e-ISSN: 2808-8263
p-ISSN: 2829-0976

Misconceptions on Multiplication Material in Grade IV Elementary School Based on Newman's Procedure

Istiqomah [1*], Tatang Herman [2], Febrialita Salma Dwinandha Putri [3], Cut Rania Kirana [4]

[1,2,3] Elementary Education Study Program, Graduate School, Indonesian University of Education

Istiqomah21@upi.edu , tatangherman@upi.edu , blorasalma394@gmail.com , cutrania.kirana55@upi.edu

Abstract. This study aims to describe the misconceptions of fourth grade elementary school students in solving multiplication problems through error analysis based on the Newman procedure. The approach used is descriptive qualitative, with 13 students selected by purposive sampling as research subjects. Data were obtained through tests and in-depth interviews to understand the patterns of students' errors at each stage of solving multiplication problems. The Newman procedure was used as an analysis framework, which includes five stages: understanding the problem, translating the problem, performing operations, writing answers, and rechecking the answers. The results showed that students experienced misconceptions at various stages of problem solving, especially at the stages of understanding the problem and translating the problem. Students tended to misinterpret multiplication operations and made mistakes in calculating nested multiplication. These findings indicate that misconceptions at the early stages can have an impact on subsequent errors that hinder the success of solving the problem as a whole. Based on the results of the study, it is hoped that teachers can develop more effective learning strategies to help students understand the concept of multiplication in depth and prevent misconceptions from occurring.

Keywords: Misconceptions, arithmetic operations, multiplication, mathematics, elementary school

How to Cite: Istiqomah., Herman, T., Putri, F. S. D., & Kirana, C. R., (2025). Misconceptions on Multiplication Material in Grade IV Elementary School Based on Newman's Procedure. The 7th International Conference on Elementary Education. 7(1). 403 – 412.

INTRODUCTION

Education is an integral and complex process, involving interactions between teachers and students in the context of effective teaching and learning. In this context, mathematics has a very important role, especially in shaping students' logical and analytical abilities (Mustofa et al., 2020) . One of the basic materials taught in elementary schools is multiplication operations. A strong understanding of the concept of multiplication is very important because it is the basis for mastering more complex mathematical materials, such as division, algebra, and geometry (Kilpatrick, 2001) .

However, many students have difficulty understanding multiplication material, which is often accompanied by misconceptions. Misconception is a wrong or inaccurate understanding of a mathematical concept (Syahril, 2021) . This can arise due to students' inability to associate new knowledge with previous experiences (Fatimah, 2023) . Research shows that errors in understanding the term "times" and the application of multiplication operations often occur in fourth grade elementary school students. These errors not only hinder their ability to solve arithmetic problems but also have a negative impact on their understanding of advanced material (Yuliana et al., 2022). The importance of a deep understanding of the concept of multiplication cannot be ignored. Research by (Ramdhani & Purnomo, 2023) shows that many students misunderstand multiplication as repeated addition. In addition, students are also often confused when working on stacked multiplication problems due to a lack of understanding of place value placement (Safitri, 2019) . Initial difficulties in understanding

these basic operations can hinder their learning process later on. Similar challenges are also found in various other countries. Misconceptions about basic mathematical operations occur in various parts of the world, including the United States and Australia (Tzur & Roberts, 2020) . This shows that the problem of mathematical understanding is not limited to one particular region or culture (Pratiwi et al., 2023) . Many studies have been conducted to identify students' misconceptions in mathematics learning, but most of them only focus on recognizing problems without providing concrete solutions to help students understand concepts better (Rahmah, 2023) .

This study aims to describe students' misunderstandings in multiplication material in grade IV of elementary school using an error analysis approach based on the Newman procedure. This procedure includes five stages of problem solving: understanding the problem, translating the problem, performing operations, writing answers, and rechecking answers (Newman, 1977) . By analyzing the errors that occur at each stage, this study is expected to provide deeper insight into the patterns of errors and misconceptions experienced by students. Through this study, the author hopes to provide recommendations for teachers in improving mathematics learning strategies to be more effective and help students understand the concept of multiplication in depth (Amalia, 2022) . The results of this study are expected to be useful not only for curriculum development but also to improve the overall quality of mathematics education in elementary schools. Finally, a strong understanding of basic operations such as multiplication will form the basis for further mathematics learning (Ramadhani, 2023) . With the Newman procedure-based approach, it is hoped that innovative solutions will emerge to overcome existing misconceptions and improve overall student learning outcomes.

Previous studies have shown that many students not only have difficulty in performing multiplication operations but also in understanding the context of the problems given (Pamungkas et al., 2022) . This indicates the need for a more structured approach in teaching so that students can interact with mathematical concepts more effectively (Pratiwi et al., 2023) . Thus, this study will focus on an in-depth analysis of how these errors occur and how to correct them. In the current educational context, the challenges in teaching mathematics are increasingly complex along with the development of technology and new learning methods (Sisca et al., 2020) . Therefore, it is important for educators to continue to update their teaching strategies to suit the needs of today's students (Dian Aprilia Kusumasari, Kiswoyo, 2021) . This study not only seeks to identify misconceptions but also to offer practical solutions for teachers and educators in facing the challenges of teaching mathematics in grade IV of elementary school. Thus, this study not only focuses on error identification but also aims to provide practical solutions for teachers and educators in facing the challenges of teaching mathematics in grade IV of elementary school. It is expected that the results of this study can

contribute to the development of better teaching methods and help students achieve a better understanding of the concept of multiplication.

METHODOLOGY

This study uses a qualitative approach with a descriptive method to gain a deep understanding of students' misconceptions (Moleong, 2006) . Qualitative descriptive research was chosen because it allows detailed exploration of students' errors and thinking in solving mathematics problems, especially on the material of stacked multiplication. This descriptive method focuses on the analysis of the stages of errors experienced by students based on Newman's procedure, which includes understanding the problem, translating the problem, performing arithmetic operations, writing down answers, and rechecking the answers (Newman, 1977) .Data collection was conducted through written tests and in-depth interviews with students who were the subjects of the study. The written test was designed to identify errors that occurred at each stage of problem solving, as well as to explore the forms of misconceptions that emerged in each student. In-depth interviews were also conducted to strengthen the data obtained from the test, making it possible to dig up further information about the reasons behind the errors experienced by students.

This study was conducted in an elementary school in West Bandung that has diverse student backgrounds in terms of both academic ability and socio-economics. This location was chosen because it allows researchers to observe variations in misconceptions that may be influenced by various student backgrounds. In general, this school environment provides access to adequate learning resources and support for students, so that environmental factors are not a major obstacle in learning multiplication.The subjects of the study were fourth grade elementary school students selected by purposive sampling, to ensure that the samples used were students who had the potential to experience difficulties or misconceptions in understanding multiplication. A total of 13 students were taken as samples in this study, some of which will be analyzed based on Newman's five-stage procedure. The selection of subjects was carried out by considering the variation in mathematical abilities among students, to obtain a comprehensive understanding of the various types of misconceptions that may arise.

The collected data were analyzed using data analysis techniques that focused on identifying recurring error patterns in solving multiplication problems. This data analysis technique is effective in grouping student errors based on the stages of the Newman procedure, thus helping researchers to better understand the misconceptions experienced at each stage (Monalisa, 2023) . Data collected from written tests and in-depth interviews were analyzed using the Newman procedure. The indicators for the written test and interview are as follows:

Table 1. Written Test Indicators (Yahya & Wibowo, 2023)

Indicator	Description
Getting to know the terms	Students can recognize the terms “times” and “sum”.
Mentioning	Students can mention multiplication problems in series
Performing Calculations	Students can perform multiplication calculations without error.

Table 2. Interview Indicators (Shipa Faujiah & Nurafni, 2022)

Indicator	Description
Understanding the Problem	Students can explain how to understand multiplication problems correctly.
Translating Questions	Students can explain how to translate multiplication problems correctly.
Performing Operation	Students can explain how to perform multiplication operations correctly.
Writing Answers	Students can explain how to write multiplication answers correctly.
Double Check	Students can explain how to double-check multiplication answers correctly.

This analysis includes: (1) Understanding the Problem : Identifying whether students understand the context of the multiplication problem; (2) Translating the Problem : Identifying whether students can translate the term "times" correctly; (3) Performing Operations : Identifying whether students can perform multiplication calculations correctly; (4) Writing Answers : Identifying whether students can write multiplication answers correctly; (5) Rechecking : Identifying whether students can recheck multiplication answers correctly. The results of the analysis showed that students made errors at various stages, including understanding the problem, translating the problem, performing operations, writing answers, and rechecking.

RESULTS AND DISCUSSION

This section presents the research results obtained from the analysis of students' errors in solving multiplication problems in grade IV of elementary school, based on the Newman procedure involving five stages of errors: understanding the problem, translating the problem, performing operations, writing answers, and rechecking. The research results obtained by the researcher indicate that there are several misconceptions experienced by students.

Figure 1. The answer of student number 1

Based on the image above, the answer of student number 1 is the answer of student 1. It can be seen that the concept of stacking multiplication in student 1 is still not correct. The results of the analysis obtained by the researcher based on the Newman procedure are **:** (1)

Understanding Questions: S1 had difficulty understanding the context of the questions given. Misconceptions at this stage indicate that students were unable to identify what was being asked in the question, thus providing irrelevant answers. (2) Translating Questions: At this stage, S1 changed the term "times" to "add", which indicates an error in understanding basic operations. This change in operations is a form of misconception that often occurs in students in interpreting mathematical language. This leads to the inability to distinguish between multiplication and addition operations, which is a conceptual error that often occurs in early grade students. (3) Performing Operations: S1 did not perform operations because he misunderstood the question. Without a correct understanding of the question, students failed to carry out the calculation steps. This shows that a wrong understanding of the question will hinder the entire process of solving the question. (4) Writing the Answer: The answer written by S1 is not relevant to the question given. This confirms that misconceptions at the understanding and translation stages will have a direct impact on the wrong final result. (5) Rechecking: S1 did not recheck his answer, so the error was not detected.

Figure 2. The answer of student number 2

Based on the image above, it is the answer number 2 from student 2. We can see that the concept of stacking multiplication in student 2 is still not quite right. The results of the analysis obtained by the researcher based on the Newman procedure are: (1) Understanding the Question: S2 can understand the core of the question but has difficulty in identifying all the important elements needed to solve the question. (2) Translating the Question: S2 managed to translate most of the words in the question, but there was an error in interpreting the numbers that had to be multiplied. (3) Performing Operations: Even though he performed the operation correctly on the wrong numbers, S2 still produced the wrong answer. This shows that errors in the question translation stage can continue and affect the overall calculation results. (4) Writing the Answer: The answer was written clearly, but because there was an error in the number translation stage, the result was still wrong. This shows the importance of accuracy in the translation stage to obtain correct results. (5) Rechecking: S2 did not recheck the calculation steps.

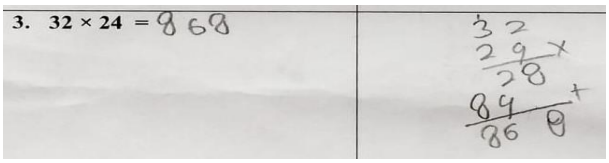

Figure 3. The answer of student number 3

Based on the image above, it is the answer number 3 from student 3. It can be seen that the concept of stacking multiplication in student 3 is still not quite right. The results of the analysis

obtained by the researcher based on the Newman procedure are as follows: (1) Understanding Questions: S3 shows a good understanding of the questions. This student is able to clearly identify what is being asked in the question. (2) Translating Questions: S3 can translate mathematical terms in questions correctly, which shows a good mastery of mathematical language. (3) Performing Operations: Despite understanding the problem well and translating it correctly, S3 made an arithmetic error in the multiplication operation. This error illustrates a technical error that is often found in students who may have sufficient conceptual understanding, but are less careful in performing calculations. (4 **)** Answer Writing: S3's written answer is neat and clear, but is inaccurate because there is an error in the calculation. (5) Rechecking: S3 did not check his answer after finishing, which resulted in the calculation error not being detected. Research shows that students who do not recheck their results tend to make more unidentified errors.

Figure 4. The answer of student number 4

Based on the image above, it is the answer number 4 from student 4. It can be seen that the concept of stacking multiplication in student 4 is still not quite right. The results of the analysis obtained by the researcher based on the Newman procedure are as follows: (1) Understanding Questions: S4 understands the questions well and can clearly identify what is being asked in the questions. (2) Translating Questions: S4 translates the terms in the questions correctly, so that he can change the verbal questions into mathematical form correctly. (3) Performing Operations: S4 successfully performed the multiplication operation correctly and showed the correct calculation steps. (4) Answer Writing: S4's answer was written clearly, listing the steps taken, but because he did not recheck the final result, the error was not detected. (5) Rechecking: S4 did not recheck the final result, so even though the calculation steps were correct, the final result was still not verified.

Figure 5. The answer of student number 5

Based on the image above, it is the answer number 5 from student 5. We can see that the concept of stacking multiplication in student 5 is still not quite right. The results of the analysis obtained by the researcher based on the Newman procedure are as follows: (1) Understanding the Question: S5 understands the context of the question well, but has difficulty in identifying the numbers involved in the multiplication. (2) Translating the Question: Although S5 can

translate the terms correctly, he chooses the wrong number to multiply. (3) Performing Operations: S5 performs operations with the wrong numbers, resulting in wrong results. This shows the importance of being careful in choosing the right numbers before performing operations. (4) Writing the Answer: The answer written by S5 is clear, but does not match the expected results due to an error in the number selection stage. (5) Rechecking: S5 does not recheck his answer, so the error made is not detected. The absence of rechecking is a factor that often causes errors to go unidentified. Based on the results of students' answers to multiplication problems, data were obtained from 13 students. Of these, 2 students answered all questions 1-5 correctly, 3 students answered 3 questions correctly, 4 students only answered 2 questions correctly, 1 student answered 1 question correctly, and 3 students gave answers that were all wrong, meaning there was no correct answer. In general, the errors found in students can be divided into two main categories: conceptual errors at the stage of understanding and translating questions, and technical errors in performing multiplication operations. These findings indicate the importance of more in-depth teaching of the basic concepts of multiplication and the importance of the habit of rechecking calculation results to minimize errors. This study also confirms that misconceptions at the initial stage can affect the final results, which is in line with existing theories regarding the importance of each stage in the process of solving mathematical problems.Based on the results of in-depth interviews with students, most students expressed that they found it difficult to understand the steps of multiplication. Some students admitted that they often felt confused when they had to multiply numbers in the tens position, so they often put the results of the multiplication in the wrong place. Some students also felt confused in multiplying numbers that were multiplied by the number 0. Other students also stated that they did not understand the basic concept of multiplication and focused more on the calculation methods taught without knowing the reasons behind the procedure.

This suggests that while students were able to technically solve the problem, they did not fully understand the importance of verifying results and consistency in mathematical calculations.

DISCUSSION

Key findings from this study indicate that students tend to have difficulty in understanding the concept of multiplication, especially related to the term "times". Many students misinterpret the term, resulting in difficulty in performing multiplication operations correctly. This misinterpretation is often rooted in a deep misunderstanding of the basic concept of multiplication, so they cannot apply the operation correctly. Thus, this study revealed that errors in calculating nested multiplication are also a significant problem. Students often do not have sufficient understanding of how to perform multiplication operations involving more than

one number, so they experience confusion when they have to solve more complex problems. This shows that a strong foundation of understanding the concept of multiplication is essential for students to overcome the challenges of solving more complex math problems. Students often cannot identify what is being asked in the problem, so they give irrelevant or incorrect answers. This inappropriate understanding process can have a direct impact on their ability to solve the problem correctly.

Based on these findings, the author recommends that teachers improve their mathematics learning strategies, especially in multiplication material. One strategy that can be applied is to provide more varied examples of questions. With a variety of questions, students will be more accustomed to facing various forms of questions and can improve their understanding of the concept of multiplication. The use of interactive media is also highly recommended to make students more active in learning. In addition, it is important for teachers to reflect with students after learning. Through this reflection session, teachers can ensure that students understand the concept of multiplication correctly and provide opportunities for students to ask questions or express their confusion. The author also recommends that further research be conducted to deepen the understanding of the factors that influence the emergence of misconceptions in multiplication material. Further research is expected to dig deeper into certain aspects that may contribute to students' misconceptions, so that teaching strategies can be adjusted and improved effectively.

CONCLUSION

This study reveals the difficulties experienced by fourth grade students in solving multiplication problems based on the Newman procedure involving five stages of errors, namely understanding the problem, translating the problem, performing arithmetic operations, writing the answer, and rechecking. The main findings of this study indicate that misconceptions that occur at the stages of understanding the problem and translating the problem are the most dominant errors that hinder students from solving the problem correctly. This emphasizes the importance of teaching that focuses not only on technical skills, but also on a deeper understanding of concepts in mathematics.

Overall, the results of this study indicate that each stage of the Newman procedure plays an important role in ensuring students' success in solving mathematics problems. The implications of this study can also be used to design more effective strategies to support students in overcoming misconceptions and improving students' abilities in solving mathematics problems, especially in the context of multiplication.

In this conclusion, the author provides suggestions and recommendations for further research in order to deepen the understanding of students' misconceptions in multiplication material. Some things that need to be reviewed again include:

1. How implementing more effective learning strategies can improve students' understanding of multiplication concepts.
2. Internal and external factors that influence the emergence of misconceptions in multiplication material.
3. The effectiveness of alternative learning models in reducing misconceptions in multiplication material.

Thus, this research can provide a positive contribution to the world of education, especially in efforts to improve the quality of mathematics education in Indonesia.

ACKNOWLEDGMENTS

The author would like to thank all parties who have supported the implementation of this research. Thanks are given to the lecturers and students who have participated in this research, as well as to fellow researchers who have provided valuable input during the research process. Thanks are also given to the institutions that have provided financial support and facilities so that this research can run smoothly. Without their help and support, this research would not have been able to be carried out properly.

REFERENCE

Amalia. (2022). *Analysis of Students' Difficulties in Learning Multiplication Arithmetic Operations in Mathematics Learning in Grade IV* . *4* (3), 945–957.

Dian Aprilia Kusumasari, Kiswoyo, and RMS (2021). *Analysis of Learning Difficulties of Multiplication in Elementary School Students* . *6* (I), 104–117.

Fatimah. (2023). The effect of integrated thematic learning connected to elementary school students' mathematics learning. *Perseda Journal* , *4* (2), 110–120.

Kilpatrick. (2001). *ADDING IT UP_HELPING SHILDREN LEARN MATHEMATICS* .

Moleong, L. (2006). Research Methods. *Raden Fatah.Ac.Id* , 1–23.

Monalisa. (2023). *ANALYSIS OF DIFFICULTIES IN LEARNING MATHEMATICS ON MIXED NUMBER ARTICULAR OPERATIONS OF GRADE IV STUDENTS OF SDN KARET 04 PAGI, SETIABUDI DISTRICT* . *8721* (20), 1165–1180.

Mustofa, R., Anis, F., & Muhibbin. (2020). Analysis of Errors in Solving Mathematical Story Problems in Elementary School Students. *Basicedu Journal* , *5* (5), 3 (2), 524–532.

Newman, 1977. (1977). *An Analysis of Sixth-Grade Pupils' Errors on Written Mathematical Tasks. Victorian Institute of Educational Research.*

Pamungkas, D., Sundari, RS, Saputro, BA, Education, FI, Education, FI, Education, FI, Article,

H., Setyo, R., & No, K. (2022). *Analysis of learning difficulties in mathematics on multiplication and division material in grade III students* . *1* (1), 1–13.

Pratiwi, A., Ramanata, R., & Tanzimah. (2023). *ANALYSIS OF MATHEMATICAL DIFFICULTIES IN MULTIPLICATION OPERATIONS OF GRADE III OF STATE ELEMENTARY SCHOOL 17 RANTAU BAYUR* . *08* (September), 89–101.

Rahmah, NR (2023). Analysis of literacy and numeracy skills of grade IV elementary school students in solving mathematical problems. *Uin Raden Intan Lampung* .

Ramadhani. (2023). *The Effect of Multiply Cards Multiplication Game on Mathematics Learning Outcomes of Grade III Students of UPT SPF SD Inpres BTN IKIP I Makassar City* . *3* (November), 1–15.

Ramdhani, FG, & Purnomo, H. (2023). Analysis of Students' Difficulties in Understanding Mathematics Story Problems for Grade V of Sd Negeri 1 Bendungan. *Wahana Sekolah Dasar* , *31* (2), 142. https://doi.org/10.17977/um035v31i22023p142-151

Safitri, A. (2019). Analysis of Student Difficulties Based on Polya's Theory Reviewed from Gender in Solving Two-Variable Linear Equation System Problems (SPLDV) at SMP Negeri 1 Sambi. *Muhammadiyah University of Surakarta* , 2–18.

Shipa Faujiah, & Nurafni. (2022). Analysis of Understanding of Multiplication Concepts in Mathematics Learning for Grade IV Elementary School Students. *Jurnal Cakrawala Pendas* , *8* (3), 829–840. https://doi.org/10.31949/jcp.v8i3.2588

Sisca, Cahyadi, F., & Wakhyudin, H. (2020). Analysis of the Difficulties of Second Grade Elementary School Students in Solving Mathematical Problem Solving on Multiplication and Division Material. *EduHumaniora | Journal of Elementary Education, Cibiru Campus* , *5* (2), 183–190.

Syahril. (2021). Analysis of Student Errors Based on Mathematical Objects on Sequence and Series Material in Grade XI of SMA/MA. *Jurnal Cendekia: Journal of Mathematics Education* , *5* (3), 2816–2825. https://doi.org/10.31004/cendekia.v5i3.766

Tzur, A., & Roberts, B. M. (2020). The Ketogenic Diet for Bodybuilders and Physique Athletes. *Strength and Conditioning Journal* , *42* (5), 108–115. https://doi.org/10.1519/SSC.0000000000000573

Yahya, AY, & Wibowo, A. (2023). *The Influence of Counting Methods on Mathematics Learning Outcomes in Basic Mathematics Multiplication Material for Grade IV Students at …* .

Yuliana, Y., Rahayu, RR, & Firmansah, F. (2022). Student Errors in Solving Mathematical Problems on the Pythagorean Theorem. *Edukatif: Journal of Educational Sciences* , *4* (4), 5532–5543. https://doi.org /10.31004/educational.v4i4.3294