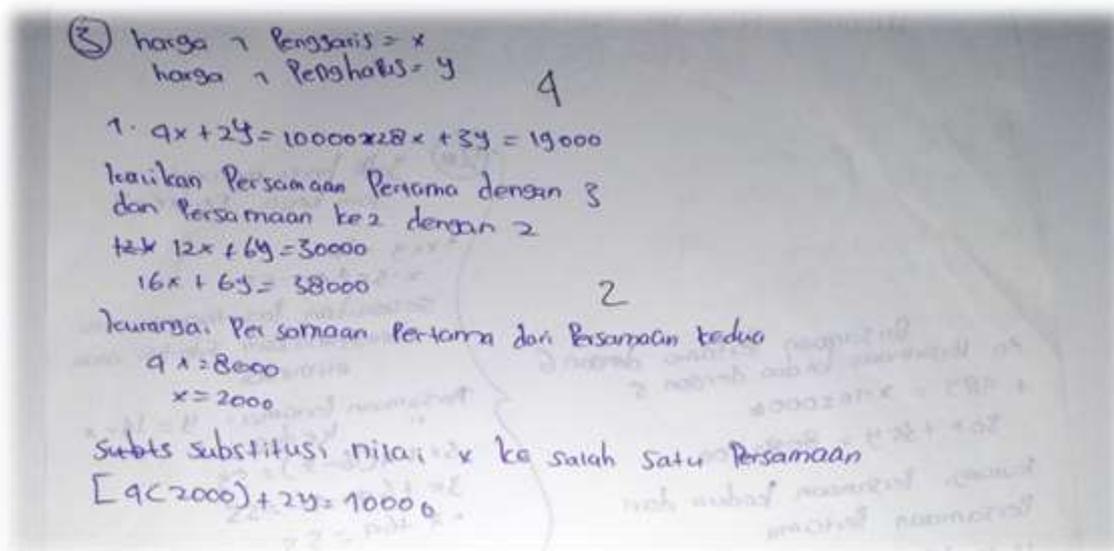


Figure 6. GV2's answer to question number 3

Based on the above answers, it can be seen that GV2 made a conceptual error, namely not understanding the information given and asked in the question. The subject made a procedural error, namely not mentioning the method of solution. Did not complete the steps systematically and completely. Did not write down the final conclusion of the results. The subject made a technical error, namely an error in performing calculations. An error in copying or rewriting numbers or variables.

c. Subject GV3

1.)  $X =$  harga satu kue bow kulus  
 $Y =$  harga satu kue dadar

$\rightarrow$  Persamaan 1 (Anisa):  $5x + 8y = 17000$   
 $\rightarrow$  Persamaan 2 (Ari):  $6x + 7y = 16500$

$= 13y = 19500$   
 $Y = 1500$

$= 5x + 8(1500) = 17000$   
 $= 5x + 12000 = 17000$

$= 5x = 5000$   
 $X = 1000$

Jadi harga satu kue bow kulus adalah Rp 1000,00 dan harga satu kue dadar adalah Rp 1500,00

#. Menghitung harga Bismillah Agass

$\bullet 11x + 5y = 11(1000) + 5(1500) = 11000 + 7500 = 18500$

Figure 7. GV3's answer to question number 1

Based on the answer above, it can be seen that GV3 made a conceptual error, namely not understanding the information given and asked in the question. The subject made a procedural error, namely not mentioning the method of solution.

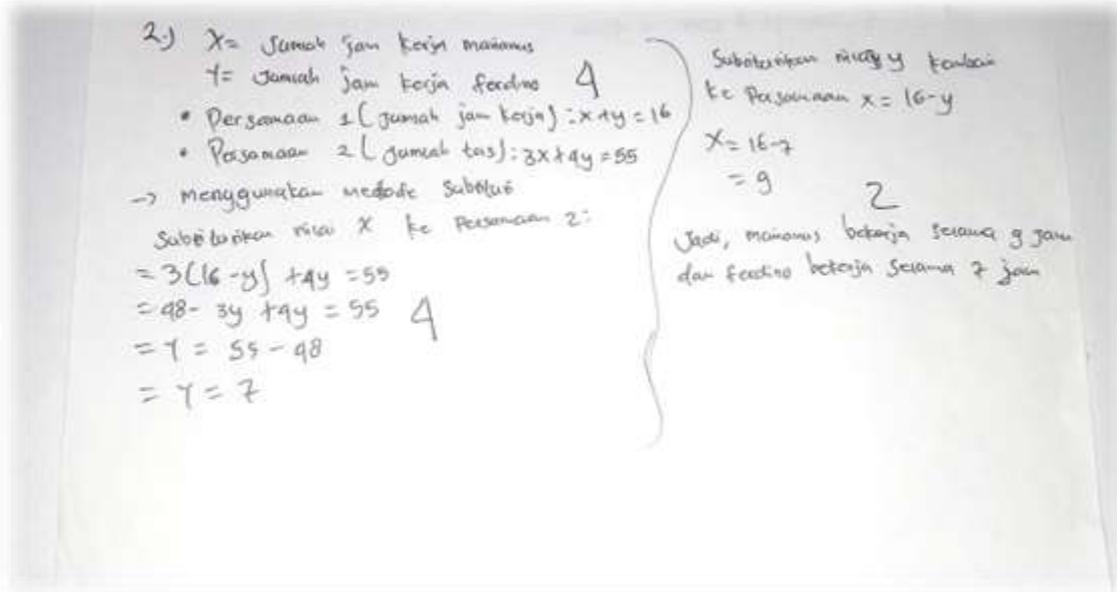


Figure 8. GV3's answer to question number 2

Based on the answer above, it appears that GV3 made a conceptual error, namely not understanding the information provided and asked for in the question.

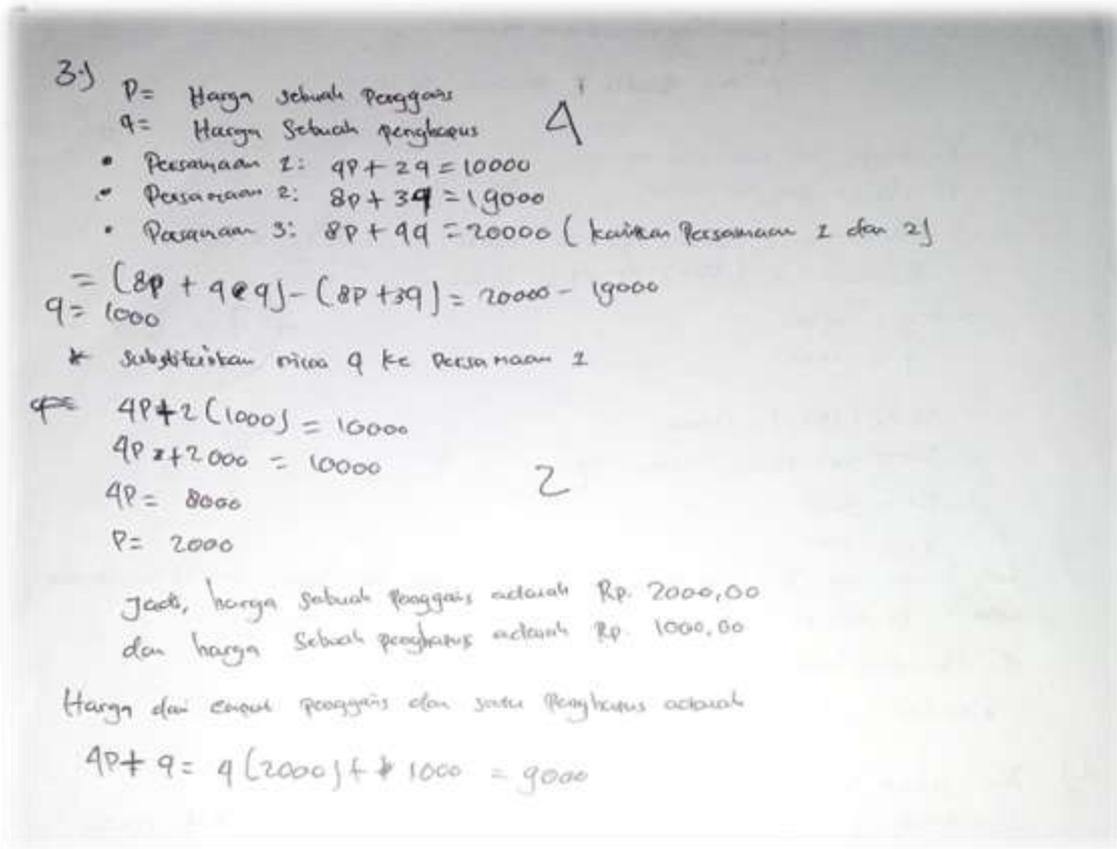


Figure 9. GV3's answer to question number 3

Based on the above answer, it can be seen that GV3 made a conceptual error, namely not understanding the information given and asked in the question. The subject made a procedural error, namely not mentioning the method of solution. The steps to solve the problem were not systematic. The final conclusion of the result was not written down. The subject made a technical error, namely an error in performing the calculation (elimination). The previous value did not match the next step.

### ***Discussion***

Based on the results of the analysis conducted on three subjects with visual learning styles, namely GV1, GV2, and GV3, it was found that each subject made various types of errors in solving SPLDV story problems. The types of errors made were grouped into three categories based on Kastolan's theory, namely conceptual errors, procedural errors, and technical errors.

#### **a. Conceptual Errors**

Conceptual errors are errors that occur because the subject does not understand the basic concepts in SPLDV story problems. In subjects GV1, GV2, and GV3, these errors appear in various forms, such as not writing down known and explicitly asked information, not creating an appropriate mathematical model, and not understanding the relationship between variables. Subject GV1 made conceptual errors in questions 1 and 2, namely not writing down the information that was known and asked and not constructing the correct SPLDV model or equation. GV2 also made a similar error in question 3, while GV3 made a conceptual error in question 2.

The factors causing these conceptual errors include: Lack of understanding of basic SPLDV concepts. Weakness in reading and analyzing information in story problems. Lack of practice in converting verbal information into mathematical form. Previous research by Yusuf and Fitriani (2020) states that many students have difficulty forming mathematical models from story problems due to their weak understanding of basic concepts.

#### **b. Procedural Errors**

Procedural errors are errors in the steps taken to solve a problem. These errors include not writing down variable assignments, not mentioning the method used to solve the problem, and not arranging the steps systematically. Subject GV1 did not write down the solution method and did not arrange the steps systematically in all questions. GV2 also did not mention the solution method and did not write down the final conclusion of the results obtained. GV3 did not write down the example and did not provide a final conclusion of the answer.

The factors causing these procedural errors are that students are not accustomed to writing down the complete steps for solving problems. Students have a low understanding of the correct sequence of mathematical procedures. Time pressure and the lack of habit on the part of teachers to assess the stages of the solution, not just the final result. This is in line with Widyasari & Dhaniar's

(2024) opinion that students tend to skip important steps in solving problems due to a lack of habit in systematically organizing the solution process.

### c. **Technical Errors**

Technical errors are mistakes made in calculations or copying numbers during the solution process. These errors appear in subjects GV2 and GV3. GV2 copied numbers incorrectly when performing substitutions and made calculation errors, while GV3 made mistakes in performing eliminations, resulting in incorrect final answers.

The factors causing technical errors are carelessness in performing calculations, lack of mastery of basic arithmetic operations, and failure to double-check calculation results. These technical errors are reinforced by research conducted by Nengsih & Pujiastuti (2021), which states that students often make errors in mathematical calculations, such as adding, subtracting, or multiplying incorrectly.

### **Conclusion**

Based on the results of the study, it can be concluded that:

1. The types of errors made by students with visual learning styles in solving SPLDV story problems include conceptual, procedural, and technical errors.
2. The factors causing these errors include internal factors (lack of conceptual understanding, carelessness, difficulty converting verbal problems into mathematical models) and external factors (minimal visualization in learning, an unfavorable learning environment, and time constraints).

### **Recommendations**

Based on the results of the study, it is recommended that mathematics teachers make greater use of visual learning media, such as diagrams, tables, or illustrations, to help students with visual learning styles understand SPLDV story problems. Teachers are also expected to encourage students to write down the steps of their solutions in sequence and provide exercises that can improve accuracy in calculations. Students are expected to practice independently converting contextual problems into mathematical models and get into the habit of double-checking their answers before submitting them. In addition, schools can facilitate the use of visual-based learning strategies to minimize student errors in solving SPLDV story problems.

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