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Errors Made by 8th Grade Students while Solving Mathematical Word Problems

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Abstract

Purpose: Mathematical word problems continue to challenge students due to their reliance on a range of interconnected mathematical concepts. This study investigates the specific types of errors students make when solving word problems, using Newman's Error Analysis as a framework. **Methodology:** Employing a descriptive-qualitative methodology, data were collected through tests and interviews with 47 eighth-grade students from a junior secondary school in the Ohangwena region of Namibia. Of these, nine students participated in interviews for a deeper understanding of their problem-solving processes. **Findings:** The analysis revealed that while no students experienced difficulties during the reading stage, significant challenges arose in later stages: comprehension errors occurred in 30.9% of cases, transformation and process skill errors were each observed in 62.2% of responses, and encoding errors, manifesting as inaccuracies in the final answer, were present in 62.8%. **Significance:** These findings highlight the critical need for educators to focus on enhancing students' abilities to tackle word problems, particularly by incorporating assignments grounded in real-life scenarios to foster better comprehension and application of mathematical concepts.

Keywords: Errors, Newman's Procedures, Problem-Solving, Word Problems.

Introduction

Mathematics word problems serve as a fundamental aspect of mathematical education, bridging theoretical concepts with real-world applications. Not only do these problems assess students' understanding of mathematical principles, but they also foster their problem-solving skills and critical thinking abilities (Nursyahidah et al., 2018). Bal and Artut (2022) highlighted that mastering the skill of solving mathematics word problems is crucial for establishing connections between academic learning and everyday life, effectively managing various activities, and ultimately attaining economic success. However, despite their pedagogical significance, research indicates that many students encounter difficulties when tackling mathematics word problems, particularly in the context of the 8th grade curriculum (Yunus et al., 2019). When students encounter story problems, their understanding of the nature of mathematical problems tends to deepen. Additionally, grappling with story problems serves as a valuable tool for

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nurturing students' cognitive abilities. Chu et al. (2017) and Dietiker (2015) state that solving mathematical problems presented as stories involves a series of cognitive steps, including understanding the meaning of each sentence, identifying key terms, converting everyday language into mathematical expressions or models, and deciding which elements to represent as variables. Emanuel et al. (2021) define a word problem as a scenario that involves the use of mathematical sentences, numbers, relationships, and arithmetic operations to solve the problem. As highlighted by Iilonga and Ogbonnaya (2023), word problems entail mathematical scenarios embedded within stories, ultimately translatable into mathematical equations. Verschaffel et al. (2020) assert that mathematical word problems function as narrative vehicles that depict real-life situations that require mathematical solutions. They explain that such problems include written descriptions that combine numerical information with inquiries or sets of questions that require resolution. Unlike conventional equations, which straightforwardly present variables and operations, word problems veil mathematical concepts within everyday contexts or plausible scenarios. A mathematical word problem, also known as a story problem, serves as a written depiction of a problem scenario for educational purposes. It usually includes one or more questions whose answers can be found by using math operations on numbers given in the problem statement or figured out from the problem statement itself (Ginsburg, 2022). Error analysis, as commonly employed, serves to pinpoint the root causes of students' consistent mistakes (Lai, 2012). It involves scrutinising students' work to detect recurring patterns of misunderstanding."

In the field of mathematics, students often face difficulties when attempting various problem-solving tasks, especially when faced with word problems structured as narratives. Students' struggles with solving mathematical story problems may stem from the inadequate transmission of concepts from teachers to students, as noted by Xin et al. (2008). Many educators' inadequate mastery of suitable teaching approaches and methods can hinder students' comprehension of the taught material, leading to difficulties in tackling mathematical word problems, as highlighted by Schmidt (2012). Setiyawati et al. (2022) underscored the importance of implementing enjoyable mathematics learning approaches to enhance students' comprehension of word problems. They advocate for addressing the root causes of students' struggles using methods such as error analysis, which involves scrutinizing students' mistakes in solving story-based questions (Santoso et al., 2022; Yunus et al., 2019). Understanding these errors helps identify the factors contributing to students' difficulties, allowing for the application of suitable and engaging teaching methods. This aligns with previous research emphasising that students' errors serve as valuable insights into their mathematical challenges, making error analysis instrumental in identifying the hurdles students face in learning mathematics (Annisa & Kartini, 2021). Rahmawati (2019) further explains that the complexity inherent in solving such narrative-based problems manifests through errors, referred to as inaccuracies in navigating through the intricacies of word problems.

Numerous studies have observed a variety of errors among students as they solve mathematical word problems (Adu et al., 2015; Haerani et al., 2021; Haghverdi et al., 2012; Verzosa-Quinto, & Mabansag, 2023). Furthermore, researchers have endeavored to investigate the potential underlying causes of these errors. Abdullah et al. (2015) introduced a taxonomy consisting of four distinct categories of errors commonly observed among students when solving mathematical problems. These categories include careless errors, conceptual errors, application errors, and procedural errors, each defined as follows: Careless errors refer to mistakes that are typically overlooked but can be identified upon careful review of one's work; conceptual errors arise due to inadequate comprehension of the properties or principles outlined in the textbook or lecture materials; application errors occur when there is a grasp

of underlying concepts but difficulty in applying them to specific scenarios or questions; procedural errors manifest when instructions are either skipped or misunderstood, yet a solution is reached nonetheless. Sepeng and Sigola (2013) conducted a case study examining errors made by 9th-grade students in mathematical word problems. Their analysis of the data revealed that students' errors in solving word problems stemmed from a lack of understanding of the mathematical terminology used in the problem statements. Davis (2019) conducted a study on junior high school learners, revealing challenges students face in recognising keywords within mathematical problems, particularly in word-based scenarios. Furthermore, Veloo et al. (2015) investigated errors made by 10th-grade students in symbols, graphs, and mathematical problem-solving. The study involved 315 students and identified several common errors, including conceptual misunderstandings, careless problem-solving, and errors in values. Santoso et al. (2017) elucidate the findings of their study, indicating that the majority of errors encountered by students when tackling mathematical word problems or mathematical tasks stem from transformation errors and deficiencies in process skills. Furthermore, Angateeah (2017) presents findings from his research indicating that high-achieving students tend to make errors in solving non-routine word problems due to carelessness, while average-achieving students commonly experience procedural errors, and low-achieving students often struggle with visualising and representing problems. Sepeng and Sigola (2013) conducted a case study on 9th-grade students' errors in mathematics word problems, revealing that these errors often stem from a lack of comprehension of the mathematical vocabulary used in problem statements. Furthermore, Tong and Loc (2017) discovered in their research that students' errors in solving mathematical problems can arise from a variety of factors, such as carelessness, subjectivity, incorrect application of calculation rules, misidentification of problem types, and inaccurate calculations. Taking these findings into account, the aim of this study is to identify errors made by students when solving mathematical word problems.

In order to assist students in effectively solving word problems, it is imperative to analyse the errors they make during the problem-solving process (Verzosa-Quinto & Mabansag, 2023). One approach to analyzing these errors is Newman's error analysis method, which delineates five stages to systematically examine students' mistakes. These stages encompass various types of errors encountered by students when tackling mathematical story problems: reading errors, comprehension errors, transformation errors, errors in procedural skills, and errors in the solving process (termination error), as outlined by White (2005).

Annizar and Kumala (2023) describes the error analysis process based on Newman's Error Analysis as follows:

a) Reading error

Reading errors may manifest. These errors arise when students struggle to comprehend words or symbols as the primary information in the problem, leading to an inability to utilise this information effectively while working on the questions. As a result, the answers provided by students often fail to align with the intended meaning or context of the problem.

b) Comprehension errors

Misunderstandings arise after students have read the questions, yet they fail to grasp what is required to address them. This leads to a misinterpretation of the information presented in the questions, hindering their ability to solve the problem effectively.

c) Transformation errors

Transformation errors occur when students understand the problem's questions but struggle to convert them into the correct mathematical format. This is often characterized by students' inability to select the appropriate mathematical operation to solve the problem.

d) Process skills error

When students are able to identify the necessary action or operation to solve a problem but fail to execute the solving procedure accurately, process skill errors emerge. This type of error may also stem from students' insufficient proficiency in counting.

e) Encoding error (mistake writing the answer)

Even after students have successfully solved math problems, errors may persist in the form of inaccurately written responses. This occurs when students misunderstand what is required or make mistakes during the solution process.

Method

This investigation employs qualitative methodology. As outlined by Davis (2019), qualitative research is characterised by the presentation of findings through descriptive language. Employing a descriptive research design, the study aims to detail and clarify the types of errors encountered by students while solving mathematical word problems. The study comprised 47 8th grade learners from one junior secondary school in the Ohangwena region. We conducted interviews with 9 out of the 47 8th grade students, specifically focusing on those who displayed a high frequency of errors. We interviewed each participant about their performance in the mathematics word problems test.

Data gathering methods employed in this study included a written test (subjective test) and an interview (based on Newman's first procedure), followed by analysis of the acquired data and information in a descriptive manner. Triangulation techniques ensured the validity of the test data. We designed the interview sheets to facilitate error analysis based on Newman's Error Analysis, which allowed the researcher to identify types of errors encountered while solving mathematical word problems (specifically, reading). According to Newman's Error Analysis, Table 1 outlines the indicators of students' errors.

Table 1. Indicators of Errors According to Newman

Types of errors	Indicators
Reading Errors	(a) The question contains important words that were not correctly interpreted. (b) Error reading main information. (c) Students do not apply the knowledge they have acquired to problem-solving.
Comprehension Errors	The students have failed to accurately capture the information in the question.
Transformation Errors	Students often struggle to translate information into accurate mathematical sentences.
Process skills errors	Students often make mistakes when performing calculations.
Encoding Errors	Students are unable to write their final answers or draw conclusions.

(Source: Suryani, 2018)

Table 2 presents a comprehensive compilation of word problems meticulously selected to serve as instrumental tools for data collection purposes. The design of these word problems specifically involves learners in comparing various scenarios, which requires them to use critical thinking skills to meticulously analyse and calculate the provided information to derive solutions.

Table 2. Written test questions

Item	Questions
1.	If you have 18 m of fabric material, 3 m is required to make a choir gown. How many gowns will you make from the fabric material?
2.	Isabella has 16 postcards, which is 7 fewer than Ashneel's postcard. How many postcards does Ashneel have?
3.	The length of a rectangular piece of land is 7 m, and the width is 5 m. Determine the perimeter of this land.
4.	A girl has 12 sweets and gives her younger sister one-third of them; how many sweets does she give her sister?

Results and Discussions

We carefully scrutinise each element of a student's work to evaluate its significance when categorising errors. We then meticulously tabulate the resulting percentages and display them in Table 3, offering a detailed breakdown for analytical reference.

Table 3. The Newman Procedure Determines the Percentage of Errors Made by Students.

Problem	Reading		Comprehension		Transformation		Processing skills		Encoding	
	N	%	N	%	N	%	N	%	N	%
1	-	-	16	34.0	20	42.6	20	42.6	20	42.6
2	-	-	5	10.6	27	57.4	27	57.4	28	59.6
3	-	-	17	36.2	35	74.6	35	74.6	36	76.6
4	-	-	20	42.6	35	74.6	35	74.6	34	72.3
Total	-	-	58	30.9	177	62.2	117	62.2	118	62.8

According to the data provided in Table 3, it is evident that out of the total 47 students who participated in the test, a noteworthy proportion exhibited errors in various aspects of word problem-solving. The word problem-solving assessments identified a total of four errors among the students. Table 3 provides a summary of the error types, their frequency (N), and the percentage distribution.

Table 3, clearly shows that none of the study participants made any reading errors in all the questions when attempted to solve the algebraic word problems. According to the table, the majority of errors occurred during the encoding stage, accounting for 62.8% of the total errors. This suggests that students encountered challenges in arriving at the correct final answers, likely due to preceding errors such as those in transformation and processing skills, which also had a significant occurrence rate of 62.2% each. This indicates a failure on the part of students to employ appropriate problem-solving methodolo-

gies. The error of comprehension was committed by 30.9% of the learners who struggled to identify the given information (known) and determine what was being asked (unknown). On the other hand, reading errors had the lowest occurrence rate at 0%, although not all students exhibited fluent reading skills. This implies that students generally had the capability to comprehend the problem statements.

Comparatively, previous studies on students' error patterns have shown a similar trend, with errors predominantly occurring at stages other than comprehension. For instance, in Trance (2013) study, transformation errors accounted for the largest proportion at 47.69%, while reading errors were minimal at 3.85%. Abdullah et al. (2015) study demonstrated the highest error percentage in encoding at 27.58%, with reading errors again registering at 0%. Similarly, Santoso et al. (2017) found transformation errors to be most prevalent at 20%, while reading errors were minimal at 2%.

Observations indicated that problem 4 exhibited a notable frequency of errors among students, whereas problem 1 was characterized by the least number of errors among the student responses. The evaluation results focused on four participants who made the most mistakes when solving word problems. We selected one problem from each student's work for analysis. Each student reviewed their test results, then participated in interviews based on their work. Figure 1 shows Learner 14 (L14)'s work on question 1.

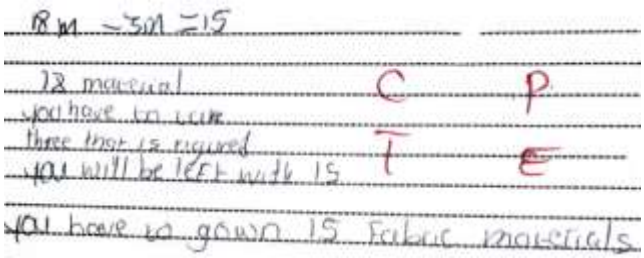

Figure 1. Test results for learner 14 on question 1

Based on Figure 1, it is apparent that L14 initially interpreted the given information as comprising 18 materials, which was inaccurate. In fact, the given information pertained to the measurement of the material, which was 18 meters. This misunderstanding indicates a comprehension error in distinguishing between what was known and what was unknown. However, L14 correctly identified the measurement required for one choir gown.

During the problem-solving process, L14 encountered difficulties in translating the information into a correct mathematical equation. Instead of employing the appropriate division operation, L14 mistakenly used subtraction. Additionally, L14 omitted to outline the method for determining the number of gowns from the provided material, indicating a lack of clarity in the transformation process. Subsequently, in the calculation stage, L14 subtracted 3 metres from the total 18 metres of material rather than dividing the total material measurement by the measurement of one choir gown. This reflects a deficiency in process skills.

In the final stage, L14 incorrectly concluded that the material could yield 15 gowns, highlighting an encoding error. Figure 2 shows Learner 2's (L2) work.

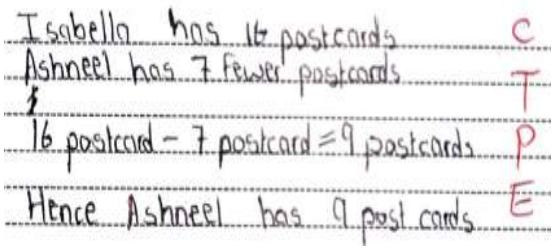

Figure 2. Shows the test results for learner 2 on question 2.

In addressing question 2, Figure 2 reveals that L2 successfully identified at least one correct piece of information, noted inaccuracies with the other piece, and failed to recognise the unknown variable. Specifically, L2 correctly noted that Isabella possesses 16 postcards. However, L2 mistakenly recorded that Ashneel has 7 fewer postcards, when in fact, it is Isabella who has 7 fewer postcards than Ashneel. This oversight in specifying the question's requirement is classified as a comprehension error. Moreover, L2 managed to document only one applicable formula for solving the problem. The failure to accurately note down the correct formulas necessary for resolving the posed question resulted in a transformation error. In the subsequent stage, L2 attempted to calculate the number of postcards Ashneel possesses by subtracting 7 from Isabella's 16 postcards, which was an incorrect approach. The proper method involved addition, not subtraction, indicating a processing skill error. Lastly, during the conclusion phase, L2 erroneously asserted that Ashneel possesses fewer postcards than Isabella—a statement that runs counter to the presented scenario and results in an encoding error. This series of mistakes demonstrates a fundamental misunderstanding of the problem's requirements and the mathematical operations needed to solve it. Figure 3 shows the work of Learner (L31)."

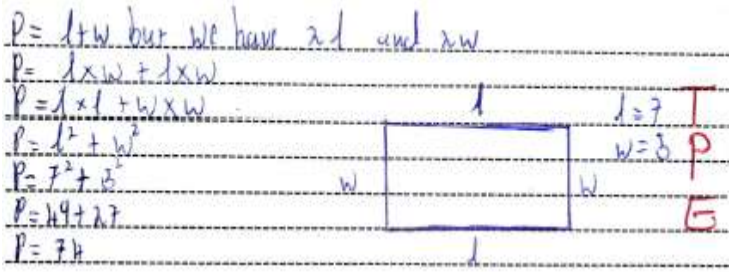

Figure 3. Test results for learner 31 on question 3

Figure 3 shows L31's progress in solving question 3. L31 correctly identified the known and unknown aspects of the problem. The problem is known to concern a rectangular piece of land with a length of 7 meters and a width of 5 meters. L31 correctly recognized that the question asked about the land's area. Furthermore, the learner correctly drew the shape of the land as a rectangle. However, L31 wrote down an incorrect formula to solve the problem. Instead of using the correct formula $P = l \times w + l \times w$, which represents the perimeter of a rectangle, L31 wrote $P = l + w + l + w$something else. This mistake indicates a transformation error. During the calcula-

tion process to determine the area of the land, L31 mistakenly multiplied the length (7 metres) and the width (5 metres) together, which is incorrect. This oversight indicates a process skill error, as it failed to follow the correct calculation method. In the final step, L31 did not arrive at the correct solution for the given problem, indicating an Encoding error. Figure 4 depicts Learner (L7)'s work.

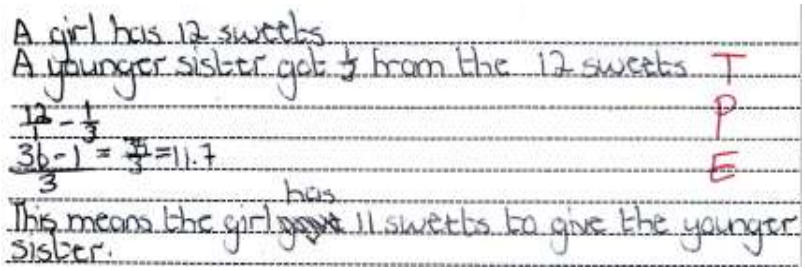

Figure 4. Test results for learner 7 on question 4.

As shown in Figure 4, in question number 4, L7 accurately recorded the initial information, stating that the girl in the provided problem possesses 12 sweets and that the younger sister has 1/3 of the 12 sweets. This suggests no error in the reading and comprehension stages. However, L7 omitted to document the formulas utilised to derive a solution for the given problem, resulting in a transformation error. Furthermore, L7 executed the process incorrectly by subtracting 1/3 from 12 sweets instead of multiplying the 12 sweets by the specified portion (1/3) allocated to the younger sister. This signifies an error in the process skill. In this scenario, the learner indicated that the younger sister received 11 sweets, whereas the correct calculation would yield 4 sweets after multiplying 12 by 1/3. Therefore, L7 failed to provide the accurate final answer, indicating an incomplete resolution of the problem across various stages, leading to an encoding error.

Conclusions

After analysing the data, it can be concluded that Grade 8 learners made errors in four distinct categories when answering word problems. These errors include comprehension errors, transformation errors, process skill errors, and encoding errors. This finding indicates that Grade 8 learners frequently encounter difficulties aligning with Newman's procedures as follows: In the comprehension stage, 30.9% of the learners struggled to identify the given information (known) and determine what was being asked (unknown). During the transformation stage, 62.2% of the learners faced challenges in devising problem-solving strategies, resulting in difficulties converting word information into correct mathematical formulas and equations. In terms of process skills, 62.2% of the learners failed to apply the appropriate operations when solving word problems, leading to errors in calculations. In the encoding stage, a large percentage of 62.8% of the learners encountered difficulties in drawing conclusions, often due to the use of incorrect formulas, while, 0% of the participants made reading errors during the algebraic word problems test.

Based on the aforementioned research findings, the study offers the following suggestions:

1. Teachers should provide more word problems based on real-life situations to enhance learners' proficiency in solving mathematical word problems.

2. The study recommends incorporating Newman's procedures into the teaching and learning of mathematical word problems.

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Declaration of Conflicting Interests

The authors declare that there are no conflicting interests regarding the publication of this paper.

References

Abdullah, A. H., Abidin, N. L. Z., & Ali, M. (2015). Analysis of students' errors in solving Higher Order Thinking Skills (HOTS) problems for the topic of fraction. *Asian Social Science*, *11*(21), 133-142. https://doi.org/10.5539/ass.v11n21p133

Adu, E., Assuah, C. K., & Asiedu-Addo, S. K. (2015). Students' errors in solving linear equation word problems: Case study of a Ghanaian senior high school. *African Journal of Educational Studies in Mathematics and Sciences*, *11*, 17-30.

Angateeah, K. S. (2017). An investigation of students' difficulties in solving non-routine word problem at lower secondary. *International Journal of Learning and Teaching*, *3*(1), 46-50.

Annisa, R., & Kartini, K. (2021). Analisis Kesalahan Siswa dalam Menyelesaikan Soal Barisan dan Deret Aritmatika Menggunakan Tahapan Kesalahan Newman. *Jurnal Cendekia: Jurnal Pendidikan Matematika*, *5*(1), 522–532. https://doi.org/10.31004/cendekia.v5i1.506

Annizar, A. M., & Kumala, D. F. (2023). Analysis of student problem-solving errors based on Newman's theory in terms of learning interest and gender. *Alifmatika: Jurnal Pendidikan Dan Pembelajaran Matematika*, *5*(1), 40-56. https://doi.org/10.35316/alifmatika.2023.v5i1.40-56

Bal, A. P., & Artut, P. D. (2022). Investigation of primary school students solving arithmetic verbal problems. *Journal of Education and Learning (EduLearn), 16*(1), 76-*84.*

Chu, J., Rittle-Johnson, B., & Fyfe, E. R. (2017). Diagrams aid symbolic problem-solving. *British Journal of Educational Psychology*, *87*(2), 273-287. https://doi.org/10.1111/bjep.12149

Davis, E. K. (2019). Linguistic influences on junior high school students' mathematics word problem solving: linguistic influences on junior high school students' mathematics word problem solving. *Ghana Journal of Education: Issues and Practice (GJE)*, *5*, 20-48. https://doi.org/10.47963/gje.v5i.464

Dietiker, L. (2015). Mathematical story: A metaphor for mathematics curriculum. *Educational Studies in Mathematics*, *90*(3), 285–302. https://doi.org/10.1007/s10649-015-9627-x.

Emanuel, E. P. L., Kirana, A., & Chamidah, A. (2021). Enhancing students' ability to solve word problems in mathematics. *Journal of Physics: Conference Series*, *1832*(1), 1–10. https://doi.org/10.1088/1742-6596/1832/1/012056

Ginsburg, L. (2022). Mathematical Word Problems in Adult Education: What the Research Says. *Adult Literacy Education*, *4*(3), 66-72.

Haerani, A., Novianingsih, K., & Turmudi, T. (2021). Analysis of students' errors in solving word problems viewed from mathematical resilience. *JTAM (Jurnal Teori dan Aplikasi Matematika)*, *5*(1), 246-253. https://doi.org/10.31764/jtam.v5i1.3928

Haghverdi, M., Semnani, A. S., & Seifi, M. (2012). A relação entre diferentes tipos de erros cometidos por estudantes eo conhecimento exigido para resolver problemas-palavra. *Bolema: Boletim de Educação Matemática*, *26*(42B), 649-666.

Iilonga, H. K., & Ogbonnaya, U. I. (2023). Grade 10 Namibian learners' problem-solving skills in algebraic word problems. *Infinity Journal*, *12*(2), 275-290.

Lai, C. F. (2012). Error Analysis in Mathematics. Technical Report# 1012. *Behavioral Research and Teaching*.

Nursyahidah, F., Saputro, B. A., & Rubowo, M. R. (2018). Students Problem Solving Ability Based on Realistic Mathematics with Ethnomathematics. *Journal of Research and Advances in Mathematics Education*, *3*(1), 13-24.

Prasad, B. D. (2019). Qualitative Content Analysis: Why is it Still a Path Less Taken? *Forum Qualitative Sozialforschung Forum: Qualitative Social Research*, *20*(3), 1-21. https://doi.org/10.17169/fqs-20.3.3392

Rahmawati, A. (2019). Analisis kesulitan siswa dalam menyelesaikan soal cerita matematika berbasis pembelajaran pemcahan masalah kelas V SD Negeri Gebangsari 01. *Jurnal Pengembangan Pembelajaran Matematika*. *1*(2). 104-109.

Santoso, D. A., Farid, A., & Ulum, B. (2017). Error analysis of students working about word problem of linear program with NEA procedure. In *Journal of Physics: Conference Series, 855*(1), 012043.

Santoso, Y. O., Yunita, A., & Muslim, A. P. (2022). Analysis of error solution of mathematics stories based on Watson Criteria. *Jurnal Pendidikan Matematika dan IPA*, *13*(2). https://doi.org/10.26418/jpmipa.v13i2.48039

Schmidt, R. (2012). Attention, awareness, and individual differences in language learning. *Perspectives on individual characteristics and foreign language education*, *6*(27), 27-49.

Sepeng, P., & Sigola, S. (2013). Making sense of errors made by learners in mathematical word problem solving. *Mediterranean Journal of Social Sciences*, *4*(13), 325-333.

Setiyawati, E., Fauziati, E., & Prastiwi, Y. (2022). Analysis problem solving errors in mathematics story questions. *JPI (Jurnal Pendidikan Indonesia)*, *11*(3), 466-479. https://dx.doi.org/10.23887/jpiundiksha.v11i3.46980

Suryani, D. R., Nengsih, L. W., Sianturi, M., Nur'Aini, K. D., & Meirista, E. (2018). An analysis of grade IV's error on the whole number based on Newman's procedure's cognitive style. In *International Conference on Science and Technology (ICST 2018)* (pp. 849–852). Atlantis Press.

Tong, D. H., & Loc, N. P. (2017). Students' errors in solving mathematical word problems and their ability in identifying errors in wrong solutions. *European Journal of Education Studies*, *3*(6), 226-241. https://doi.org/10.5281/zenodo.581482

Trance, N. J. C. (2013). Process Inquiry: Analysis of Oral Problem-Solving Skills in Mathematics of Engineering Students. *Online Submission*, *3*(2), 73-82.

Veloo, A., Krishnasamy, H. N., & Wan Abdullah, W. S. (2015). Types of student errors in mathematical symbols, graphs, and problem solving. *Asian Social Science*, *11*(15), 324-334.

Verschaffel, L., Schukajlow, S., Star, J., & Van Dooren, W. (2020). Word problems in mathematics education: A survey. *ZDM*, *52*, 1-16.

Verzosa-Quinto, E. M., & Mabansag, A. B. (2023). Error Analysis in Solving Word Problems among Grade 8 Students. International Journal of Current Science Research and Review, 06(10), 6585–6599. https://doi.org/10.47191/ijcsrr/V6-i10-10

White, A. L. (2005). Active Mathematics in Classrooms: Finding Out Why Children Make Mistakes—And Then Doing Something to Help Them. Square One, *15*(4), 15-19.

Xin, Y. P., Wiles, B., & Lin, Y. Y. (2008). Teaching conceptual model—based word problem story grammar to enhance mathematics problem solving. *The Journal of Special Education*, *42*(3), 163–178. https://doi.org/10.1177/0022466907312895

Yunus, J., Zaura, B., & Yuhasriati, Y. (2019). Analysis of Students Error According to Newman in Solving Mathematics Problems of Algebra in The Form of Story in Second Grade of SMPN 1 Banda Aceh. *Jurnal Geuthèë: Penelitian Multidisiplin*, *2*(2), 308–313. https://doi.org/10.52626/jg.v2i2.63