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Error Analysis in Fraction Arithmetic Operations Among Fourth Grade Students

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Abstract

This study was motivated by the low learning results of mathematics fraction material for grade IV students of SDN-13 Palangka in Palangka Raya city in fraction calculation operations, the problems that arise are what are the types and factors that cause student errors in completing fraction calculation operations. The purpose of this study is to identify the types of errors and factors that cause student errors in solving problems related to fractional calculation operations, The procedure for analyzing student errors used is the Newman procedure. This type of research is a quantitative research with a case study design. Data collection was carried out by test techniques and analysis of student answers on test answer sheets, with 32 research subjects. The data analysis technique uses quantitative descriptive analysis. The questions used for data collection were first tested to determine the distinguishing power and difficulty level of the questions. The results showed that all 32 research subjects made mistakes in each question item with various types of errors, namely concept errors of 45.93%, principles errors of 16.25%, operational errors of 1.87% and errors due to lack of thoroughness of 5%. There are 3 factors that cause students to make mistakes, namely: 1) difficulty understanding concepts; 2) not understanding the principle of fraction operation; 3) and because of forgetting and not being thorough. The factors that cause student errors in solving problems are related to instrumental factors, one of which is the teacher who is incomplete in providing an understanding of mathematical concepts, especially the concept of fractions and their operations.

Keywords: Analysis, Calculation Operations, Fractions

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INTRODUCTION

Education is one of the community's efforts to advance civilization and develop science (Dewi et al., 2024). Law No. 20 of 2003 explains that national education aims to develop the potential of students to become human beings who believe in and fear God Almighty, have noble character, are healthy, knowledgeable, capable, creative, independent and become democratic and responsible citizens (Indonesia, 2003). Efforts to achieve these educational goals are manifested in the implementation of education from the basic education level to higher education. (Ismail et al., 2020)

One form of primary education is elementary school. The basic knowledge obtained by students in elementary school is the foundation of knowledge that will be developed at the next level (Nindiawati et al., 2021). One of the subjects in elementary school is mathematics. Mathematics subjects need to be given to all

students starting from elementary school to equip students with logical, analytical, systematic, critical, and creative thinking skills, as well as the ability to work together (Soviawati, 2011). These competencies are needed so that students can have the ability to acquire, manage, and utilize information to survive in an ever-changing, uncertain, and competitive situation.

However, with this excellent goal, until now mathematics is still considered a difficult and unpleasant subject by many students, even a number of students consider mathematics to be scary. This view then causes students to experience difficulties in learning mathematics. The difficulties in learning mathematics faced by students are characterized in several common mistakes in working on math problems, namely mistakes in understanding symbols, place values, calculations, using the wrong process, and unreadable writing. Therefore, to improve students' understanding of mathematics, it is necessary to realize fun mathematics learning in various materials.

Mathematics learning is never separated from the material of calculation operations, both addition, subtraction, multiplication and division operations, all of which are related to number material. Counting operations on numbers, integers, and fractions have been taught in elementary schools. This is because the calculation operations on numbers, integers, and fractions play a very important role in various mathematical calculations. Learning fractions as a basis for learning calculation operations is also carried out in grade IV, which includes material simplifying various forms of fractions, addition operations, as well as fraction reduction and mathematical problem solving.

The problem of low student mathematics learning outcomes and students' difficulties in solving mathematical problems in the form of fractional calculation operations indicates that there is an error in students' understanding of fractional calculation operations so that improvements are needed. However, before making improvements, teachers must first analyze what mistakes students experience in performing fraction calculation operations. By knowing the mistakes experienced by students, it is hoped that teachers can take appropriate corrective steps for the next teaching and learning process. Based on this, it is very necessary to analyze students' mistakes in working on fraction problems to improve learning about fractions and story problems in the next material.

One of the procedures that can be used to analyze student errors in working on story problems is the Newman (*Newman Error Analysis or NEA*) procedure (Safitri et al., 2019). In accordance with the NEA, there are 5 errors that may occur when a child completes a calculation operation including fractional calculation operations, including reading errors, errors in understanding, transformation errors, calculation process errors, and errors in coding or writing answers (Fitry et al., 2022)**.** The selection of Newman's (1977) procedure to analyze students' mistakes in solving fractional material story problems is expected to be used to find out the variations of student errors and the factors that cause students' mistakes.

The material for fractional calculation operations consists of fractional addition and subtraction calculation operations. The first introduction of fractions from grade IV to grade V of elementary school. Fractions are one of the materials in mathematics that are widely applied in daily life (Gustiani & Puspitasari, 2021). In addition, fractions are a prerequisite material for algebraic fractional materials and

are often used in other materials. Therefore, it is very important for students to master and understand the concepts of fractions well, including addition and subtraction of fractions, so that students do not have difficulty applying fractional materials in mathematics and in daily life.

The reality in the field is that there are still many students who do not understand and master the concept of fractions correctly, so students have difficulty solving the problem of addition and subtraction of fractions which results in many errors. In line with that, (Zebua et al., 2020) stated that data in the field also showed that there were still many students who made mistakes in doing problems in the fraction discussion. Furthermore, Untari stated that the difficulties experienced by students allow students to make mistakes in solving math problems in each subject in learning. The difficulties experienced by the students resulted in students thinking that the material for the operation of arising, adding and subtracting fractions was one of the materials that was considered difficult. As (Sadiah & Afriansyah, 2023) said, one of the

What students consider difficult is the operation of addition and subtraction of fractions.

Based on the results of interviews with fourth grade teachers of SDN-13 Palangka, it is said that there are still many students who have not completed learning fractional material, this can be seen from the learning outcomes of students for fractional material is still relatively low, which ranges from 50 to 60 scores, there are even students whose scores are below 50 and a small number of students who are able to achieve scores more than 60. Furthermore, the fourth grade teacher said that almost all forms of fractional calculation operations are difficult for students to master, which includes the operations of addition, subtraction, multiplication and division. Especially in grade IV is the first time at the elementary school level that fractional material has been introduced. It is said that the most common mistakes experienced by students are in terms of the operation of calculating the addition and subtraction of fractional numbers, both the same denominator and different denominator. Furthermore, based on interviews with students, it was stated that fractional material is difficult to understand. The importance of the role of problem solving in solving problems, it is necessary to conduct research aimed at identifying the mistakes made by grade IV students in solving fraction calculation operation problems and finding out the factors that cause grade IV students to make mistakes in solving fraction calculation operation problems

METHODS

The type of research carried out is research with the survey method, In this study a descriptive research method is used (Syahrizal & Jailani, 2023). Descriptive research is used to collect, summarize and interpret the data obtained, which is then reprocessed so that it is expected to produce a clear, directed and comprehensive picture of the problem that is the object of the research. (Pugu et al., 2024)

In this study, the data obtained from the study will be presented as it is and do not draw further conclusions or even predict the future from the existing data.

Furthermore, the researcher wanted to describe the symptoms that occurred from the data obtained by analyzing to get an idea of the mistakes made by students in the fraction calculation operation.

The population in this study is 62 students in grade IV at SDN-13 Palangka, Palangka Raya City for the 2019/2020 school year.

The sample is a part of the population to be studied that can be considered to be able to describe the characteristics of the population. The determination of the sample of this study is guided by the opinion of Arikunto (2006: 134) stating that "as an ancer-ancer for subjects that are less than 100, it is better to take all as samples". In this study, students in grade IV of SDN-13 Palangka were divided into 2 groups, namely rombel A as many as 32 students and robbel B as many as 30 students, the researcher took the determination of the sample by shangling, from the results of the draw that had been carried out, the sample in this study produced rombel A as the one that was researched and rombel B as a test of research instruments. Thus, the sample in this study is grade IV students of group A which totals 32 students.

RESULTS & DISCUSSION

Based on information from grade IV teachers, that student learning outcomes are generally quite good, this can be seen based on the number of students who have completed learning. The minimum limit for learning completeness is 7 while for mathematics it is 6.5. However, according to the fourth grade teacher, even though it is said that the learning outcomes of students are quite good, there are some materials that are still difficult for students to master, one of which is fractional material, so the learning outcomes for this material are still not good and satisfactory.

The diagnostic test questions given previously have gone through a validation process and are declared suitable for use. After the diagnostic test was carried out, the researcher examined the results of the answers of the subjects to identify the location and type of mistakes made by the students.

As described in Chapter I, this study aims to find out the mistakes made by students in solving fractional calculation operation problems, find out the factors that cause students to make mistakes in solving fraction calculation operation problems and describe solutions that can be used to minimize errors in solving fraction calculation operation problems.

In line with this goal, to obtain data that is then used as analysis material in answering the formulation of research problems, researchers conduct diagnostic tests.

The procedure carried out in giving this test is that the researcher coordinates with the fourth grade teacher to get information on how to contact students during the implementation of distance learning activities during the covid-19 pandemic. The information obtained by the researcher is that to get in touch with current students, grade IV teachers have created a WA group whose members are students/parents of grade IV students. Based on this information, the researcher

provided problems for the calculation of addition and subtraction of fractions sent through the WA of the student group/parents of the students.

Based on the results of the operation test for the calculation of addition and subtraction of fractional numbers given to 32 students, the score data of the student test results were obtained as follows:

The result of calculating the percentage of total errors obtained is 69.06%, each of which can be shown in a pie graph as follows:

Error Type Graph

Types of mistakes students make

Based on the results of data analysis conducted by the researcher, the types of errors and causative factors of errors made by students in solving the problem of calculating the addition and subtraction of fractional numbers were obtained. The following is a discussion of the results of the data analysis that has been obtained:

a. Conceptual errors

Conceptual errors are students' mistakes in interpreting and using mathematical concepts. Based on the results of the error calculation, the type of conceptual error occurred 147 times or 45.93%. Conceptual mistakes made by students include:

1. Multiply the value of the numerator by the numerator and the value of the denominator by the denominator
2. Summing fractions without equalizing the denominator value
3. Subtract fractions without equalizing the denominator value
4. Summing the numerator value and multiplying the denominator
5. Just write the answer based on the facts in the question
6. Equalize the denominator value, then immediately add the numerator value without changing it to a fraction of the value
7. Subtract the value of the numerator but add up the denominator value without equalizing the denominator value
8. Not solving problems while there is still a lot of time

b. Principle error

Mistake of principle is a mistake in relating some facts or some concepts. Based on the results of the error calculation, the type of error in principle occurred 52 times or 16.25%. Mistakes in principle made by students include:

1. Error in converting the value of the numerator into a fraction of the value
2. Inability to use rules in stacked summation
3. Error in converting decimal fractions to ordinary fractions
4. Error in converting mixed fractions into ordinary fractional forms
5. Wrong in equalizing denominator values

c. Operation errors

Operational errors are errors in calculations, algebra, and other mathematical tasks. Based on the results of the error calculation, the type of operation error occurred 6 times or 1.87%. Operational errors made by students include errors in doing calculations, especially in doing multiplication.

d. Mistakes due to carelessness/lack of thoroughness

Mistakes due to carelessness/lack of thoroughness are students' mistakes due to mistakes in calculations. Based on the results of the error calculation, the type of error due to carelessness / lack of thoroughness occurred 16 times or by 5%,

Mistakes due to carelessness/lack of thoroughness made by students include:

1. Misreading and writing the operation mark
2. Forgetting to write the final result

Factors that cause errors

Based on the results of the data analysis carried out, several factors were obtained that caused the mistakes made by students in solving the problem of calculating the addition and subtraction of fractional numbers. The following is a discussion of the results of the data analysis that has been obtained.

a. Conceptual errors

Based on the results of the data analysis carried out, the cause of students making conceptual mistakes is that students do not understand or are unable to interpret the basic concepts of addition and subtraction of fractional numbers, especially about fractions of value. This is in accordance with the opinion of (Rosyidah et al., 2020) who stated that conceptual errors are caused by inconsistencies in interpreting mathematical concepts. Where the main factors of inconsistency in interpreting mathematical concepts are the lack of precision in understanding mathematical problems, lack of language mastery, and reasoning as one of the basic competencies of mathematics in addition to understanding, communication and problem solving.

An effort that can be made by an educator to minimize conceptual errors is to emphasize the basic concept of fractional numbers, especially about equivalent fractions.

b. Principle error

Based on the results of the data analysis carried out, the cause of students making mistakes in principle is the lack of mastery of knowledge and prerequisite skills, namely in determining the KPK, not understanding the principles in determining fractions of value, not understanding the rules in changing the form of mixed fractions into ordinary fractions and ordinary fractions into decimal fractions. This is in accordance with the opinion of (Sani, 2021) who stated that the error in principle is caused by students not paying attention to the content of the problem or the inability to connect several facts, several concepts associated by a relationship or operation.

Efforts that can be made by an educator to overcome errors in principles in mathematics learning by providing prerequisite practice questions before entering a new lesson such as giving questions on how to determine the KPK before entering fractional material. That way it makes it easier for students to remember the material that has been studied before.

c. Operation errors

Based on the results of the data analysis carried out, the cause of students making operational errors is not being careful in counting and forgetting or not mastering multiplication. This is in accordance with the opinion of Khasna (2010: 91) who stated that the error of the operation

This is because students forget the concepts, formulas or operations that they will use to solve math problems.

In this case, it is necessary for teachers to be able to minimize operational errors, by holding continuous exercises so that students tend to remember the material that has been learned.

d. Mistakes due to carelessness

Based on the results of the data analysis carried out, the cause of students making mistakes is carelessness, namely forgetfulness, and haste in doing problems. This is in accordance with the opinion of (Khasna et al., 2020) who stated that the error of carelessness is caused by students' lack of understanding of other materials related to calculations. Students tend to be in a hurry to solve problems. All concepts in mathematics in general can be understood easily, it's just that often students are easily satisfied with a few examples and do not want to explore more deeply on other problems, considering themselves capable of working on mathematical problems.

Problems due to students' careless mistakes, educators can try to minimize mistakes by providing various practice questions about arithmetic arithmetic operations of addition and subtraction of fractional numbers and always remind them to always be careful in doing problems.

CONCLUSION

Based on the data from the results of the research that has been carried out, the researcher can draw the conclusion that from 32 students as a sample of the study, it was found that all made mistakes, while the type of mistake that was most made by students in performing fraction calculation operations was in conceptual errors, which was 45.93%, then principle errors were 16.25%, while errors caused by wrong operations and carelessness/lack of thoroughness were less proportional. The total number of mistakes made was 221 errors or 69.06%. The factors that cause student errors in solving problems are related to instrumental factors, one of which is the teacher's lack of understanding of mathematical concepts, especially fractional calculation operations.

Paying attention to the types of mistakes that are most often made by students in fraction calculation operations, it is expected that teachers will instill an intensive concept of fractions for students.

In mathematics learning, more emphasis should be placed on understanding concepts in mathematics material which will be delivered more specifically on fractional calculation operation material.

Teachers should be able to provide frequent exercises to practice the application of instilling the concept of fractional calculation operations to students by presenting various problems/problem solving. To minimize students' errors in fractional calculation operations, teachers need to mature their knowledge of the concept of fractional numbers and the mathematical properties that govern their processing and operations.

Learn ways to guide students to find concepts, understand algorithms and improve their skills in processing fractional numbers. Study various experiments, with which fractional number programs can be learned individually.

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