Misconception on Addition and Subtraction of Fraction at Primary School Students in Fifth-Grade

V Trivena¹, A R Ningsih¹* and A Jupri²

¹Program Studi Pendidikan Dasar, Sekolah Pascasarjana, Universitas Indonesia, Bandung, Indonesia  
²Departemen Pendidikan Matematika, Program Studi Pendidikan Matematika dan Program Studi Pendidikan Dasar, Sekolah Pascasarjana, Universitas Pendidikan Indonesia, Bandung, Indonesia

*anggunrestu@student.upi.edu

Abstract. This study aims to investigate the mastery concept of the student in mathematics learning especially in addition and subtraction of fraction at primary school level. By using qualitative research method, the data were collected from 23 grade five students (10-11-year-old). Instruments included a test, that is accompanied by Certainty Response Index (CRI) and interview with students and teacher. The result of the test has been obtained, then processed by analyzing the student’s answers for each item and then grouped by the CRI categories that combined with the results of the interview with students and teacher. The results showed that student’s mastery-concept on additional and subtraction dominated by category ‘misconception’. So, we can say that mastery-concept on addition and subtraction of fraction at fifth-grade students is still low. Finally, the impact can make most of primary student think that learning addition and subtraction of fraction in mathematics is difficult.

1. Introduction
Mathematics is one of the subjects that be taught at every level of education. In fact, mathematics has been introduced from an early age to students. This is because mathematics indirectly affects the student activities. But in fact, there are still many students who think that mathematics is difficult and unpleasant subject. If students only consider that mathematics is fun, puts the value of mathematics, believes that mathematics is important for theirs success in school and for their future, it will affect their learning motivation [1].

One of the materials be considered difficult in mathematics is fractions [2], especially in primary school children. However, the fraction is one of the important materials in learning mathematics [3-5]. Fractions is the key in the theory of numerical development which states that fractions allow students to deepen their knowledge of numbers beyond the levels that may arise from the experience of whole numbers [6]. Fractions if interpreted are one or more equal parts of an object [7]. Fractions are conceptual and procedural. Fractions conceptual requires students’ ability to show fractions as a magnitude allowing students to compare and sort fractions by size while procedural fractions involve arithmetic operations skills including addition, subtraction, multiplication, and division [4,5]. In primary school, fractions have begun to be taught from grade 3 to grade 6 [8].

Students who consider that fractions is difficult material will affect their understanding of fractions. The students who do not understand the fractions value significantly considered incapable of studying
the fraction procedure because they will not predict arithmetic problems so it is impossible to predict a reasonable solution or to reject a defective procedure in answer [9,6]. These opinion followed by preliminary test results of fractions result that given to fifth-grade students. The students still difficult to operating addition and subtraction with different denominators. One of the mistakes made is most of students in addition fractions do not follow the proper procedure. For example, on \( \frac{1}{4} + \frac{2}{8} \), most students directly add the numerator (1 + 2) and the denominator (4 + 8) so the result is \( \frac{3}{12} \).

This indicates that there have been misconceptions in fractional procedures, especially the addition and subtraction of fractions in fifth-grade students. Based on that background, the authors decided to use Certainty of Response Index (CRI) to investigate student’s reason. Departing from the initial discovery, the focus of this study aims to find out the level of mastery-concepts on addition and subtraction of fractions at fifth-grade students. And it is expected that the results of this study will be a consideration for similar research that aims to improve student’s mastery concepts of addition and subtraction of fractions.

2. Method
This research uses the qualitative-descriptive method that aims to examine students mastery-concept on addition and subtraction of fractions without giving treatment to the subjects then the results are presented in a straightforward and candid way. The subjects of this research are fifth students in one of Primary School in Bandung Regency, West Java with 23 participants (10-11-year-old). They are 13 boys and 10 girls who have had prior knowledge about addition and subtraction of fraction.

The instruments used in data collection are tests and interviews. The type of this test is multiple choice with the level of CRI which has five items, each question representative each indicator that will be used measuring the student’s mastery-concepts on addition and subtraction. The test results obtained are then analyzed per item by looking at the answers to the questions, reasons, and levels of confidence and then categorized into one of the CRI categories (understand the concept well, understand the concept but not confident, misconception or do not know the concept) [10].

3. Result and Discussion
There are five indicators used to measure the level of student’s mastery-concepts on addition and subtraction of fractions. Table 1. presents the recapitulation of student’s mastery-concepts on addition and subtraction in CRI category for each indicator or item.

| Indicators of fractions mastery concepts | Understand the Concept Well | Understand the concept but not confident | Misconception | Do not Know the Concept |
|----------------------------------------|-----------------------------|-----------------------------------------|---------------|-------------------------|
| Know the numerator and denominator concept | 56.52 | 0 | 34.78 | 8.70 |
| Addition the same denominators | 8.70 | 0 | 73.91 | 17.39 |
| Addition the different denominators | 13.04 | 0 | 73.91 | 13.04 |
| Subtraction the same denominators | 43.48 | 4.34 | 26.09 | 26.09 |
Table 1. shows that the student’s mastery-concepts in addition and subtraction evenly 53.91% is dominated by the 'misconcept' category and the smallest level of student’s mastery-concepts in the category of 'understand the concept but not confident' with average percentage is 0.87%. Meanwhile the average percentage of mastery-concept in the category 'understand the concept well' and 'do not know the concept' evenly 25.22% and 20%. The table also makes clear that the level of students' understanding in the addition and subtraction of fractions for the categories do not know concepts tend to be more and only just a little differently with the categories of understanding the concept well. This can be seen in Figure 1.

![Image of a bar chart showing average percentage of students primary school on concept of addition and subtraction of fractions](image)

**Figure 1. Recapitulation of average percentage of students primary school on concept of addition and subtraction of fractions**

The next step will be described student’s mastery-concept on addition and subtraction fraction for each indicator or item.

### 3.1. Know numerator and denominator concept

In question number 1 or on the 'know numerator and denominator concept' is dominated by the category of 'understanding the concept well' with a percentage of 56.52%. It means that 13 out of 23 students answered the number 1 correctly, giving the right reason and confidence level above 2.5 [10]. This is in line with the results of previous research which states that children don’t have too many
difficulties in presenting the fractional value in the form of circles or shaded rectangles [11]. Problem number 1 can be seen in figure 2.

![Diagram](image)

1. If the figure above is written in a form fractions, then it is...
   a. \( \frac{6}{3} \)  
   b. \( \frac{3}{3} \)
   c. \( \frac{6}{3} \)
   d. \( \frac{3}{6} \)

**Figure 2.** Question number 1 to measure the numerator and denominator concept

Figure 2. Shows the question number 1 measuring the numerator and denominator concept. For the category of 'misconception' with percentage 34.68%, for category 'do not know concept' with percentage 8.70%. Students with misconception category indicate that there are some students whose the answer was wrong, the reason was wrong but they were very confident with the answer. From the reasons was given by students who have the misconception, it proving that students are still confused in interpreting the shaded images into fractions. The student felt difficult to distinguish whether the 3 shaded columns of 6 columns is \( \frac{3}{6} \) or \( \frac{6}{3} \). The student who answering with correct reason, "because the box is 6 and the blackened there are 3" while for the answer \( \frac{6}{3} \) the reason was also the same. This indicates that the student is still difficult to distinguish the numerator and denominator concept. That reason was gotten from the interview. The question that asked the student who has misconception: "which is the numerator and denominator in \( \frac{3}{6} \)" The student replied, "the numerator is at the bottom and the denominator is at the top".

Judging from the result tests and interviews with some students, there are factors that affect the student is difficult to distinguish the numerator and denominator of the student's prior knowledge about the concept are poor, because they forgot the concept was taught while to master the concepts and procedures of the fractions need to account the students' math skills earlier [3].

3.2. Addition the same denominators

Here's a question of measuring the mastery concept of addition the same denominators which we can see in figure 3.

![Diagram](image)

2. What is the result of \( \frac{1}{4} + \frac{2}{4} \)?
   a. \( \frac{3}{8} \)  
   b. \( \frac{3}{4} \)
   c. \( \frac{7}{8} \)
   d. \( \frac{4}{3} \)

**Figure 3.** Question number 2 to measure addition the same denominator fractions concept

Figure 3. Shows the questions was given to the students for measuring the concept of addition the same denominators. In this question, most of students are 73.91% in misconception category and for
the 'do not know the concept' category and 'understanding the concept well' in successive percentages of 17.39% and 8.70% (see Table 1.). Students who have misconception category indicate most of them answered incorrectly, but the reason was given with a high level of confidence. Few of misconception students gave the reason, "because 2+1=3 and 4+4=8 so the result is \( \frac{3}{8} \)." The reasoning indicates that the students do not understand the procedure of addition fractions. Students assume that adding a fraction equals adding the whole number. Students who do not understand fractions or have not learned fractions will assume that all numbers have the characteristic of whole number [12].

3.3. Addition the different denominators

Here's a question of measuring the concept of addition with the different fractions in students which we can see in figure 4.

![Figure 4. Question number 3 to measure the concept of the addition of the different denominators](image)

Figure 4. Demonstrate the question of measuring the student’s mastery-concepts on addition the different denominators. The result of this indicator is 73.91% (see table 1) indicate that students who had the misconception in answering about the different addition denominators. While each category 'understand the concept well' and 'do not know the concept' is 13.04%. The reason was given by students who misconception, "because 2+1=3 and 5+2=7, so the result is \( \frac{3}{7} \)." This further indicates that besides the students do not understand the addition procedure of either the same or different disparate fractions, the students also do not understand that there are different procedures in working on the same or different dominators. In addition to the case in question number 1, where some students still suffer misconceptions in distinguishing between numerators. Previous studies also argue that students who do not understand the fractional value are significantly incapable of studying fractions procedures because they can not predict arithmetical problems [4]. This means if students understand the concept of magnitude fractions, so they should be sequences the fractions. For example, if their add \( \frac{1}{2} + \frac{2}{5} \) the result should be greater than \( \frac{1}{2} \) thus, the students would think again about the answer \( \frac{3}{7} \) because \( \frac{3}{7} \) even smaller than \( \frac{1}{2} \).

3.4 Substraction the same denominators

Here's a question of measuring the same denominators was given to students which we can see in figure 5.
4. What is the result of $\frac{4}{6} - \frac{2}{5}$?
   a. $\frac{2}{0}$
   b. $\frac{0}{6}$
   c. $\frac{2}{6}$
   d. $\frac{2}{12}$

Figure 5. Question number 4 to measure the concept of subtraction of the same denominators

Figure 5. Demonstrate the question was used for measuring the student’s mastery-concepts on the subtraction of the different denominators. The result of data analysis shows the percentage of students with the category of ‘understanding the concept well’ is 43.48%, while the percentage of students who ‘misconception’ is 26.09% (see Table 1) and for the percentage of category ‘do not know concept’ and ‘understand concept but not confidence’ respectively is 4.35% and 26.09%. Students who have misconception the reason given is, "because 4-2 = 2 and 6-6 = 0, so the result is $\frac{2}{0}$", the case in number 4 is same with the case in number 1 and 2 but the difference just at the subtraction. However, in students who understand the concept well, followed by the results of interviews with some students, there is a different understanding of the subtraction fractions, this is because students choose the correct answer that is $\frac{2}{0}$ not because of knowing the procedure of subtraction but because they have never gained experience with fractions that have "0" denominators so they assume that the probability that the answer is false.

3.5 Subtraction the different denominations

The question of measuring the concept of subtraction different denominators can be seen in figure 6.

Figure 6. Question number 5 to measure the concept of different subtraction of denominators

Figure 6. Demonstrate the conceptualizing indicator of subtracting the different fractions. From the results of the analysis in table 1. show that the concept of subtracting different denominator fractions most of students who 'misconception' have the percentage of 60.87%. Students who misconceptions on this matter give the reason that is, "because 7-1 = 6 and 8-2 = 6, so the result is $\frac{6}{6}$". From the results of this data, it is increasingly indicated that most of students have not understood the procedure in addition and subtraction of fractions. Students equate arithmetic procedures to a fraction equal to the arithmetic procedure of whole numbers. Whereas difficulties in the fractions are different in complex terms. Additions and subtractions to fractions require the same denominator [6]. However, based on the results of data analysis, students do not understand the concept of addition and subtraction of both denominations are same or different.
4. Conclusion
Most of the student’s mastery-concept on addition and subtraction of both the same and the most different has experienced 'misconception'. Many of students’ misconceptions occur in question number 2 with the addition the same denominators, question number 3 with the addition the different denominators, and the number 5 with the subtraction with different denominators. Based on these findings it can be concluded that the students are still having difficulties in understanding the arithmetic procedures of the fraction especially the addition and subtraction. Particularly the student does not yet know that addition and subtraction operations must equalize the denominator first not necessarily add or subtract the numerator with the numerator and denominator with the denominator. Therefore, it would be better to do further research on the causes of misconceptions about the addition and subtraction of fractions of subsequent improvement of understanding the student’s concept in various classes, especially in primary schools.

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