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FACTOR ANALYSIS OF LEARNING DIFFICULTIES IN MATHEMATICS FOR GRADE 5 FRACTION CALCULATION MATERIAL

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Abstract

This study aims to describe the difficulties in learning mathematical fraction calculations in Grade 5 at SD Poris Gaga 8. The research method employed is qualitative, specifically a case study involving students and teachers of Grade 5 at SD. Data collection is carried out through observation techniques and face-to-face interviews. The study's results on factors contributing to students' difficulties in learning material about fractions include both students' cognitive aspects and physical aspects related to fractions. The challenges in learning, considering the students' cognitive conditions, are influenced by their concentration levels during math lessons. This is often attributed to students' disinterest in studying mathematics, their tendency to become easily bored at school, and an unfavorable learning environment. Regarding the material aspects of learning fractional calculations, students face difficulties due to their lack of familiarity with common denominators, general understanding of denominators, and the fundamental concepts of multiplying and dividing fractions. Furthermore, when solving problems involving fraction division, students struggle to effectively model these problems using appropriate mathematical approaches.

Keywords: *Educational Challenges, Fraction Learning, Mathematics Education, Learning Difficulties*

1. INTRODUCTION

Mathematics is one of the mandatory subjects for students starting from Kindergarten, Elementary School, Junior High School, High School, and even further. Beth & Piaget revealed that Mathematics is the knowledge of various core aspects of a concept, based on patterns and deductive thinking (Runtukahu & Kandou, 2014). Mathematics also plays a crucial role in achieving overall educational goals, particularly in training individuals to think logically, systematically, accurately, objectively, and openly across various fields (Siraj-Blatchford & Nah, 2014).

In the process of learning mathematics, one of the tools utilized is fraction calculations. Solving fractional arithmetic problems demands a deeper understanding of concepts compared to other arithmetic operations. Consequently, many students encounter difficulties in mastering fraction calculations. Based on observations and interviews with homeroom teachers and fifth-grade students, it is evident that numerous students struggle with understanding mathematics, particularly the concept of fractions. Throughout the learning process, it is noticeable that many students pay insufficient attention when teachers explain concepts, and instead, they engage more in discussions. Data illustrates a significant decline in midterm exam scores or PTS assessments. In the first semester at SD Mutiara Persada, mathematics learning outcomes remain low. In British Columbia (3.1), difficulties arise in adding and subtracting fractions with different denominators. Out of 24 students, only over

37.5% achieve the objective, while 62.5% do not. In Business Mathematics (3.2), challenges emerge when dealing with fraction and decimal multiplication. A notable 95.8% of students do not meet the Minimum Mastery Criteria (KKM).

Difficulties in comprehending fractional concepts contribute to challenges in solving problems involving fractions. Learning difficulties serve as a clear indicator that a student is not achieving satisfactory results or is falling below established standards (Sugihartono & KN, 2012). Therefore, special attention to errors in the teaching and learning process is essential for improvement. Prior to corrections, analyzing the difficulties students face when working on fraction problems is crucial to implement appropriate solutions in the learning process. It is hoped that teachers can discover effective solutions to facilitate further teaching and learning processes.

This study aims to identify and analyze students' learning difficulties in comprehending and applying the concept of fraction calculations in mathematics education for Class V at SD Poris Gaga 8. By exploring the factors contributing to these difficulties, this research is expected to provide deeper insights into the challenges students face in understanding fraction concepts. The primary objective of this study is to enhance the understanding of the reasons behind students' learning difficulties related to fraction concepts and arithmetic operations. Therefore, it is anticipated that this research can offer guidance and recommendations for educators to design more effective and supportive teaching strategies, enabling students to overcome these barriers more easily and achieve a better understanding of mathematics.

2. RESEARCH METHOD

This research can be characterized as a qualitative study that involves a case study approach. Within this framework, the research subjects are focused on three students and one teacher from Class V at SD Poris Gaga 08. To attain a comprehensive understanding, data is collected through a range of techniques including observation, face-to-face interviews, question analysis, document review, and written tests.

The observation technique is used to meticulously observe and record various aspects of interaction among the research subjects within the learning environment. Meanwhile, face-to-face interviews are conducted to gain deeper insights from the perspectives of both students and the teacher regarding the challenges faced in comprehending the concepts of fractional calculations. The analysis of questions and examination of documents complement this approach by providing a thorough view of the previous performance of students, as well as the teaching materials used. In an effort to ensure data reliability and validity, the researcher applies source transfer and cross-check techniques. This is capable of minimizing bias and ensuring that the generated findings have a solid and consistent foundation.

In essence, this research employs an in-depth and holistic qualitative approach, with a focus on a case study involving students and a teacher from Class V. Through diverse data collection techniques and the implementation of steps to ensure data reliability, the research aims to provide a rich and profound insight into the challenges faced in understanding the concepts of fractional calculations, while also establishing a strong basis for further educational recommendations.

3. RESULT AND DISCUSSION

3.1. Research Result

3.1.1. Question Number 1

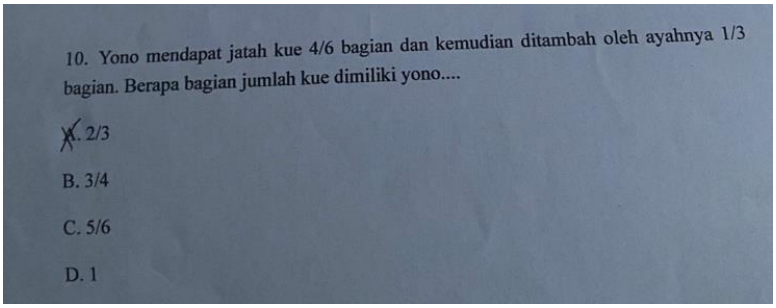


Figure 1. Question Number 1

In this question, we are asked to calculate the total number of cakes portions that Yono has after receiving his share of the cake and being added to by his father. Let's solve this problem step by step.

Discussion:

- Step 1: Yono receives a share of the cake, which is 4/6 portions.
- Step 2: His father adds 1/3 portion to the amount of cake Yono has received.
- Step 3: To find the total number of cake portions Yono has after his father's addition, we need to add these two portions together. We will add these two portions:

4/6 + 1/3

Before adding the fractions, we need to make sure they have the same denominator. The smallest common denominator that can be used is 6, as 6 is a multiple of both 6 and 3. So, we will convert the fraction 1/3 into 2/6 (multiply both the numerator and denominator by 2). Now, we can add the two fractions:

4/6 + 2/6 = 6/6

However, 6/6 is equal to 1 whole, which means Yono has a total of 1 whole portion of the cake after receiving his share and his father's addition. As the result, the total number of cakes portions that Yono has after receiving his share of 4/6 portion and being added to by his father with 1/3 portion is 1 whole portion of the cake.

3.1.2. Question Number 2

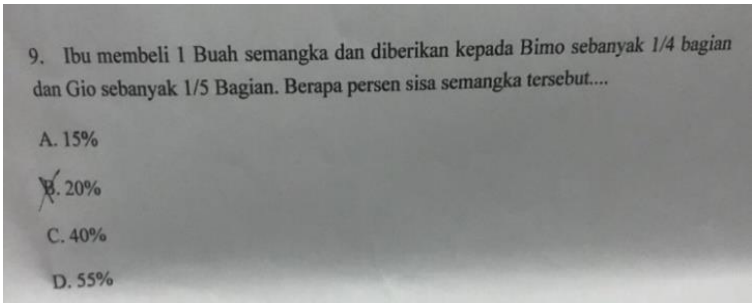


Figure 2. Question Number 2

Division of objects or resources becomes an intriguing topic to explore, especially in the context of fair distribution or allocation. In this journal, we will analyze a situation where a mother buys a watermelon and divides it between her two children, namely Bimo and Gio. The watermelon is split into two portions, one for Bimo and one for Gio. The objective of this study is to determine the percentage of remaining watermelon after the division.

To analyze the watermelon division scenario, we employ a mathematical and percentage-based approach. Based on the information provided in the problem, the watermelon purchased by the mother is divided into two portions, one for Bimo and one for Gio. The division is carried out with a quarter portion for Bimo and a fifth portion for Gio. To calculate the percentage of remaining watermelon, we will use the following formula:

$$\text{Percentage of Remaining Watermelon} = \frac{(\textbf{Remaining Watermelon})}{(\textbf{Initial Total Watermelon})} \boldsymbol{X}\ \mathbf{100}$$

- Watermelon Division for Bimo:
  A quarter portion of a watermelon is given to Bimo. The initial total watermelon is one. Therefore, Bimo receives of a watermelon.
- Watermelon Division for Gio:
  A fifth portion of a watermelon is given to Gio. The initial total watermelon is one. Therefore, Gio receives of a watermelon.
- Calculating Remaining Watermelon:
  After the division between Bimo and Gio, the remaining watermelon can be calculated as follows:

Remaining Watermelon =
Initial Total Watermelon - (Portion Given to Bimo) - (Portion Given to Gio)
Remaining Watermelon = 1 - () - ()

- Calculating Percentage of Remaining Watermelon:
  The percentage of remaining watermelon can be calculated using the formula mentioned above:

$$\text{Percentage of Remaining Watermelon} = \frac{(\textbf{Remaining Watermelon})}{(\textbf{Initial Total Watermelon})} \boldsymbol{X}\ \mathbf{100}$$

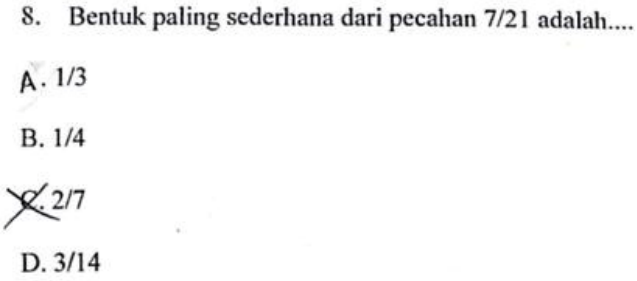
$$\text{Percentage of Remaining Watermelon} = \frac{(\mathbf{1} - () - ())}{\mathbf{1}} \boldsymbol{X}\ \mathbf{1}$$

$$= \frac{(\mathbf{20} - \mathbf{5} - \mathbf{4})}{\mathbf{120}} \boldsymbol{X}\ \mathbf{100} = \mathbf{55}\ \%$$

Based on the analysis of the watermelon division scenario between Bimo and Gio, it is determined that the remaining watermelon after the division is approximately 55%. This journal documents the process of calculating the percentage of remaining watermelon based on the division carried out between the two children. This study serves as a reference to

comprehend the concept of division and calculate the remaining resources after a specific allocation.

3.1.3. Question Number 3


8. Bentuk paling sederhana dari pecahan 7/21 adalah....

A. 1/3

B. 1/4

C. 2/7

D. 3/14

Figure 3. Question Number 3

Fractions are an essential part of mathematics, used to represent parts of a whole. In this context, we will explore fractions and seek their simplest form. The simplest form of a fraction occurs when the numerator (top number in the fraction) and the denominator (bottom number in the fraction) do not have any prime factors greater than 1 in common. This research aims to identify the simplest form of fractions and provide a deeper understanding of the concept of fractions and their simplification.

To find the simplest form of fractions, we will utilize the Euclidean algorithm and prime factorization. The steps taken in this research are as follows:

- Simplify the fraction by identifying the prime factors common to both the numerator and denominator.
- Divide both the numerator and denominator by the prime factors identified in the previous step.
- Repeat steps 1 and 2 iteratively until no common prime factors exist between the numerator and denominator.

Prime Factorization:
The prime factorization of 7 and 21 yields 7, as 7 is a prime number and is the only common factor between them.

Simplifying the Fraction:
To simplify the fraction, we divide the numerator and denominator by the common prime factor, which is 7.

: (7 ÷ 7) / (21 ÷ 7) =

Through the analysis of fractions, it is concluded that the simplest form of the given fraction is 1/3. In this form, the numerator and denominator do not share any prime factors greater than 1. This research successfully identifies and simplifies fractions using the Euclidean algorithm and prime factorization. These findings highlight the significance of grasping the concept of fractions and their simplification, as the simplest form of a fraction offers a more accessible representation in various mathematical contexts and everyday life scenarios.

3.2. Discussion

Based on the analysis of data from teacher interviews, the following are the research findings regarding the factors causing difficulties in learning mathematics for 5th-grade elementary school students:

a. Conceptual difficulties

Most students experience difficulties in understanding mathematical concepts such as the understanding of calculations, the components of calculations, and the relationship between the numerator and denominator. This could be due to a lack of prior conceptual exposure or a fast-paced curriculum.

b. Lack of practice

Many students struggle to master the arithmetic operations due to insufficient practice. Learning mathematics requires a deep understanding and repeated practice, especially in more abstract topics such as calculations.

c. Lack of learning resources

Environmental factors also influence difficulties in learning mathematics. Some students may have limited access to textbooks or other learning resources at home. Moreover, limited resources within the school can also affect how teachers deliver the material.

d. Fear and insecurity

Some students may feel fear or lack confidence when facing mathematics, especially if they have experienced difficulties in the subject before. This fear and insecurity can disrupt the students' learning process.

Difficulties in understanding operational aspects of calculations can also result in changing the form of calculations. Difficulties in converting calculations from mixed numbers to improper fractions, including addition, subtraction, multiplication, and division operations. If students change the form of calculations, the results of the two calculations may not always be the same.

Difficulties in addition and subtraction arise when students do not know the common denominator. Difficulty in reducing fractions occurs when students cannot find the least common multiple (LCM) of the two denominators. Students who are unfamiliar with multiplication and division concepts also struggle with performing multiplication and division operations on calculations. Lastly, difficulties arise when multiplying two calculations in word problems, as students cannot model the problem mathematically. Mathematical modeling involves planning calculations in writing with detailed explanations and breakdowns. When students cannot build a model, it seems they need to rewrite the problem to understand it better.

There are some factors that complicate the addition and subtraction of calculations, namely the first factor and the compatibility factor. The first is the physical condition, according to research results, rather than the physical condition of healthy students following the lesson, it is not always healthy, leading to an inability to focus on lessons. (Christine, 2016) notes that a healthy and fresh physical condition significantly affects academic performance.

Ernawati & Aminah (2017) also state that the higher the students' material condition, the higher their learning motivation. If students' health conditions are not good, their academic performance will decline as it can disrupt the learning process.

The second factor is related to the environmental factor. According to research results, almost all problems in the students' social environment disrupt their learning. However, there is at least one independent learning place at home that is crowded and disrupts students' learning concentration. However, students can focus on learning, for example by closing their bedroom door or listening to music with headphones to reduce the surrounding noise.

The third factor is motivation and attitude. According to research results, some are less interested in calculations, especially mathematics. This is also in line with the opinion of (Rosyadi, 2016), who states that students who do not like mathematics are the type of students who are less interested in mathematics. When there is less liked subject matter, extra effort is needed to teach it. Therefore, a teacher's attitude is required to overcome this.

(Putri et al., 2012) argue that a person's attitude and tendency influence their actions in a certain way. As the discussion above, particularly the first one, regarding the difficulties in adding and subtracting two fractions. The difficulty in fraction addition is that students do not understand the process of adding fractions. Students do not understand the denominator at all. This aligns with what (Nasiruudin & Hayati, 2019) wrote, that students often make the mistake of adding the denominators of two numbers but not dividing the denominators, which is a common error.

This is also in line with (Badaruddin & Anggo, 2016), who write that students often struggle to understand the concept of subtracting fractions with different denominators. Moreover, it is difficult if students haven't understood the least common multiple (LCM). If students don't understand the LCM, then they wouldn't know the smallest common multiple of two denominators in a fraction.

The second discussion touches upon the difficulty of solving word problems in fraction addition and subtraction. The challenge in solving addition and subtraction problems that most students face is because they are not familiar with the process of solving word problems involving arithmetic operations on fractions. According to Hartini (2017), this is a major difficulty for students who don't understand the topic. Lack of understanding of the material, especially among less proficient students, prevents them from converting the material into a solution or mathematical model. While mathematical modeling, as described by Hartono & Karnasih (2017), is the process of representing real-world situations in mathematical form to find solutions.

The third discussion addresses the difficulty in combining and distributing denominators. Concerning fraction multiplication, the first challenge students face is not understanding the concept of fraction multiplication, such as $abxcd = axc\ bxd$. Due to not grasping this concept, students sometimes struggle when adding fractions by adding both the numerators and denominators. This is also affirmed by Astuty (2013), who state that in the process of fraction multiplication, students use the algorithm of adding fractions. Furthermore, students' difficulty in dividing fractions is caused by a lack of understanding of the concept of fraction division $ab \div cd = axd\ bxc$. When students don't understand the concept of fraction division, they might write incorrect answers. This also aligns with Astuty (2013), who assert that the problem in solving questions is due to students' lack of knowledge of the rules or failure to remember those rules accurately.

4. CONCLUSION

The analysis of factors contributing to the difficulty of learning mathematics among 5th-grade elementary school students in this study encompasses two aspects. The first aspect involves learning difficulties stemming from the students' conditions and comprises physical, environmental, motivational, behavioral, and psychological factors. Physical factors influence students who are unwell or not in optimal health, thereby hindering their ability to concentrate on learning at home. Environmental factors reveal that students studying at home struggle to concentrate due to a noisy study environment. Motivational and attitudinal factors depict students who have a lack of interest in mathematics. They find the mathematics lessons in this learning process uninteresting. Psychological factors highlight students becoming bored when engaging in mathematics learning. This sense of monotony also affects students' enthusiasm for learning mathematics, especially within a school setting.

Additionally, concerning the learning difficulties aspect related to the topic of adding and subtracting fractions, students encounter several challenges. The first challenge lies in their inability to convert mixed numbers, percentages, and decimals into proper fractions. The second challenge pertains to students struggling with adding and subtracting fractions. The third challenge is that students have not grasped the concept of multiplying and dividing fractions. Due to their lack of comprehension of these concepts, students often make mistakes in the process of mathematical operations. The fourth challenge revolves around solving word problems involving fractions. This difficulty arises from students' inability to apply mathematical models to solve such word problems.

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