# Analysis of Students' Errors in Solving Mathematics Story Problems in View of Learning Styles in Class VII Students of SMP Negeri 13 Mataram Academic Year 2023/2024

Lale Amrini Rosmala Dewi[1], Nani Kurniati[2], Ulfa Lu'luilmaknun[3], Sri Subarinah[4]

[1,2,3,4] Mathematics Education Study Program, Faculty of Teacher Training and Education, Mataram University, Indonesia

**Abstract:** This study aims to describe the level of tendency and causes of students' errors in solving mathematic story problems. Error analysis was carried out based on the Polya's procedure reviewed from the students' learning styles. This type of research is descriptive qualitative. The sampling technique used purposive sampling and consideration from the mathematics teacher so that class VII H of SMP Negeri 13 Mataram was obtained as the research subject. The sample used was 29 students. Data collection techniques using learning style questionnaires, test questions, and interviews. Data analysis techniques are data collection, data reduction, data presentation, and conclusion drawing. Based on the results of data analysis obtained from test results and interviews, it can be concluded that, students of visual learning styles tend to make mistakes at the plans implementing stage with an error rate of 63% including in the high category and the recheck stage with an error rate of 86% including in the very high category. Students of auditorial learning styles tend to make mistakes at the recheck stage with an error rate of 58% including in the medium category. Students of kinesthetic learning styles tend to make mistakes at the recheck stage with an error rate of 44% including in the low category. The causes of these errors are because 1) students are less to understand the problem, 2) less careful in doing calculations, 3) not used to writing conclusions because students used the results from the previous stage as conclusions.

**Keywords:** Error analysis; Story problem; Polya; Learning style

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## Introduction

Mathematics is a very important subject for the development of every individual. Mathematics is taught not only to know and understand concepts but to train thinking patterns in solving mathematical problems in order to be able to apply mathematical concepts to everyday life (Patmawati, 2019)

Given the importance of mathematics that many problems that are categorized as high often occur in education, namely making mistakes in solving mathematical problems, especially problems presented in the form of story problems, thus causing low student ability in solving mathematical problems. The low ability of students in solving math story problems also occurs in class VII SMP Negeri 13 Mataram. Based on the results of interviews with mathematics teachers, the errors that often occur in students are errors in understanding the problems in the problem, errors in using formulas, errors in solving steps, errors in counting, and errors in determining the final answer. This causes low student learning outcomes in mathematics subjects in class VII SMP Negeri 13 Mataram. The average score obtained in each exam is very far if to target to reach the minimum completion criteria score. Can be seen in Table 1.

**Table 1. Students' Mathematics Daily Test Score**

| N | Class | Number | Average | Classical | Minimum |
|---|-------|--------|---------|-----------|---------|

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Email: laleamrinird09@gmail.com

| o | | of Students | | Completeness (%) | Completion Criteria |
|---|---|---|---|---|---|
| 1 | VII G | 36 | 46,76 | 23% | |
| 2 | VII H | 34 | 50,42 | 28% | 75 |
| 3 | VII I | 36 | 48,67 | 11% | |
| 4 | VII J | 34 | 44,55 | 8% | |

Based on Table 1 it can be seen that the level of student mastery scores is still fairly low. The class that gets a low average score is class VII J with an average score of 44,55 and its class completeness is 8%, which gets a high average score but still has not reached the minimum completion criteria score is class VII H with an average score of 50,42 and its class completeness is 28%. Many of the students still get scores far below the minimum completion criteria set by the school which is 75. This indicates that the level of mastery of students in mathematics is not optimal. The results of observations found in the student learning process by the way students receive information and the material provided also vary. With the results of interviews obtained, some students understand the material by recording what they see, what they hear, and what they practice. So it can be concluded that one of the causes of student errors in solving math problems is the difference in learning styles. In line with Sinta (2022) that the factors that influence student errors in solving math problems are student characteristics, one of which is learning style.

Ghufron & Risnawita (2012:42) suggests that learning style is an approach that explains how individuals learn to concentrate on mastering information. Ahmad (2020:17) suggests that learning style is a way that a person tends to choose to think, absorb information, manage and understand information and remember the acquisition of information from skills, knowledge through learning or experience. In line with Nasution (2022) learning style is a way of responding to students in carrying out learning activities, each individual has a different learning style that can affect learning outcomes such as how to read, listen, and find. Deporter & Hernacki (2010) suggest that learning styles are divided into three types, namely visual, auditorial, and kinesthetic learning styles. The indicators put forward by Ramli (2022) regarding visual, auditorial, and kinesthetic learning styles are how to receive information, interaction with the environment, and personality.

To find out the mistakes made by students with visual, auditorial, and kinesthetic learning styles in solving math story problems, an error analysis is carried out. This error analysis is carried out so that the teacher knows the level of tendency and causes of student errors in solving math story problems, so that the teacher can find solutions to overcome these problems. This error analysis technique can use two procedures, including procedures based on Polya and procedures based on Newman. Polya's procedure has the stages of understanding the problem, developing a plan, implementing the plan, and checking again, while Newman's procedure has the stages of reading the problem, understanding the problem, problem transformation, process skills, and writing the answer. However, in this study, the procedure that will be used to analyze student errors is the procedure based on Polya because the error analysis using the Polya procedure is more detailed and clear, and also at stages one and two the Newman procedure has the same meaning as the Polya procedure stage one.

## Method

The type of research used is descriptive qualitative research which aims to describe fully and in depth about the level of tendency and causes of student errors in solving math story problems in terms of learning styles. The data sources used were 4 classes in class VII of SMP Negeri 13 Mataram. The sampling technique was carried out using purposive sampling. Sugiyono (2018:95-96) argues that purposive sampling is a technique taken from data sources with certain considerations. This particular consideration with students mastering and understanding the material, problem solving and communication skills are high and fulfill all types of learning styles. So that the subjects in this study were VII H class students.

As for analyzing the mistakes made by students in solving mathematical story problems in this study using the Polya procedure. The following indicators based on Polya's procedure according to Rofi'ah (2019) can be seen in Table 2.

**Table 2. Error Indicators Based on Polya's Procedure**

| Fault | Indicator |
|---|---|
| Understand The Problem | 1. Students are wrong in writing what is known in the problem<br>2. Students do not write what is known in the problem<br>3. Students are wrong in writing what is asked in the question<br>4. Students do not write what is asked in the problem |
| Developing a plan | 1. Students are wrong in writing mathematical models or formulas to answer questions<br>2. Students write down the mathematical model or formula but incomplete<br>3. Students do not write down the mathematical model or formula to be used in the problem |
| Implementing The Plan | 1. Students are wrong in completing the solution steps<br>2. Students are wrong when entering known things in the mathematical model<br>3. Students are wrong in doing calculations<br>4. Students make mistakes because they cannot complete the calculations to |

|  |  | determine the answer to the question |
| --- | --- | --- |
|  | 5. | Students make mistakes because they cannot complete the steps in solving the problem completely. |
|  | 6. | Students incorrectly do not write the steps used to solve the problem. |
| Rechecking | 1. | Students are wrong in drawing conclusions that match what is asked in the question. |
|  | 2. | Students write the conclusion but it is not in accordance with the given problem |
|  | 3. | Students do not write back (conclusion) the results of the solution obtained |

This research instrument uses instruments put forward by Prayitno (2019:31-44) namely questionnaires, test questions, and interviews. The questionnaire instrument used consists of 15 statements where each answer choice represents a type of learning style. The test instrument is a description question consisting of 3 questions with each question concerning each type of learning style. The interview guideline instrument consists of 13 questions in accordance with Polya's procedure. Before conducting research, the research instruments that will be used are tested for validity first. This validity test uses content validity using Aiken' V (1985).

The data analysis technique was coined by Miles dan Huberman (1984) proposed by Sugiyono (2018:133-134) with the stages of the data analysis technique, namely data collection, data reduction, data presentation and conclusion drawing. The formula used to determine the percentage level of errors made by students according to Safitri (2021) is as follows.

$$P_j = \frac{n_j}{N_j} \times 100\%$$

Description:

$P_j$ = Percentage of all students' errors at stage $j$

$j$ = 1 (understanding the problem), 2 (developing a plan), 3 (implementing the plan), and 4 (rechecking)

$n_j$ = the score of errors made by all students at stage j for all questions

$N$ = Total score of errors made by all students at stage j× number of questions

The percentage of errors made by students according to Sulaiman (2023) can be grouped into 5 criteria with assessment guidelines. The criteria can be seen in Table 3.

**Table 3. Percentage Error Rate**

| No | Interval | Criteria |
| --- | --- | --- |
| 1 | $80\% \leq x \leq 100\%$ | Very high |
| 2 | $60\% \leq x \leq 79\%$ | High |
| 3 | $40\% \leq x \leq 59\%$ | Medium |
| 4 | $20\% \leq x \leq 39\%$ | Low |
| 5 | $0\% \leq x \leq 19\%$ | Very Low |

Information x = Total score obtained by students

## Result and Discussion

The learning style questionnaire was given to 4 classes, namely VII G, VII H, VII I, and VII J. After the data was grouped based on the total score of each learning style determined, it turned out that there were students who had the first and second types of learning styles. The data on the results of the learning style questionnaire of students in class VII SMP Negeri 13 Mataram obtained can be seen in Table 4.

**Table 4. Categories of Learning Style Questionnaire Results of VII Grade Students of SMP Negeri 13 Mataram**

| Class | Learning style | | | | Students |
| --- | --- | --- | --- | --- | --- |
|  | Visual | Auditorial | Kinesthetic | Visual-Auditorial |  |
| G | 17 | 6 | 8 | 3 | 34 |
| H | 19 | 9 | 4 | 2 | 34 |
| I | 21 | 5 | 3 | 0 | 29 |
| J | 18 | 10 | 1 | 2 | 31 |
| Total | 75 | 30 | 16 | 7 | 128 |
| (%) | 59% | 24% | 12% | 5% | 100% |

Based on Table 4 it is known that the VII G and VII H classes obtained the results of the learning style questionnaire whose criteria were in accordance with the researcher's wishes. However, the researcher obtained consideration from the math teacher that VII H had high problem solving skills. So that class VII H was chosen to be the subject given the problem test. This problem test aims to find out the mistakes made by students. This test is in the form of story-shaped description questions which are presented in 3 forms of questions according to the type of learning style. Students who received the math story problem test were 29 students because 5 students did not take the test, consisting of 16 visual learning style students, 7 auditorial learning style students, 4 kinesthetic learning style students, and 2 visual-auditorial learning style students. But in this study only focused on students who have 1 type of learning style The following error test results of all students based on Polya's procedure can be seen in Table 5.

**Table 5. All Students' Errors Based on Polya's Procedural Error Types**

| No | Types of Polya's Procedure Errors | Total Errors of All Students | Percentage Score | Category |
| --- | --- | --- | --- | --- |
| 1 | Understand the problem | 187 | 35% | Low |
| 2 | Developing a plan | 96 | 36% | Low |
| 3 | Implementing the plan | 291 | 55% | Moderate |
| 4 | Rechecking | 191 | 73% | High |

Based on Table 5 that errors with high categories were made in the type of error stages of checking back with a total of 191 errors and a percentage of 73%.

Errors in the medium category but high errors were made in the type of error implementing the plan with a total of 291 errors and a percentage of 55%. While errors in the low category were made at the type of error stages of understanding the problem with a total of 187 errors and a percentage of 35% and at the stage of making mistakes with a total of 96 errors and a percentage of 36%. So that the tendency of errors made by VII H class students in solving math story problems in the types of stages of implementing the plan and checking back.

After the data was analyzed, several subjects were selected to be interviewed in depth regarding the answers obtained on the test questions given. The subjects chosen were representative subjects of each type of learning style, so that 9 subjects were obtained consisting of 3 visual learning style students, 3 auditorial learning style students, and 3 kinesthetic learning style students.

### 1. Error Rate of Visual Learning Style Type Students

Presented the level of error of students with visual learning styles as many as 16 students in solving math story problems on data presentation material based on Polya's theory in Table 6.

**Table 6. Error Rate of All Visual Learning Style Type Students in Review of Errors Based on Polya's Theory.**

| No | Error Type | Maximum Score of Error | Number of Errors | (%) | Error Rate |
|----|------------|------------------------|------------------|-----|------------|
| 1 | Understand the problem | 18 | 128 | 44% | Moderate |
| 2 | Developing a plan | 9 | 67 | 46% | Moderate |
| 3 | Implementing the plan | 18 | 182 | 63% | High |
| 4 | Rechecking | 9 | 124 | 86% | Very High |

Based on Table 6 that the level of error of students with visual learning style type with high category is at the error stage of implementing the plan and checking back. This indicates that students who have a visual learning style tend to make many mistakes in solving problems, calculations, and making conclusions. The results of the error analysis of the three subjects on the test results obtained can be seen in Table 7.

**Table 7. Error Analysis Results of Visual Learning Style Subjects.**

| Subyek | No. | M1 | M2 | M3 | M4 | Tendency |
|--------|-----|----|----|----|----|----------|
| SV15 | 1 | 0 | 0 | 0 | 0 | Develop a plan & Implementing the plan |
|  | 2 | 0 | 1 | 1 | 0* |  |
|  | 3 | 0* | 0* | 0* | 0* |  |
| SV27 | 1 | 0 | 0 | 0 | 1 | Rechecking |
|  | 2 | 0 | 0 | 0 | 0* |  |
|  | 3 | 0* | 0* | 0* | 0* |  |
| SV14 | 1 | 0 | 0 | 0 | 0 | Understand the problem |
|  | 2 | 1 | 0* | 0* | 0* |  |
|  | 3 | 0* | 0* | 0* | 0* |  |

Description:
M1   : Understanding the Problem       M3 : Implementing the Plan
M2   : Developing a Plan       M4 : Rechecking
0    : Not Making Mistakes       0* : Not working on the question
1,2, . . : Number of Mistakes

Based on Table 7 it can be seen that the three visual subjects made mistakes at all four stages of Polya's procedure. The error in understanding the problem is in the form of errors in writing the known and questionable things in the problem. In line with Surgana (2022) that errors in understanding the problem arise due to students' lack of mastery of concepts related to obtaining known and questionable information in the given problem. planning errors in the form of errors in writing formulas or mathematical models. In line with Hidayah (2016) that students are not accustomed to writing down the plan that will be used first in solving problems, such as writing down the formula to be used. Errors in carrying out the plan in the form of errors in the steps of solving the problem, errors in calculations, and errors made because of the previous stage. In line with Hidayah (2016) that students are less careful in performing mathematical calculations and solving appropriately. And the error of the checking back stage is in the form of an error in writing the final answer or conclusion obtained. In line with Hidayah (2016), the error in checking back is because it is not usual to double-check the results of their work and it is unusual to write conclusions because the conclusions will be the same as the solution results obtained, so students are better off not writing conclusions.

### 2. Error Rate of Auditorial Learning Style Type Students

Presented the level of error of students with an auditorial learning style as many as 7 students in solving math story problems on data presentation material based on Polya's theory in Table 8.

**Table 8. Error Rate of All Auditorial Learning Style Type Students in Review of Errors Based on Polya's Theory.**

| No | Error Type | Maximum Score of Error | Number of Errors | (%) | Error Rate |
|----|------------|------------------------|------------------|-----|------------|
| 1 | Understand the problem | 18 | 32 | 25% | Low |
| 2 | Developing a plan | 9 | 17 | 26% | Low |
| 3 | Implementing the plan | 18 | 59 | 46% | Moderate |
| 4 | Rechecking | 9 | 37 | 58% | Moderate |

Based on Table 8 that the level of error of students with auditorial learning style type with moderate category is at the error stage of checking

back. This indicates that students who have an auditorial learning style tend to make mistakes in making conclusions. The results of the error analysis of the three subjects on the test results obtained can be seen in Table 9.

**Table 9. Error Analysis Results of Auditorial Learning Style Subjects**

| Subyek | No. | Error Type | | | | Tendency |
|--------|-----|-----|-----|-----|-----|----------|
| | | M1 | M2 | M3 | M4 | |
| SA23 | 1 | 0 | 0 | 0 | 0 | Implementing |
| | 2 | 0 | 0 | 1 | 0 | the plan |
| | 3 | 0 | 0 | 0 | 0 | |
| SA18 | 1 | 0 | 0 | 0 | 1 | |
| | 2 | 0 | 0 | 0 | 0 | Rechecking |
| | 3 | 0 | 0 | 0* | 0* | |
| SA24 | 1 | 0 | 1 | 0 | 0 | Developing a |
| | 2 | 0 | 0 | 0 | 0 | plan |
| | 3 | 0* | 0* | 0* | 0* | |

Based on Table 9 it can be seen that the three auditorial subjects made mistakes at all three stages of Polya's procedure. This planning error is in the form of an error in writing the formula or mathematical model used. In line with Rofi'ah (2019) the lack of accuracy and knowledge of prerequisite material related to the problems provided and the lack of students' ability to construct known and questionable data to be able to make a formula plan used to solve the problem. Errors in the implementation stage of the plan occur because students are wrong in the steps of solving the problem and in the calculation process. In line with Rofi'ah (2019) that students are unable to perform arithmetic operations and problem solving, this error arises because of student errors at the previous stage. And the error in the rechecking stage occurs because students are less able to write the final answer or conclusion obtained. In line with Rofi'ah (2019) this error arises because there is an error at the previous stage that affects this stage, so that students draw the wrong conclusions too, the mistakes made by students are also because they do not write the conclusion.

### 3. Error Rate of Kinesthetic Learning Style Type Students

Presented the level of error of students with kinesthetic learning styles as many as 4 students in solving math story problems on data presentation material based on Polya's theory in Table 10.

**Table 10. Error Rate of All Kinesthetic Learning Style Type Students in Review of Errors Based on Polya's Theory.**

| No | Error Type | Maximum Score of Error | Number of Errors | (%) | Error Rate |
|----|-----------|------------------------|------------------|-----|------------|
| 1 | Understand the problem | 18 | 12 | 16% | Very low |
| 2 | Developing a plan | 9 | 6 | 16% | Very low |
| 3 | Implementing the plan | 18 | 27 | 37% | Low |
| 4 | Rechecking | 9 | 16 | 44% | Low |

Based on Table 10 that the level of error of students with kinesthetic learning style type with low category is at the error stage of checking back. This indicates that students who have kinesthetic learning styles tend to make mistakes in making conclusions. The results of the error analysis of the three subjects on the test results obtained can be seen in Table 11.

**Table 11. Error Analysis Results of Kinesthetic Learning Style Subjects**

| Subyek | No. | Error Type | | | | Tendency |
|--------|-----|-----|-----|-----|-----|----------|
| | | M1 | M2 | M3 | M4 | |
| SK07 | 1 | 0 | 0 | 0 | 0 | Implementing |
| | 2 | 0 | 0 | 0 | 0 | the plan & |
| | 3 | 0 | 0 | 1 | 1 | Rechecking |
| SK21 | 1 | 0 | 0 | 0 | 0 | Implementing |
| | 2 | 0 | 0 | 1 | 1 | the plan & |
| | 3 | 0 | 0 | 0 | 0 | Rechecking |
| SK01 | 1 | 0 | 0 | 0 | 1 | |
| | 2 | 0 | 0 | 0 | 0 | Rechecking |
| | 3 | 0 | 0 | 0* | 0* | |

Based on Table 11 it can be seen that the three kinesthetic subjects tend to make mistakes at both stages of Polya's procedure. Errors in the stage of implementing the plan occur because students are wrong in the calculations. In line with Rofi'ah (2019) that students lack accuracy in the ability of arithmetic operations, thus causing these errors. Re-checking errors occur due to student errors at the previous stage, so students are wrong in drawing conclusions. In line with Rofi'ah (2019) this error arises because there is an error at the previous stage that affects this stage, so students draw the wrong conclusion too.

From the explanation above, it can be concluded that the causes of student errors in solving math story problems are due to students' lack of ability to understand the problem, not accustomed to writing mathematical formulas or models, lack of accuracy in arithmetic operations and not used to writing conclusions that are wrong to write conclusions due to errors in the previous stage. The cause based on learning style is the lack of learning methods that support each type of learning style. The following tendencies of students with learning style types in solving math story problems can be seen in Table 12.

**Table 12. Student Error Tendency in Each Learning Style**

| No | Learning Style Type | Student Error Tendency |
|----|---------------------|------------------------|
| 1 | Visual | Implementing the plan & Rechecking |
| 2 | Auditorial | Rechecking |
| 3 | Kinesthetic | |

Based on Table 12 it can be seen that students with visual learning styles have the most error tendencies compared to other types of learning styles, namely errors at the stage of implementing the plan and checking back.

## Conclusion

1. The level of error tendency of all VII H classes is at the stage of implementing the plan and checking back. In more detail at the stage of understanding the problem by 35%, the stage of developing a plan by 36%, the stage of implementing the plan by 55%, and the stage of rechecking by 73%.

2. The level of tendency of visual learning style students to make mistakes at the stage of implementing the plan and rechecking. In more detail at the stage of understanding the problem by 44%, the stage of drawing up a plan by 46%, the stage of implementing the plan by 63%, and the stage of rechecking by 86%. The level of tendency for auditorial learning style students to make mistakes at the rechecking stage. In more detail at the stage of understanding the problem by 25%, the stage of preparing the plan by 26%, the stage of implementing the plan by 46%, and the stage of rechecking by 58%. The level of tendency for kinesthetic learning style students to make mistakes at the rechecking stage. In more detail at the stage of understanding the problem by 16%, the stage of developing a plan by 16%, the stage of implementing the plan by 37%, and the stage of rechecking by 44%.

3. The causes of errors made by students in solving math story problems are 1) lack of ability to understand the problem, 2) not careful in doing calculations, 3) not accustomed to writing conclusions because if the calculation process is complete, students think the problem has been answered completely without the process of drawing conclusions from the results obtained.

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