

## Students' error profiles in solving statistical problems based on Newman's error analysis

Sunu Paramarta<sup>1</sup>, Ida Dwijayanti<sup>2</sup>, Farida Nursyahidah<sup>3</sup>, Windia Hadi<sup>4</sup>

<sup>1,2,3</sup>Mathematics Education Study Program, Universitas PGRI Semarang, Central Java, Indonesia

<sup>3</sup>PUI-PT Techno-Ethno-Realistic Mathematics, Universitas PGRI Semarang, Central Java, Indonesia

<sup>4</sup>Doctoral School of Education, University of Szeged, Hungary

Correspondence: [faridanursyahidah@upgris.ac.id](mailto:faridanursyahidah@upgris.ac.id)

Received: Nov 3, 2025 | Revised: Dec 18, 2025 | Accepted: Dec 23, 2025 |

Published Online: Dec 27, 2025

Many students experience difficulties when solving statistical problems, indicating the need for further research to address these issues. The purpose of this study is to identify the types of errors students make and the factors contributing to these errors. The error types in this study are analyzed using Newman's Error Analysis (NEA), which includes reading and decoding errors, comprehension errors, transformation errors, process skill errors, and encoding errors. This study employs a qualitative method with six ninth-grade students as research subjects. Data were collected through tests, interviews, and documentation. A purposive sampling technique was employed, and the data were analyzed using Miles and Huberman's data analysis model. The results show that students with low cognitive ability committed comprehension errors, while students with medium and high cognitive ability did not. Process skill errors and encoding errors occurred among students across all cognitive ability levels—high, medium, and low. The factors contributing to these errors include limited literacy skills, lack of student accuracy, and the influence of previous errors.

**Keywords:** cognitive ability; Newman's Error Analysis; statistics

**How to Cite:** Paramarta, S., Dwijayanti, I., Nursyahidah, F., Hadi, W. (2025). Students' error profiles in solving statistical problems based on Newman's error analysis. *Aksioma: Jurnal Matematika dan Pendidikan Matematika*, 16(3), 483-498. <https://doi.org/10.26877/674vqb11>

### INTRODUCTION

Statistics is an essential aspect of human life because data-related competencies play a significant role in supporting the ability to comprehend texts, solve mathematical problems, and draw scientific conclusions (Ezra Putranda Setiawan, 2021). However, statistics is considered one of the more challenging topics for students to learn (Wisesa et al., 2022), due to the large number of formulas involved and the fact that statistical problem-solving typically requires sequential and systematic procedures (Ramadhani & Putri, 2022). These factors contribute to students' incomplete understanding of problems related to statistical concepts (Sa'idah & Wijayanti, 2022). Mayani & Muhammad, (2022) also report that many students show low interest in learning statistics.

Given that many students still experience difficulties in learning mathematics, it is essential for teachers to identify the types and sources of students' errors as a basis for

improving future instruction. Students who can identify their weaknesses at a fundamental level are more likely to respond correctly to tasks of higher complexity (Lian et al., 2022). Several previous studies have examined students' error profiles from various perspectives. Sulistyoningrum et al. (2021) investigated students' error profiles based on Newman's Error Analysis (NEA) in terms of learning styles. (2024) explored students' errors using Polya's problem-solving framework in relation to students' readiness to receive instruction. Sari et al. (2021) examined students' error profiles based on NEA using purposive sampling, while Magdalena & Muslim, (2023) applied a saturated sampling technique (population sampling) to analyze students' errors through the NEA framework. Furthermore, Putri et al. (2024) analyzed students' error profiles based on Kastolan indicators in relation to mathematical ability. However, none of these studies have examined students' error profiles based on Newman's Error Analysis (NEA) in relation to students' cognitive abilities.

Newman's Error Analysis (NEA) is a well-established and comprehensive framework for analyzing the errors made by students (Wardhani & Argaswari, 2022). Previous studies have demonstrated that NEA enables researchers to gain deeper insights into the various types of mistakes students commit, the underlying reasons for these errors, and how different factors may influence their occurrence (Kania et al., 2024). Therefore, the present study adopts NEA as an appropriate analytical framework because it allows for a detailed and systematic classification of students' errors.

The novelty of this study lies in its examination of students' error profiles based on Newman's Error Analysis (NEA) in relation to their cognitive ability levels. The researcher aims to connect NEA with students' cognitive abilities because the common assumption that higher cognitive ability consistently corresponds to fewer errors has not been sufficiently supported by empirical evidence. During preliminary observations in the trial class, it was found that not all students with high cognitive ability achieved higher scores than those with medium or low cognitive ability. By linking NEA error categories with levels of cognitive ability, this study offers a more comprehensive analytical model. Teachers are able not only to identify the types of errors students make, but also to understand which cognitive processes are not being met. This contributes to advancing the study of diagnostic errors in mathematics education.

Based on the background described above, the objective of this study is to describe students' errors in solving statistical problems based on NEA across high, medium, and low cognitive ability groups, and to analyze the factors that contribute to these errors. It is expected that the findings of this research will contribute to advancing diagnostic error studies in mathematics education.

## **METHODS**

The approach used in this study was qualitative. The data were obtained from six ninth-grade students of Public Junior High School 4 Semarang, consisting of two students with high cognitive ability, two students with moderate cognitive ability, and two students with low cognitive ability. The study consisted of two subjects from each cognitive ability level. This decision was based on the use of source triangulation to ensure data validity, and having two subjects for each cognitive category was sufficient to allow the triangulation process to be carried out effectively. The students' cognitive abilities were categorized based on the results of a cognitive ability test, which referred to Bloom's Taxonomy. There were ten short-answer questions, each classified according to cognitive levels. Questions 1 and 2 measured the remembering level (C1), questions 3 and 4 measured the understanding level (C2), questions 5 and 6 measured the applying level (C3), questions 7 and 8 measured the analyzing level (C4), while questions 9 and 10 measured the evaluating (C5) and creating (C6) levels, respectively. The cognitive ability test items had been validated for both validity and reliability by university lecturers, subject teachers, and students from the pilot class. The categorization of cognitive abilities in this study was as follows: remembering (C1) and understanding (C2) were classified as low cognitive ability; applying (C3) and analyzing (C4) were classified as medium cognitive ability; and evaluating (C5) and creating (C6) were classified as high cognitive ability (Jimaa, 2011; Kusumaningpuri et al., 2022). The selection of research subjects employed the purposive sampling technique. According to Tajik et al. (2024), purposive sampling is a sampling technique in which data sources are intentionally selected based on their relevance to the research questions. The data collection techniques employed in this study included tests, interviews, and documentation. The students' problem-solving processes were analyzed based on Newman's Error Analysis (NEA) stages, with the observed error indicators presented in Table 1.

**Table 1.** Indicators of Errors Based on Newman's Error Analysis (NEA)

<b>Error Type</b>	<b>Indicators</b>
Reading and decoding error	<ol style="list-style-type: none"> <li>1. The student is unable to read the words presented in the problem correctly (Mansur &amp; Subanji, 2021).</li> <li>2. The student is not yet able to identify the information, keywords, symbols, or variables altogether (Rejeki &amp; Sari, 2021).</li> </ol>
Comprehension error	<ol style="list-style-type: none"> <li>1. The student is not yet able to identify the information, keywords, symbols, or variables altogether (Rejeki &amp; Sari, 2021).</li> <li>2. The student can record what is known and what is asked, but some important information is omitted (Mansur &amp; Subanji, 2021).</li> </ol>
Transformation error	<ol style="list-style-type: none"> <li>1. The student does not convert the problem into a mathematical model or does so inaccurately (Rejeki &amp; Sari, 2021).</li> <li>2. The student makes errors in manipulating prerequisite elements (numbers) before applying the main formula in problem solving (Abu Mansor et al., 2021).</li> <li>3. The student fails to recall the formula required to solve the problem, leading them to create a new (and potentially incorrect) formula based on their own reasoning (Noutsara et al., 2021).</li> </ol>
Process skill error	<ol style="list-style-type: none"> <li>1. The student performs inaccurate calculations due to incorrect application of mathematical concepts or rules (Sulistyoningrum et al., 2021).</li> <li>2. The student can identify the appropriate operations or the correct order of operations required to solve the problem; however, they do not know the proper procedure to carry out these operations accurately (Mansur &amp; Subanji, 2021).</li> <li>3. The student is careless during the calculation process (Mansur &amp; Subanji, 2021).</li> </ol>
<i>Encoding error</i>	<ol style="list-style-type: none"> <li>1. The student has completed the problem, but did not write a conclusion (Sulistyoningrum et al., 2021).</li> <li>2. The student makes an error in concluding the answer obtained (Abu Mansor et al., 2021).</li> <li>3. The student made an error in the previous problem-solving process, resulting in an incorrect final answer (Noutsara et al., 2021).</li> </ol>

The data analysis technique employed in this study was the qualitative data analysis model developed by Miles & Huberman, which involves data collection, data reduction, data display, and conclusion drawing and verification. The data collection stage involved gathering the results of the cognitive ability test and problem-solving test, conducting interviews with the research subjects, and compiling research documentation. During the data reduction stage, the researcher categorized the data based on the students' cognitive ability levels. In the data presentation stage, the locations of students' errors were described in the form of narrative explanations outlining the processes they underwent

while completing the test instruments, based on the indicators of Newman's Error Analysis (NEA). The conclusion-drawing stage was carried out using both inductive and deductive reasoning, namely by formulating conclusions from the patterns identified in the data and comparing them with findings reported in previous studies (Chairunisa et al., 2025). In qualitative research, the researcher serves as the main instrument, acting as the primary observer and reflector throughout the study. A collaborating teacher also assisted the researcher in conducting classroom observations.

To ensure data validity, this study employed triangulation, which aims to verify the accuracy of data by comparing information obtained from different sources at various stages of the research process (Saadah et al., 2022). This study employed source triangulation by conducting interviews with two subjects representing each of the cognitive ability levels. The written test responses and interview results from the two subjects in each category were then compared and examined for consistency. If the comparison showed that the written responses and interview findings from both subjects were consistent, the data were deemed valid.

## **RESULTS AND DISCUSSION**

Students' cognitive abilities were categorized based on the results of a cognitive ability test, which referred to Bloom's Taxonomy. From each cognitive ability level, two students were selected as research subjects. The selection of subjects was supported by students' daily assessment data as well as recommendations and input from the mathematics teacher. The selected research subjects are presented in Table 2.

**Table 2.** Selected subject based on cognitive ability

<b>Cognitive Ability</b>	<b>Subject's Number</b>	<b>Subject's Code</b>
High	1	HCA 1
	2	HCA 2
Medium	1	MCA 1
	2	MCA 2
Low	1	LCA 1
	2	LCA 2

Each subject was then asked to complete a problem-solving test, and the results of their answers were analyzed to identify the types of errors made using Newman's Error Analysis.

### Subject with high cognitive ability (HCA)

The responses of the high cognitive ability students (HCA) were triangulated to examine the validity of the data obtained. The results of the triangulation for the HCA students' responses are presented in Table 3.

**Table 3.** Triangulation for the HCA students' response

Newman's Step	HCA 1	HCA 2
Reading and decoding error	Subject HCA 1 did not write down the information presented in the problem; however, during the interview, the subject was able to convey the information provided in the question.	Subject HCA 2 did not write down the information presented in the problem; however, during the interview, the subject was able to identify and point out the data presented in the question.
Comprehension error	Subject HCA 1 did not write down the information being asked in the problem; however, during the interview, the subject was able to convey the information requested in the question clearly..	Subject HCA 2 did not write down the information requested in the problem; however, during the interview, the subject demonstrated a clear understanding of the information being asked in the question.
Transformation error	Subject HCA 1 was able to understand the steps required to follow and the formulas needed to solve the problem.	Subject HCA 2 understood the steps and formulas required to solve the problem.
Process skill error	Subject HCA 1 was able to answer the problem well; however, there was an error in the calculation.  <div style="border: 1px dashed black; padding: 5px; width: fit-content; margin: 10px auto;"> <p>di bawah rata-rata :</p> <p>Rw 1 = 8 anak</p> <p>Rw 2 = 3 anak</p> <p>Rw 3 = 3 anak</p> <p>Rw 4 = 8 anak</p> <p>Rw 5 = 3 anak</p> </div> <p>The number of children with below-average body weight in RW 1 and RW 4 should have been 9, but Subject HCA 1 wrote the total as eight children.</p>	Subject HCA 2 was able to solve the problem correctly; however, the subject was less careful during the calculation process.  <div style="border: 1px dashed black; padding: 5px; width: fit-content; margin: 10px auto;"> <p>Jumlah badan dibawah rata-rata :</p> <p>Rw 1 = 8 anak      Rw 3 = 3 anak      Rw 5 = 3 anak</p> <p>Rw 2 = 3 anak      Rw 4 = 8 anak</p> </div> <p>The total number of children in RW 1 and RW 4 should be nine, but the subject wrote eight.</p>

---

Encoding error	Because the answer obtained by Subject HCA 1 was incorrect, the conclusion they drew was also inaccurate. Subject: <i>"My conclusion is as follows: for RW 1 the data are not normally distributed, and there are eight children with below-average body weight; ... for RW 4 the data are not normal, and there are 8 children; ..."</i>	The response provided by Subject HCA 2 was incorrect, which resulted in an inaccurate conclusion. When asked about the number of children, the subject reported the following distribution: RW 1 = 8, RW 2 = 3, RW 3 = 3, RW 4 = 8, and RW 5 = 3.
----------------	--	---

---

Based on the triangulation results presented in Table 3, it can be seen that the HCA (High Cognitive Ability) subjects made errors at the process skill and encoding stages. At the process skill stage, the subjects made mistakes in calculating the number of children whose body weight was below the average. This occurred due to the lack of carefulness demonstrated by the high-cognitive-ability subject (HCA) in completing the given problem. Since the obtained answer was incorrect, the conclusion drawn was consequently also inaccurate. This mistake in formulating the conclusion is categorized as an encoding error.

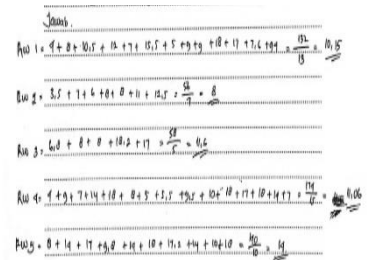
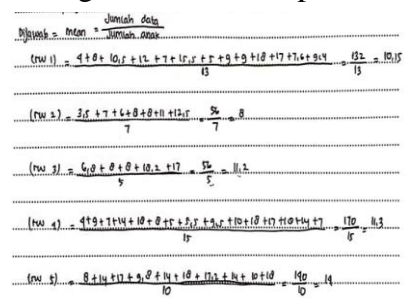
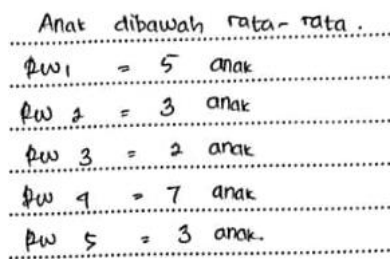
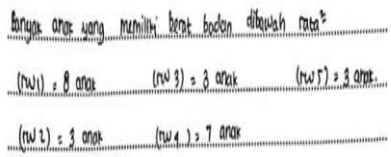
This finding is consistent with Salim & Mahmudah (2021), Napsawati et al. (2023), and Bulan (2023), who stated that the highest percentage of student errors occurs at the process skill stage, with respective percentages of 58.33%, 26.67%, and 29%. Meanwhile, Suhaeti et al. (2021) reported that the most frequent student errors occurred at the encoding stage. Similarly, Fauzan et al. (2021) found that the highest proportion of errors occurred at the encoding stage (69.35%), followed by the process skill stage (67.74%). These findings are further supported by Ningtiyas et al. (2022), who reported that the majority of student errors occurred at the process skill and encoding stages, accounting for 16% of the total errors.

Given that a lack of carefulness caused some of the students' errors, teachers need to provide systematic training to improve students' accuracy. One effective way to foster carefulness is by assigning non-routine problems, as such problems typically contain implicit information that students often overlook. Through repeated engagement with non-routine tasks, students are expected to develop greater attentiveness in reading and understanding mathematical problems.

**Subject with medium cognitive ability (MCA)**

After the MCA subject completed the test, a triangulation of the MCA subject's responses was conducted. The triangulated results of the MCA subject's answers are presented in Table 4.

**Table 4.** Triangulation for the MCA students' response

Newman's Step	MCA 1	MCA 2
Reading and decoding error	Subject MCA 1 was able to accurately and correctly record the information presented in the problem.	Subject MCA 2 was able to identify and accurately restate all the information presented in the problem.
Comprehension error	Subject MCA 1 was able to comprehend and accurately identify the information requested in the problem.	Subject MCA 2 identified and stated all the information requested in the problem completely.
Transformation error	<p>Subject MCA 1 was able to identify the necessary steps to be taken; however, the subject was less careful during the calculation process.</p>  <p>In calculating the average for RW 4, it should have been 11.6; however, the subject recorded it as 11.06.</p>	<p>The subject MCA 2 can identify the steps and formulas that need to be used, but makes errors during the calculation process..</p>  <p>The averages for RW 3 and RW 4 should have been 11.6; however, the subject recorded the average for RW 3 as 11.2 and for RW 4 as 11.3.</p>
Process skill error	<p>Subject MCA 1 is aware of the steps that need to be taken but lacks precision in the calculation process.</p> 	<p>Subject MCA 2 understands the steps that need to be followed but makes errors during the calculation process.</p>  <p>The number of children in RW 1 and RW 4 should have been 9 each; however, the subject</p>

	The number of children with below-average weight should have been 8, 3, and 8 for RW 1, 3, and 4, respectively. However, subject MCA 1 recorded the numbers as 5, 2, and 7.	recorded 8 children for RW 1 and 7 children for RW 4..
Encoding error	Subject MCA 1 did not write a conclusion based on the answer obtained. Researcher: <i>"Oh, I see. So, what is the conclusion from your answer?"</i> Subject: <i>"I don't know, sir."</i>	Subject MCA 2 did not write a conclusion based on the answer obtained. Researcher: <i>"So, for your answer here, what is the conclusion?"</i> Subject: <i>"I don't know, sir."</i>

Based on the triangulation in Table 4, it can be observed that the MCA subjects made errors in the transformation, process skill, and encoding stages. At the transformation stage, the subjects made mistakes in calculating the average weight of the children. In contrast, at the process skill stage, they made errors in determining the number of children with below-average weight. A lack of carefulness caused the mistakes made by the subject in both stages during the calculation process. Since the answers obtained were incorrect, the conclusions drawn were also inaccurate. The errors made in drawing these conclusions fall into the category of encoding errors.

This finding is consistent with Winarso et al. (2022), who stated that the highest number of student errors occurred at the encoding stage (7%), followed by the process skill stage (5%), and the transformation stage (3%). In addition, Salim & Mahmudah (2021) also reported that most student errors occurred at the process skill stage (58.33%), followed by the transformation and encoding stages, with 50.42% and 47.92%, respectively.

Given that a lack of carefulness caused the subject's errors, teachers need to incorporate non-routine problems into instruction to improve students' attention to detail. Non-routine problems typically contain implicit information, which can help train students to be more meticulous when working through mathematical tasks.

**Subject with low cognitive ability (LCA)**

Based on the responses of the LCA subjects, source triangulation was conducted to verify the validity and readiness of the obtained data for analysis. The results of the triangulation are presented in Table 5.

**Table 5.** Triangulation for the LCA students' response

<b>Tahapan Newman</b>	<b>LCA 1</b>	<b>LCA 2</b>
Reading and decoding error	Subject LCA 1 did not write down the information presented in the question; however, during the interview, the subject was able to identify the information correctly.	Subject LCA 2 did not write down the information presented in the question; however, during the interview, the subject was able to identify and clearly read the information presented in the question.
Comprehension error	Subject LCA 1 neither wrote down nor understood the information being asked in the question. Researcher: <i>"Alright, let's continue. What is being asked in the question?"</i> Subject: <i>"The average."</i> Researcher: <i>"What else?"</i> Subject: <i>"That's all, sir."</i> In fact, the question asked whether the data were normally distributed and how many children had below-average weight.	Subject LCA 2 did not write down the information being asked in the question. During the interview, the subject was able to identify part of the information asked but not completely. Researcher: <i>"So, what is being asked in the question?"</i> Subject: <i>"I'm not sure, sir."</i> Researcher: <i>"Try reading the question again."</i> Subject: <i>"Is the data from each posyandu normally distributed?"</i> Researcher: <i>"There you go... Why did you say you weren't sure earlier?"</i> Subject: <i>"Because I hadn't read this part yet, sir."</i>
Transformation error	Subject LCA 1 was able to apply the appropriate formula to solve the problem but lacked accuracy in the calculation process..	Subject LCA 2 was able to write and apply the formula used to solve the problem but was not careful in the calculation process.

$$\begin{aligned}
 \text{RW 1} &= \frac{4+8+10+12+14+16+18+20+22+24+26+28+30}{13} \\
 &= \frac{130}{13} = 10,1 \\
 \text{RW 2} &= \frac{3,5+7+6+8+8+11+12,5}{7} \\
 &= \frac{280}{7} = 28 \\
 \text{RW 3} &= \frac{6,8+8+8+10,2+17}{5} \\
 &= \frac{59}{5} = 11,2 \\
 \text{RW 4} &= \frac{4+9+7+14+18+8+5+5,5+10+12+14+17+19+21+23}{15} \\
 &= \frac{184}{15} = 11,9 \\
 \text{RW 5} &= \frac{8+14+17+9,8+14+10+12,2+14+10+8}{10} \\
 &= \frac{140}{10} = 14
 \end{aligned}$$

$$\begin{aligned}
 \text{RW 1} &= \frac{4+8+10+12+14+16+18+20+22+24+26+28+30}{13} \\
 &= \frac{130}{13} = 10,1 \\
 \text{RW 2} &= \frac{3,5+7+6+8+8+11+12,5}{7} \\
 &= \frac{56}{7} = 8 \\
 \text{RW 3} &= \frac{6,8+8+8+10,2+17}{5} \\
 &= \frac{59}{5} = 11,6 \\
 \text{RW 4} &= \frac{4+9+7+14+18+8+5+5,5+10+12+14+17+19+21+23}{15} \\
 &= \frac{184}{15} = 11,9 \\
 \text{RW 5} &= \frac{8+14+17+9,8+14+10+12,2+14+10+8}{10} \\
 &= \frac{140}{10} = 14
 \end{aligned}$$

The averages for RW 2 and RW 3 should have been 8 and 11.6, respectively; however, subject LCA 1 recorded them as 28 and 11.2. The averages for RW 4 and RW 5 were not calculated by subject LCA 1.

The average for RW 4 should have been 11.6; however, the subject recorded it as 11.9.

Process skill error	<p>Subject LCA 1 did not categorize the data based on its distribution and did not calculate the number of children with below-average weight.                  Researcher: <i>“Why didn’t you try to find out and calculate that?”</i>                  Subject: <i>“Because I thought the question only asked for the average, sir.”</i></p>	<p>Subject LCA 2 did not categorize the data based on its distribution and did not calculate the number of children with below-average weight.                  Researcher: <i>“Did you check which data were normally distributed and which were not?”</i>                  Subject: <i>“No, sir.”</i>                  Researcher: <i>“What about the number of children whose weight is below average?”</i>                  Subject: <i>“I didn’t do that either, sir. I thought we were only asked to find the average.”</i></p>
Encoding error	<p>Subject LCA 1 did not write a conclusion because the answer obtained did not fully solve the problem.</p>	<p>Subject LCA 2 did not write an answer because the problem in the question had not yet been solved.</p>

Based on the triangulation in Table 5, it can be seen that the LCA subjects made errors at the comprehension, transformation, process skill, and encoding stages. At the comprehension stage, the subjects were unable to understand the problem presented in the question. This is because the subject is not yet accustomed to solving mathematics problems presented in the form of word problems. At the transformation stage, they made errors in calculating the average weight of the children, because the subject demonstrated

insufficient accuracy during the calculation process. At the process skill stage, the subjects did not calculate the number of children with below-average weight, which was a consequence of the errors made at the comprehension stage. Since the answers obtained did not resolve the problem, the subjects were unable to draw a conclusion from their responses.

This finding is consistent with Wardhani & Argaswari (2022) as well as Seng (2020), who stated that most student errors occur at the comprehension, transformation, process skill, and encoding stages. In addition, Nuryati et al. (2022) also reported that students frequently made errors at the comprehension, transformation, and encoding stages. Era Setiyawati et al. (2022) stated that one of the factors contributing to student errors is cognitive factors. This is supported by Setyawati & Saadah (2022), who reported that the higher a student's cognitive abilities, the better they can meet indicators of mathematical connections; consequently, the number of errors made by students tends to be lower.

Due to the errors made by the subject, teachers are advised to familiarize students with non-routine problems. In addition to containing implicit information, non-routine problems are often presented in the form of word problems, which can help students become accustomed to such formats and are expected to improve their accuracy.

## **CONCLUSION**

Based on the study's results, it can be concluded that the most frequent errors made by students occurred at the process skill and encoding stages, while the fewest errors occurred at the reading and decoding stages. Students with high cognitive ability made errors in the process skill and encoding stages. Those with moderate cognitive ability made errors in the transformation, process skill, and encoding stages. In contrast, students with low cognitive ability made errors in the comprehension, transformation, process skill, and encoding stages. Given these errors, teachers should incorporate non-routine problems more frequently into instruction to help students become familiar with word-problem formats and improve their accuracy. This study contributes to the development of theoretical and methodological approaches in error diagnosis by providing a detailed mapping of error types, sources of errors, and students' cognitive processes. The analytical approach employed in this study may serve as a model for future research in designing more rigorous and evidence-based diagnostic strategies.

## DECLARATIONS

Author Contribution : SP: developing the research framework, conducting data collection, and drafting the initial manuscript; ID: data analysis and interpretation of the research findings; FN: literature review, manuscript editing, and verification of references; WH: validating the research methodology.

## REFERENCES

- Abu Mansor, S. N., Samsudin, N., & Ahmad Shukri, F. N. (2021). Newman's error analysis of common errors in solving convergence of power series using ratio test. *International Journal of Academic Research in Business and Social Sciences*, 11(9), 888–898.
- Anugerah, Amri, Suryanti, Asmal, & A. (2024). Profil kesalahan siswa dalam menyelesaikan masalah limit fungsi aljabar pada siswa SMAN 6 Bone. *ELIPS: Jurnal Pendidikan Matematika*, 5(4), 89–98.
- Bulan, D. D. (2023). Newman's error analysis dalam pembelajaran matematika berbasis aktivitas luar ruangan dengan mathcitymap. *Jurnal Research and Education Studies*, 3(1), 11–20.
- Chairunisa, K., Himma, A., & Karimah, S. (2025). Analisis kemampuan literasi numerasi dengan konten aljabar dan bilangan siswa kelas VIII. *Aksioma: Jurnal Matematika dan Pendidikan Matematika*. 16(1), 96–106.
- Ezra Putranda Setiawan. (2021). Statistical literacy in primary school mathematics curricula: historical review and development. *Jurnal Pendidikan Dan Kebudayaan*, 6(1), 1–20. <https://doi.org/10.24832/jpnk.v6i1.1915>
- Fauzan, F. A., Supurwoko, S., & Suharno, S. (2021). Analisis kesalahan jawaban siswa dalam mengerjakan soal uraian pada materi gerak harmonik sederhana siswa kelas X MIPA SMA Negeri 1 Teras Tahun Pelajaran 2018/2019. *Jurnal Materi dan Pembelajaran Fisika*, 11(2), 84. <https://doi.org/10.20961/jmpf.v11i2.49050>
- Jimaa, S. (2011). The impact of assessment on students learning. *Procedia - Social and Behavioral Sciences*, 28, 718–721. <https://doi.org/10.1016/j.sbspro.2011.11.133>
- Kania, N., Kusumah, Y. S., Dahlan, J. A., Nurlaelah, E., & Kyaruzi, F. (2024). decoding student struggles in geometry: newman error analysis of higher-order thinking skills. *International Journal of Geometry Research and Inventions in Education (Gradient)*, 1(01), 31–47. <https://doi.org/10.56855/gradient.v1i01.1146>
- Kusumaningpuri, A. R., Murtiyasa, B., Fuadi, D., & Hidayati, Y. M. (2022). Analisis kesulitan matematika pokok bahasan statistika pada siswa sekolah dasar aditya.

- Jurnal Basicedu*, 6(5), 933–942. <https://journal.uii.ac.id/ajie/article/view/971>
- Lian, L. H., Yew, W. T., & Meng, C. C. (2022). Assessing lower secondary school students' common errors in statistics. *Pertanika Journal of Social Sciences and Humanities*, 30(3), 1427–1450. <https://doi.org/10.47836/pjssh.30.3.26>
- Magdalena, Z., & Muslim, M. A. B. (2023). Identifikasi profil kesalahan siswa dalam menyelesaikan soal keterampilan berpikir kritis menggunakan newman's error analysis. *Jurnal Literasi Pendidikan Fisika (JLPPF)*, 4(1), 82–87.
- Mansur, N., & Subanji, S. (2021). Analisis kesalahan siswa dalam menyelesaikan masalah open ended berdasarkan teori newman. *Al Hikmah: Journal of Education*, 2(1), 23–36.
- Mayani, I., & Muhammad, I. (2022). Analysis of students' errors in solving statistical problems: a case of 8th grade students at SMPN 4 Siak Hulu, Indonesia. *Jurnal Pendidikan MIPA*. 23(November), 1827–1838.
- Napsawati, Yusdarina, Sakti, I., & Idamayanti, R. (2023). Identifikasi kesalahan pengerjaan materi dilatasi waktu berdasarkan newman error analysis (NEA). *JIPFRI (Jurnal Inovasi Pendidikan Fisika Dan Riset Ilmiah)*, 7(1), 28–34. <https://doi.org/10.30599/jipfri.v7i1.2133>
- Ningtiyas, S. K., Sary, R. M., & Artharina, F. P. (2022). Analisis kesalahan siswa dalam menyelesaikan soal cerita materi pembulatan berdasarkan metode nea pada kelas IV sd negeri Kalicari 01 Semarang. *Didaktik : Jurnal Ilmiah PGSD STKIP Subang*, 8(1), 1–52. <https://doi.org/10.21608/pshj.2022.250026>
- Noutsara, S., Neunjhem, T., & Chemrutsame, W. (2021). Mistakes in mathematics problems solving based on newman's error analysis on set materials. *Journal La Edusci*, 2(1), 20–27.
- Nuryati, N., Purwaningsih, S. S., & Habinuddin, E. (2022). Analysis of errors in solving mathematical literacy analysis problems using newman. *International Journal of Trends in Mathematics Education Research*, 5(3), 299–305. <https://doi.org/10.33122/ijtmer.v5i3.164>
- Putri, Baharuddin, Pathuddin, & M. (2024). Profil kesalahan siswa kelas vii smp negeri 1 dako pemean dalam menyelesaikan soal operasi hitung bilangan bulat ditinjau dari kemampuan matematika. *AKSIOMA : Pendidikan Matematika FKIP Universitas Tadulako*, 13(february).
- Ramadhani, D., & Putri, S. D. (2022). Analisis kesalahan siswa dalam menyelesaikan soal statistika di kelas XII MIPA SMA N 1 Kecamatan Gunuang Omeh *Pendahuluan*. 1(4), 370–380.
- Rejeki, S., & Sari, Y. R. (2021). Analisis kesalahan berdasarkan teori newman dalam menyelesaikan soal cerita materi pecahan pada siswa kelas VII. *Educatif Journal of Education Research*, 3(4), 1–12.

- Sa'idah, 'Aina, & Wijayanti, P. (2022). Analisis kesalahan siswa smp pada materi statistika ditinjau dari gaya belajar dengan menggunakan instrumen CRI. *Jurnal Ilmiah Pendidikan Matematika*, 11(2), 620–629.
- Saadah, M., Prasetyo, Y. C., & Rahmayati, G. T. (2022). Strategi dalam menjaga keabsahan data pada penelitian kualitatif. *Al-'Adad: Jurnal Tadris Matematika*, 1(2), 54–64.
- Salim, M. S., & Mahmudah, U. (2021). Newman's error analysis untuk memetakan tingkat kesalahan siswa dalam menyelesaikan soal cerita matematika dan penyebabnya. *CIRCLE: Jurnal Pendidikan Matematika*, 1(02), 1–15. <https://doi.org/10.28918/circle.v1i02.3532>
- Sari, M. N., Riyadi, R., & Kamsiyati, S. (2021). Profil kesalahan dalam menyelesaikan soal cerita materi pecahan. *Didaktika Dwija Indria*, 9(2), 59–64.
- Seng, N. B. (2020). Newman error analysis for errors in mathematical word questions among year three students in sekolah kebangsaan taman kluang barat. *International Journal of Novel Research in Education and Learning*, 7(2), 58–63. [www.noveltyjournals.com](http://www.noveltyjournals.com)
- Setiyawati, E., Fauziati, E., Minsih, D., & Prastiwi, Y. (2022). Problem solving errors in mathematics story questions. *JPI (Jurnal Pendidikan Indonesia)*, 11(3), 466–479. <https://doi.org/10.23887/jpiundiksha.v11i3.46980>
- Setyawati, R. D., & Saadah, L. (2021). Analisis kemampuan koneksi matematis dalam menyelesaikan masalah kontekstual himpunan. *Jurnal Kajian Pembelajaran Matematika*. 5(2): 285–296.
- Suhaeti, A., Aminah, N., & Wahyuni, I. (2021). Kesalahan jawaban siswa sma berdasarkan newman ditinjau dari tingkat kecemasan matematis. *JagoMIPA: Jurnal Pendidikan Matematika dan IPA*, 1(2), 124–134. <https://doi.org/10.53299/jagomipa.v1i2.70>
- Sulistyoningrum, E., Kartinah, K., & Sudargo, S. (2021). Profil kesalahan siswa berdasarkan newman's error analysis (nea) dalam menyelesaikan soal cerita matematika ditinjau dari gaya belajar siswa. *Imajiner: Jurnal Matematika Dan Pendidikan Matematika*, 3(4), 322–329.
- Tajik, Golzar, & N. (2024). Purposive sampling. *International Journal of Education and Language Studies*, 2(December), 1–9.
- Wardhani, T. A. W., & Argaswari, D. P. A. D. (2022). High school students' error in solving word problem of trigonometry based on newman error hierarchical model. *Infinity Journal*, 11(1), 87–102. <https://doi.org/10.22460/infinity.v11i1.p87-102>
- Winarso, W., Whid, S., & Rizkiah, R. (2022). Type of error in completing mathematical problem bades on newman's error analysis (NEA) and polya theory. *Jurnal*

*Pendidikan Matematika dan IPA*, 13(1), 51–67.  
<https://jurnal.untan.ac.id/index.php/PMP/article/view/72399>

Wisesa, K. T., Lexbin, M., & Judah, E. (2022). Menyelesaikan soal statistika kelas VIII di masa pandemi covid 19. 5(2), 599–606. <https://doi.org/10.22460/jpmi.v5i2.599-606>