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ANALYSIS OF STUDENTS' ERRORS IN SOLVING ADDITION AND SUBTRACTION PROBLEMS USING THE NEWMAN TECHNIQUE

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Abstract
The ability to solve mathematical word problems is an essential skill for elementary school students, as it involves contextual understanding and mathematical reasoning. However, in practice, students still experience various difficulties in solving addition and subtraction word problems. This study aims to analyze the types and patterns of errors made by students in solving word problems based on the Newman Error Analysis stages. This study employed a descriptive qualitative approach involving six third-grade elementary school students in Sumedang Regency as research participants. Data were collected through a written test consisting of three contextual word problems completed individually. Data analysis was conducted by identifying errors at the stages of reading, comprehension, transformation, process skills, and encoding. The findings indicate that the most dominant errors occurred at the comprehension and transformation stages, particularly in interpreting information and determining appropriate mathematical operations. Errors at the process skills and encoding stages were also identified, but with lower frequency. The study concludes that the ability to solve word problems needs to be supported by strengthening mathematical literacy and the use of Newman's Error Analysis as a diagnostic tool in instruction.
Keywords: *error analysis; word problems; addition and subtraction; Newman technique*

Abstrak
Kemampuan menyelesaikan soal cerita matematika merupakan keterampilan penting bagi siswa sekolah dasar karena melibatkan pemahaman konteks dan penalaran matematis. Namun, dalam praktiknya, siswa masih mengalami berbagai kesulitan dalam menyelesaikan soal cerita penjumlahan dan pengurangan. Penelitian ini bertujuan untuk menganalisis jenis dan pola kesalahan yang dilakukan oleh siswa dalam menyelesaikan soal cerita berdasarkan tahapan Teknik Newman. Penelitian ini menggunakan pendekatan kualitatif deskriptif dengan melibatkan enam siswa kelas III sekolah dasar di Kabupaten Sumedang sebagai subjek penelitian. Data diperoleh melalui tes tertulis berupa tiga soal cerita kontekstual yang dikerjakan secara individu. Analisis data dilakukan dengan mengidentifikasi kesalahan pada tahap membaca, memahami masalah, transformasi, keterampilan proses, dan penulisan jawaban akhir. Hasil penelitian menunjukkan bahwa kesalahan paling dominan terjadi pada tahap memahami masalah dan transformasi, khususnya dalam menafsirkan informasi dan menentukan operasi matematika yang tepat. Kesalahan pada tahap keterampilan proses dan penulisan jawaban akhir juga ditemukan, namun dengan frekuensi yang lebih rendah. Simpulan penelitian ini menunjukkan bahwa kemampuan menyelesaikan soal cerita perlu didukung oleh penguatan literasi matematika serta penggunaan Teknik Newman sebagai alat diagnosis dalam pembelajaran.
Kata kunci: analisis kesalahan; soal cerita; penjumlahan dan pengurangan; teknik Newman

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Introduction

Mathematics learning is one of the core subjects in elementary school that plays an important role in developing students' logical, critical, and systematic thinking skills. Through mathematics instruction, students are expected not only to perform procedural calculations but also to understand concepts and relate them to real-life contexts. The National Council of

Teachers of Mathematics (2020) emphasizes that high-quality mathematics instruction focuses on conceptual understanding and mathematical reasoning rather than merely the accuracy of final answers. In line with this, Hiebert and Grouws (2019) state that meaningful mathematics learning provides opportunities for students to construct understanding through thinking activities, discussions, and problem-solving processes. Therefore, mathematics instruction in elementary school needs to be designed meaningfully in order to provide a strong foundation for mastering mathematical concepts at higher levels of education.

At the elementary level, mathematics learning serves not only as computational activity but also as a means to develop problem-solving skills related to real-life situations (Rismawati & Hutagaol, 2018). One form of problem that represents this objective is word problems, particularly in basic arithmetic operations such as addition and subtraction. Word problems require students to read and understand the presented situations, identify relevant information, determine appropriate mathematical operations, and organize solution steps systematically. Therefore, success in solving word problems reflects students' comprehensive understanding of mathematical concepts. When students fail to solve such problems, it often indicates difficulties in the underlying thinking processes rather than merely computational limitations.

Previous studies indicate that word problems are among the most challenging types of problems for elementary school students (Mariyati et al., 2018). Research in mathematics education reveals that many students experience difficulties in understanding the language of problems, interpreting story contexts, and connecting verbal information with appropriate mathematical operations (Verschaffel et al., 2020; Pongsakdi et al., 2020; Daroczy et al., 2021). These difficulties often lead to inappropriate solution strategies, such as applying operations based solely on the presence of numbers without considering the meaning of the context. Similar patterns were observed in the students' work analyzed in this study, where errors occurred in selecting operations, performing procedures, and writing final answers in contextual addition and subtraction problems.

Recent studies further highlight that difficulties in solving word problems are influenced by linguistic, cognitive, and contextual factors (Walkington et al., 2020; Daroczy et al., 2021). The complexity of language affects students' comprehension, while limitations in identifying relevant information hinder the construction of appropriate mathematical models (Boonen et al., 2020; Wijaya et al., 2021). In addition, higher-order thinking skills (HOTS), particularly analysis and reasoning, play a significant role in successful problem solving (Krawec & Montague, 2021; Powell & Fuchs, 2021). Without sufficient analytical abilities, students tend to rely on superficial strategies. This tendency reflects procedural thinking rather than meaningful reasoning, as also emphasized in schema-based instruction research (Xin & Zhang, 2021). Moreover, international assessments such as PISA show that students' mathematical literacy, especially in interpreting and modeling real-world problems, remains a challenge (OECD, 2023). These findings suggest that mathematics instruction should prioritize contextual understanding and modeling skills.

Studies on students' errors in mathematics indicate that errors are not isolated but occur in interconnected stages. Students who are able to perform calculations correctly may still produce incorrect answers due to failure in understanding the problem context (Damayanti et al., 2017). Other studies show that errors frequently occur when students transform verbal information into mathematical models (Rahayu, 2016). This suggests that analyzing errors based solely on final answers is insufficient. Instead, errors should be examined through the stages of the problem-solving process. In this context, error analysis becomes an important tool to identify students' misconceptions and to support more targeted instructional interventions (Amini & Yunianta, 2018).

One widely used approach to analyze students' errors is the Newman Error Analysis Technique, which classifies errors into five stages: reading, comprehension, transformation, process skills, and encoding (Fatahillah et al., 2017). Previous studies consistently report that comprehension and transformation errors are the most dominant types among elementary students (Fatahillah et al., 2017; Sennen et al., 2016). These findings indicate that students' difficulties are closely related to interpreting contextual information and constructing mathematical representations. However, process skill and encoding errors are often reported as secondary consequences of earlier misunderstandings.

However, although previous studies have successfully identified dominant types of errors, most of them remain descriptive and focus primarily on general classifications without examining how these errors are interconnected within students' cognitive processes. In addition, limited attention has been given to early-grade students, particularly in the context of foundational topics such as addition and subtraction, which play a crucial role in shaping subsequent mathematical understanding. This indicates a gap in the literature regarding how error patterns develop and interact at the initial stages of mathematics learning.

Therefore, this study does not merely replicate previous research but aims to strengthen and extend existing findings by focusing specifically on lower elementary students and analyzing error patterns in addition and subtraction word problems. By examining how errors occur across Newman's stages and how they are related to one another, this study seeks to provide a deeper understanding of students' problem-solving processes and contribute to bridging the gap between error identification and conceptual understanding.

Thus, this study is grounded in the conceptual framework of mathematical problem solving and Newman's Error Analysis, which views errors as a sequential cognitive process involving reading, comprehension, transformation, process skills, and encoding (Newman, 1977). This framework provides a systematic basis for analyzing students' difficulties and understanding how problem-solving skills develop in elementary mathematics learning.

Based on the above description, this study focuses on analyzing students' errors in solving addition and subtraction word problems using the Newman Technique. This study is expected to provide theoretical contributions to the development of mathematics education research and practical contributions for teachers in improving the quality of mathematics instruction in elementary schools.

Research Methods

This study employed a descriptive qualitative approach, specifically a qualitative descriptive case study, to analyze students' error patterns in solving mathematical word problems under natural conditions without manipulating variables (Creswell & Creswell, 2018; Merriam & Tisdell, 2020). This approach is appropriate for capturing students' cognitive processes and error patterns in a natural problem-solving context. A qualitative design was selected because the focus of this study is to understand how and why errors occur across different stages of problem solving rather than to measure them quantitatively. Error analysis requires in-depth interpretation of students' thinking processes, as the data are process-oriented and reflect students' reasoning, interpretation, and decision-making when solving problems.

The research was conducted in the second semester of the 2024/2025 academic year at an elementary school in Sumedang Regency, West Java Province. The subjects were six third-grade students selected purposively based on pedagogical considerations that Grade III

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represents a crucial stage in strengthening basic arithmetic concepts and introducing word problems as foundational mathematical problem-solving tasks. The selection criteria included students who had learned addition and subtraction word problems and were able to complete the tasks independently. The participants represented varying levels of academic ability (high, medium, and low) to capture diverse error patterns. Students' responses were collected individually to ensure that the data reflected their authentic abilities and thinking processes.

The number of participants was intentionally limited to six students to allow an in-depth analysis of students' error patterns based on the Newman Error Analysis framework. In qualitative research, the focus is not on the number of participants but on the richness and depth of the data (depth over breadth). Each student's response was analyzed comprehensively across all problem-solving stages to capture detailed cognitive processes and recurring error patterns. Therefore, the selected participants were considered sufficient to represent typical variations of errors within the scope of this study, although the findings are not intended for statistical generalization.

Data were obtained through a written test consisting of three addition and subtraction word problems situated in familiar daily-life contexts, such as marbles, candies, and notebooks. The instrument was designed to assess students' abilities to read and comprehend problems, identify known and unknown information, transform verbal statements into mathematical models, and perform appropriate operations. The test items were developed based on the elementary mathematics curriculum and relevant literature on word problem solving, and were validated through expert judgment by a mathematics education lecturer and an elementary school teacher to ensure content validity and clarity. A pilot test was also conducted with students outside the research subjects to evaluate the readability and level of difficulty of the items. The data collection was carried out during regular classroom hours in the second semester of the 2024/2025 academic year, with a duration of approximately 30–40 minutes in a classroom setting under teacher and researcher supervision to ensure independent work. All answer sheets were collected and documented as the primary data source, and students' solution steps were analyzed to capture their mathematical reasoning processes.

Data analysis followed the interactive model proposed by Creswell (2018), which includes data reduction, data display, and conclusion drawing. Students' responses were reduced by focusing on segments indicating errors and then organized into narrative descriptions and classification tables based on the Newman Error Analysis stages: reading, comprehension, transformation, process skills, and encoding. The analysis involved coding each response according to the type and stage of error, followed by categorization to identify recurring patterns. To ensure consistency, the data were repeatedly reviewed, and an additional rater (a mathematics teacher) was involved to validate the coding results. Data validity was strengthened through triangulation by comparing responses across problems and through discussions with experts to confirm the interpretations. The findings provide an in-depth and accountable description of students' errors in solving addition and subtraction word problems.

Results and Discussion

The research data were derived from third-grade students' written responses to the instrument entitled *"Understand and Solve Word Problems,"* which consisted of three word problems related to addition and subtraction operations. These problems required students to demonstrate their ability to: (1) read quantitative information presented in the text, (2) comprehend the intent of the question, (3) transform the information into an appropriate mathematical model (i.e., select the correct operation), (4) perform the necessary calculations, and (5) write the final answer correctly. All of these stages were analyzed using the Newman Error Analysis framework.

Although the number of analyzed answer sheets was limited to six students, each response was examined in depth to identify consistent and recurring error patterns. The purpose of this analysis was not to generalize findings statistically, but to provide a detailed description of students' thinking processes and error characteristics across Newman's stages. This approach aligns with qualitative research principles that emphasize depth of analysis over the number of participants.

To enhance clarity in presenting the findings, a summary of the problem structures and the corresponding correct conceptual answers is first provided. This step is essential because many students' errors in word problems are not merely computational mistakes, but rather errors in selecting the appropriate mathematical operation due to misinterpretation of the situational meaning embedded in the story context. This study involved six third-grade students, and a preliminary analysis shows that errors were not evenly distributed across problems. For instance, most students were able to solve Problem 1 correctly, while Problem 2 generated the highest number of errors, with five out of six students showing comprehension and transformation errors. In Problem 3, errors were found in about half of the students, particularly in incomplete modeling of the problem situation. The following table presents a summary of the problems, the required operations, and the correct conceptual answers.

Table 1. "Summary of Word Problem Structures and Corresponding Mathematical Models"

No.	Core Context of the Problem	Required Operation (Correct Model)	Correct Answer
1	Ahmad gave 13 marbles to Budi and 19 to Candra. The question asks for the total number of marbles given.	13 + 19	32
2	A student had 78 candies. He later received 36 and 17 candies. The question asks for the number of candies before receiving the additional candies.	78 − 36 − 17	25
3	Rani had 25 notebooks, bought 17 more, and then gave away 12. The question asks for the number of notebooks Rani has now.	25 + 17 − 12	30

Based on observations of six available student answer sheets, the following major patterns emerged:

1. Problem 1 tended to be easier
   The majority of students were able to select the correct operation (addition of 13 and 19) and obtain the result of 32. This indicates that in the context of "given to two people" with the question "how many were given in total," many students were able to interpret the meaning of "total given" as addition.
2. Problem 2 generated the most errors
   Several students applied a strategy of "adding all visible numbers" (for example, writing 36 + 17 = 53, or 78 + 36 + 17 = 131). This suggests dominant errors at the

comprehension and transformation stages, since Problem 2 actually asked for the "amount before," meaning the correct model should involve subtraction from 78.

3. Problem 3 revealed two pattern groups
   Some students successfully modeled the sequence of events (had 25, bought 17, gave away 12), resulting in 30. However, others ignored one piece of information (for example, calculating only 25 − 12 = 13), indicating weaknesses at the comprehension and transformation stages.

Thus, the findings indicate that students' primary difficulties lie in understanding key terms (such as *before*, *received*, *gave away*) and transforming them into correct mathematical operations, rather than in computational skills alone.

Table 2. Descriptive Matrix of Students' Errors Based on Newman's Stages

Answer Sheet Code	Problem 1 (13+19)	Problem 2 ("before")	Problem 3 (25+17−12)	Descriptive Notes
S1	Correct (32)	C–T (added 36 and 17 to get 53; ignored "before" and 78 as final total)	T–P (wrote 17 and 12, result 28; did not model 25, buy 17, give 12 completely)	S1 appeared "trapped" by visible numbers and defaulted to addition, especially in Problems 2–3.
S2	Correct (32)	C–T (36+17=53)	T/P (steps did not represent 25+17−12 fully; final answer inconsistent)	Strong in Problem 1; difficulty interpreting questions in Problems 2 and 3.
S3	T/P/E (wrote 52 instead of 32; possible miscalculation or misrepresentation)	C–T (78+36+17=131; interpreted "before" as accumulation)	Correct (25+17=42; 42−12=30)	Interesting contrast: capable of two-step reasoning in Problem 3 but conceptually incorrect in Problem 2.
S4	Correct (32)	C–T (added 36 and 17; result did not lead to 25)	Correct (30)	Correctly modeled "add then subtract" in Problem 3 but misunderstood "before" in Problem 2.
S5	Correct (32)	C–T (calculation did not reflect subtraction from 78)	Correct (30)	Consistent pattern: Problem 2 remained the primary difficulty.

S6	Correct (32)	C–T (78+36=114; added instead of subtracting)	C–T (25−12=13; ignored "bought 17")	Tendency to omit relevant information, especially in Problem 3.

Note:
R = Reading error
C = Comprehension error
T = Transformation error
P = Process skill error
E = Encoding error

1. Problem 1 (Total marbles given)
   Most students were able to extract the two key numbers (13 and 19) and combine them to obtain 32. This indicates that in a straightforward "two contributions" context, students can interpret keywords correctly. However, a few answer sheets displayed incorrect outputs (e.g., 52), suggesting process skill or encoding errors. In Newman's framework, these cases fall into process skill or encoding errors, since the selected operation was appropriate but the final output was inaccurate.
2. Problem 2 ("Number of candies before")
   Problem 2 was the most dominant source of errors. Conceptually, if a student has 78 candies after receiving 36 and 17, the previous amount must be determined by subtracting the additions. However, several students performed addition (36+17=53) or even added all numbers (78+36+17=131). In Newman's terms, these errors primarily occurred at the comprehension stage (failure to interpret "before" as an initial state) and the transformation stage (failure to convert the situation into subtraction). This reflects an "instant strategy" tendency: see numbers → add, without analyzing the temporal relation "before–after."
3. Problem 3 (Rani's notebooks now)
   This problem required two-step modeling: addition (buying) followed by subtraction (giving away). Some students correctly wrote 25+17=42 and 42−12=30, demonstrating stepwise procedural reasoning. However, others omitted the information "bought 17" and directly calculated 25−12=13. In Newman's framework, this reflects comprehension and transformation errors. The pattern suggests that some students struggle to maintain consistency in narrative sequencing when more than one action is involved.

The findings of this study confirm that students' errors in solving addition and subtraction word problems do not occur independently; rather, they form an interconnected sequence across Newman's stages. Out of six students, five showed errors at the comprehension and transformation stages, particularly in Problem 2. In Problem 3, three students demonstrated errors related to incomplete modeling, while only one student made errors at the process skills or encoding stage. These results indicate that students' errors tend to occur sequentially and are interconnected across different stages of problem solving. Within the context of Higher-Order Thinking Skills (HOTS), the most prominent errors were found in the domains of analysis and reasoning rather than mere computation (Rismawati, 2016). When students are required to solve word problems, they engage in higher-order cognitive activities: interpreting situations, selecting relevant information, constructing mathematical models, and evaluating whether the final answer aligns with the given context. This aligns with Kilpatrick et al. (2001), who argue that conceptual understanding and adaptive reasoning are central components of mathematical proficiency, alongside procedural fluency. In the analyzed data, these HOTS components appeared particularly fragile in Problem 2 and partially in Problem 3.

1. Dominant Errors in Comprehension and Transformation as Indicators of Weak HOTS

   The dominance of errors in Problem 2 indicates that keywords such as *"before"* were not fully understood as markers of temporal relationships. Consequently, students failed to construct the appropriate cause–effect structure: "final total = initial total + additions," implying that to determine the initial total, the inverse operation (subtraction) must be applied. This is precisely where HOTS becomes essential: students must analyze relationships between statements rather than merely process numbers. When students answered 36 + 17 = 53, they demonstrated computational ability but failed to analyze contextual meaning. Likewise, when students wrote 78 + 36 + 17 = 131, they applied an incorrect procedural generalization (every number → add).

   Such transformation errors are often associated with instructional practices that emphasize procedural drills in isolation, without habituating students to interpret contextual narratives. As a result, students develop oversimplified heuristics, such as "word problems = addition." This explains why Problem 1 (which indeed required direct addition) was relatively successful, whereas Problem 2 (which required inverse reasoning) resulted in substantial failure.

2. The Phenomenon of "Omitting Information" in Problem 3: Issues of Relevant Information Selection

   In several responses, students ignored the information "bought 17 more" and directly calculated 25 − 12. This indicates instability in selecting relevant information—distinguishing which elements must be included in the mathematical model and which serve merely as contextual details. Within HOTS, information selection constitutes an essential analytical skill, requiring students to filter data and construct coherent problem representations. Responses that only performed 25 − 12 reveal that students did not fully construct the sequence of events. Interestingly, some students successfully solved Problem 3 using a two-step model (25 + 17 = 42, then 42 − 12 = 30), demonstrating emerging stepwise modeling ability. However, this competence was not yet consistent across all students.

3. Process Skill Errors

   Some responses showed incorrect results despite the correct selection of operations (e.g., adding 13 and 19 but producing an inaccurate sum). Within Newman's framework, such cases are categorized as process skill errors or encoding errors. These errors often occur when students rush or fail to recheck their work. Although less dominant than comprehension and transformation errors, process skill errors remain significant, highlighting the need to cultivate careful procedural habits and verification practices.

4. Instructional Implications: Strengthening Mathematical Literacy and Using Newman as Formative Assessment

   Practically, these findings suggest several targeted instructional recommendations. First, teachers should habituate students to conduct "information mapping" before performing calculations: identifying keywords (*before, received, gave away, now*), rewriting known and unknown information in their own words, and determining the appropriate operation. Second, practice should not be limited to routine word problems but should include varied structures involving final totals, initial amounts, and changes, so students understand the relationship among "initial–change–final" quantities. Third, Newman's Error Analysis can function not only as a research framework but also as a classroom diagnostic tool (formative assessment). Teachers may guide students through simplified Newman questions:

How did you read the problem?

What is being asked?

What operation will you use?

How did you calculate it?

Does your answer match the story?

Such reflective questioning promotes HOTS by encouraging students to justify reasoning rather than merely produce numerical answers. These findings align with mathematical problem-solving theory emphasizing contextual understanding as the foundation of procedural work. Polya (1957) asserts that understanding the problem is the decisive step in successful problem-solving. When students fail to interpret situational meaning, their strategies become mechanical and decontextualized. Mayer (2002) similarly notes that errors in word problems generally stem from failures in constructing accurate mental representations rather than from limited computational skills.

Within higher-order thinking, weaknesses in comprehension and transformation reflect insufficient analytical and reasoning abilities. Brookhart (2010) emphasizes that HOTS requires students to identify relationships and select strategies appropriate to contextual demands. When students automatically apply addition without considering "initial–change–final" relationships, analytical thinking has not yet been achieved. Hiebert and Grouws (2019) further argue that conceptual understanding develops when students reason about the meaning underlying procedures rather than merely memorizing solution steps.

Repeated transformation errors may also be explained through Skemp's (1976) distinction between instrumental and relational understanding. Students relying primarily on instrumental understanding tend to apply quick procedural rules without grasping the rationale for selecting operations. Consequently, they struggle when confronted with inverse-operation tasks, as seen in Problems 2 and 3. NCTM (2020) emphasizes that mathematical literacy requires the ability to interpret, model, and evaluate real-life situations mathematically, thereby necessitating instructional environments that prioritize meaning-making over final answers.

Moreover, the phenomenon of omitting relevant information highlights limitations in students' information selection skills. According to OECD (2019), the ability to identify relevant information is central to mathematical literacy and constitutes a key indicator of HOTS-based assessment. Students must be trained to read reflectively and construct logical event sequences. In this regard, Newman's Error Analysis (Newman, 1977) provides an effective systematic framework for identifying weaknesses across stages—from reading and comprehension to transformation and encoding. When used formatively, this technique can guide teachers in designing targeted interventions that strengthen students' mathematical reasoning.

Overall, the findings suggest that students' errors in solving addition and subtraction word problems may not be understood solely through the correctness of final answers. Instead, they tend to be better explained through the cognitive processes students undergo at each problem-solving stage. The dominance of comprehension and transformation errors may indicate the importance of strengthening mathematical literacy and modeling skills from the early elementary grades. Furthermore, Newman's Error Analysis can be considered a useful lens for understanding students' thinking patterns and for developing targeted instructional recommendations.

However, this study has several limitations. The number of participants was limited to six students, which may not fully represent the diversity of students' abilities and error patterns in broader contexts. Therefore, the findings of this study are context-specific and are not intended for generalization to larger populations. Future studies are recommended to involve a larger number of participants or combine qualitative and quantitative approaches to obtain more comprehensive results.

Theoretically, this study contributes to the development of mathematics education research by providing empirical evidence that students' errors in word problems are hierarchical and interconnected across Newman's stages, particularly at the comprehension and transformation levels. This finding reinforces existing theories on mathematical literacy and higher-order thinking skills (HOTS), emphasizing that difficulties in problem solving are more closely related to weaknesses in contextual understanding and reasoning rather than procedural computation alone. In addition, this study extends previous research by focusing specifically on lower elementary students in the context of basic arithmetic operations, which are often underexplored despite their foundational role in mathematics learning.

Practically, the findings of this study provide important implications for classroom instruction. Teachers are encouraged to emphasize the development of students' mathematical literacy by guiding them to interpret problem contexts, identify relevant information, and construct appropriate mathematical models before performing calculations. The use of Newman's Error Analysis as a formative assessment tool can help teachers diagnose students' difficulties more accurately and design targeted interventions. Furthermore, incorporating structured questioning strategies and varied word problem types can support students in developing analytical thinking and improving their ability to solve contextual mathematical problems effectively.

Conclusion

This study concludes that third-grade elementary students' errors in solving addition and subtraction word problems, analyzed using Newman's Error Analysis, most dominantly occurred at the comprehension and transformation stages. Students experienced difficulties in interpreting keywords and converting verbal information into appropriate mathematical models, leading to incorrect selection of operations. These findings indicate that the primary obstacle does not lie in basic computational skills but rather in analyzing contextual meaning and constructing accurate mathematical representations. Although process skill and encoding errors were also identified, they occurred less frequently and generally represented subsequent effects of earlier comprehension and transformation errors. Therefore, elementary mathematics instruction should place greater emphasis on strengthening word problem comprehension, mathematical literacy, and analytical reasoning habits. Utilizing Newman's framework as a diagnostic tool can support teachers in designing more effective and targeted instructional strategies.

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