

# Understanding of Fraction Concepts of Elementary School Students through Problem Solving

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**Abstract.** Fractions are material numbers that are very important in mathematics and everyday life. However, many students have difficulty understanding the concept of fractions. This study aims to describe the concept understanding among student about fractions through problem-solving assisted by visual representation. Descriptive research with a mixed approach was used and involve 13 elementary school students in grade V and 31 junior high school students in grade VII as research subjects. Data obtained through the subject's written answers to the two fraction questions given were further analyzed descriptively. The analysis shows that the subject can understand the concept of fractions based on the visual representation of images, but still has difficulty presenting fractions in image representations.

**Keywords:** *fraction concept, fraction problem, problem solving*

## INTRODUCTION

Fractions in English are words derived from the Latin *fractus*, which means 'broken' [1]. Fractions is a very important building block for other mathematical skills, and the successful experience of learning new concepts such as algebra, probability, trigonometry, and calculus [2]–[4] and critical in daily life activities: interpreting recipes, calculating discounts, comparing rates, converting units of measurement, reading maps, investing money, count calories from food labels and measure daily intake of protein, carbohydrates and fat [5], [6].

According to Neagoy [6], there are three reasons why fractions become things that must be considered in their learning, namely: 1). Fractions play an important role in students' feelings about mathematics. For many students, fractions present the first stumbling math. Students incline to dislike mathematics when they have to give up on common sense and give up on memorization without understanding. 2). Fractions are very important for mathematics and everyday life. Although fractions support many complex mathematical topics, including ratios, percentages, proportions, and slope, their importance is not limited to the study of

mathematics. The smoothness with fractions is also needed for many activities of daily life. 3). Fractions are fundamental to success in other mathematical material, more specifically algebra,

The introduction of fractions is one of the learners' first experiences with mathematical concepts outside the basic arithmetic skills of numbers [7], [8]. Fractions are also difficult concepts to learn and teach [8]–[10], thus becoming sustainable pedagogical challenges for the mathematics education community [11]. The students' relatively limited conceptual understanding of fractions is due to the teaching of reproductive mathematics through mechanical repetition of the various rules provided by textbooks [12]. Besides, the factors most often mentioned contribute to the complexity of fractions because fractions have five interrelated constructs: part-whole, ratio, operator, quotient, and measure [13]–[15] which is often referred to as the concept of fractions.

Various attempts were made to facilitate the understanding of the concept of fractions such as reproductive through mechanical repetition of various rules provided by textbooks [12] and using visual representations, such as circles and number lines [10], [11], [16], [17] because the use of representation can be an excellent way to introduce abstract concepts in mathematics especially for students in primary education [4], [10]. Therefore the study of student knowledge about fractions is very important because fractions present a very complex set of concepts and skills in mathematics [3], [18].

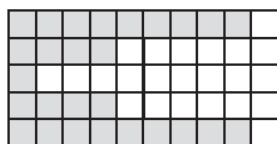
Students learn mathematics as a result of their efforts to understand mathematical concepts and procedures during their problem solving [19]. In addition, the selection of tasks and representations of learning over a long time will be very helpful in building a strong conceptual understanding of mathematical concepts [11]. Therefore, it is very important to see the problem-solving process of student fractions as an effort to measure conceptual and procedural understanding. The task or problem given in this research is visual form. Problem-solving in research is defined as a cognitive activity that is observed from written answers.

## METHOD

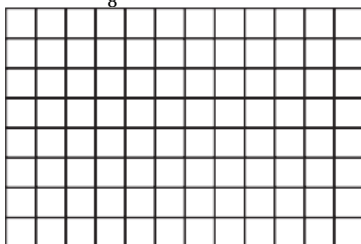
The purpose of this study is to describe the process of problem-solving fraction among elementary school student without interference. The type of research used is descriptive with a mixed approach [20]. Grade V students of SDN numbered 13 people with 4 males and 9 females and private VII grade junior high school students totalling 31 consisting of 9 males and 22 females were subjected to the study.

The data is obtained from the subject's written answers. Data collection instruments in the form of fractional test questions adopted from [21] consist of two problems, which are looking for a form of fraction from the shaded area and driving the area if the fraction is given.

1. State the shaded area in the picture beside in the form of fractions!



2. Shade the area in the image next to that states value  $\frac{3}{8}$ !



Furthermore, the data that has been obtained is analyzed descriptively by coding the truth of the subject's answers and the problem-solving process that is associated with understanding the concept of fractions.

## RESULT & DISCUSSION

Based on the data, the exposure to the results is presented in two parts, namely the frequency distribution of the correctness of the answers and the subject's problem-solving process.

### Distribution of Subject Answers

The distribution of subject answers is presented based on the school level, question number, and gender, as presented in Table 1.

Table 1. Distribution of subject answers

Grade	Problem number 1				Problem number 2			
	Male		Girl		Male		Girl	
	Right	False	Right	False	Right	False	Right	False
V	4	0	9	0	4	0	4	5
VII	9	0	22	0	5	4	9	13
TOTAL	13	0	31	0	9	4	13	18

Based on Table 1, for question 1, states fractions from shaded areas subject to no difficulty, both in terms of school level and gender. All subjects can answer correctly. However, for question number 2, to grind the area if given a fractional value, the subject experienced difficulties, except for male elementary school students, all answered correctly. Female elementary students still experience as much difficulty 38.46% of the total elementary subjects, 27.78% of the total female subjects, and 16.13% of the total subjects. Junior high school students also experienced difficulties as much as 41.94% of the total junior high school subjects, 41.94% of the total female subjects and 29.55% of the total subjects.

In contrast, junior high school students experience difficulties as much as 9.09% of the total subjects, 30.07% of the total male subjects and 44.44% of the total junior high school subjects. In general, female students experienced difficulties of 40.91% and male students 9.09% of the total subjects. This means that in problem-solving number 2, male subjects are better than women. This is in line with the statement that men excel in terms of mathematics and spatial ability while women excel in terms of language and writing [22], [23] which results in a different problem-solving strategy [24], men tend to be more flexible using more abstract strategies and retrieval strategies, whereas women tend to use manipulative and more concrete strategies. If viewed from the school level, elementary students are more problem solving than junior high school students. This is in accordance with [11], who states that adults continue to struggle with the concept of fractions even when fractions are important for everyday work-related tasks.

### Problem Solving Process

#### Problem number 1.

To determine the fractional value of the shaded area, the subject counts the number of shaded squares and the total number of squares. Next, create or write the fractional form. In the given problem, there are 29 shaded squares, and there are 50 total squares so that the fractional value obtained is  $\frac{29}{50}$ . The subject's written answers are presented in Figure 1.

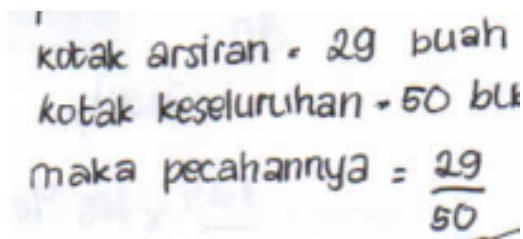


Figure 1. The process of the subject determining the fractional value of the shaded area

This question was answered correctly by all subjects. This means through visual representations of images, the subject can understand the concept of fractions, part of the whole. Using visual representations of images is an excellent way to introduce abstract concepts in mathematics, especially for students in primary education [4], [10], [11], [25].

Problem number 2.

To determine the number of boxes to be shaded, 50.00% of the total subjects answered correctly. The first step taken by the subjects calculating the total number of squares then looking for fractions that are equivalent to given fractions by performing a multiplication count operation on the denominator then followed by multiplication on the numerator. The number value in the numerator indicates the number of squares to be shaded. In question number 2, given a fraction  $\frac{3}{8}$  and a total of 96 squares. Next to get the denominator 96, then  $8 \times 12$ , then  $3 \times 12$  to get the equivalent fraction, that is  $\frac{3}{8} \times \frac{12}{12} = \frac{36}{96}$ . So the number of squares to be shaded is 36 out of a total of 96 squares. The subject's answers are presented in Figure 2.



Figure 2. The process of the subject in determining the area to be shaded

They can visualize and perform operations mentally with numerators and denominators of greater value. They have a good sense of estimation and apply the equivalence of fractions [13]. Conversely, subjects who have not been able to answer correctly, they still understand the formal symbolism of fraction notation. They cannot understand that the symbolic representations of different fractions may be only alternative (equivalent) written forms of the same number [12].

Learning fractions requires the reorganization of numerical knowledge.

## CONCLUSION

Understanding fraction concepts for elementary school students is very important because fractions are complex topics and are very important for learning other mathematical material and are widely used in daily life. To express fractions, a portion of an entire visual representation of a given picture, elementary education students do so by counting many shaded areas (as a numerator) and calculating the total of all regions (as a denominator). In this problem, elementary education students can solve it correctly.

Solving the problem of determining (shading) an area if given a fraction, is done by making equivalent fractions based on the many regions that are used as denominators and numerators of fractions that are worth stating the number of areas to be shaded. For problems like this, there are still many students who have not been able to answer correctly. Therefore, the use of multiple visuals in fraction learning should be a concern. Besides, this research is only limited to understanding the basic concepts of fractions. Thus, there is still very much open research regarding the operation of calculating fractions and how students determine the value of decimal fractions and the per cent of fractions given, and vice versa.

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