Analysis of Sixth Graders' Difficulties in Solving Mathematics Word Problems on Whole Numbers, Fractions, and Decimals

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U I Kusuma[1], H Retnawati[2]

[1]Graduate Program of Mathematics Education, Universitas Negeri Yogyakarta Indonesia
[2]Departement of Mathematics Education, Faculty of Mathematics and Natural Science, Universitas Negeri Yogyakarta, Indonesia
Jl. Colombo No. 1 Depok, Catur tunggal, Sleman, 55281, Yogyakarta, Indonesia

[1] uliviaisnawati.2017@student.uny.ac.id
[2] heri_retnawati@uny.ac.id

Abstract. Operation which involve whole numbers, fractions, and decimals are important concepts that must be possessed by students. It is a part of mathematics that is very close to everyday life. In fact, many students who have difficulty in understanding the fractions, especially in the word problems. This study aims to describe sixth graders' difficulties in solving mathematics word problems on the operation which involve whole numbers, fractions, and decimals. This research is descriptive with students of grade six as the subjects. Data were collected by tests and in-depth interviews. Tests were used to analyze students difficulties in solving mathematics word problems on the operation which involve whole numbers, fractions, and decimals. Interviews were conducted to know the difficulties experienced by the students in depth. The unstructured interviews were conducted with students' error. The results showed that students' difficulties in solving mathematics word problems on the operation which involve whole numbers, fractions, and decimals are caused by: 1) Students' difficulties in the word problem, 2) Students' difficulties in understanding the concept of fractional operations, 3) Students have less numeracy skills, and 4) Inaccuracy.

1. Introduction

Mathematics is a subject that taught from primary school to college. It also becomes a subject gradually taught from concrete to abstract. It must be learned since it has a very important role in solving problems for everyday life. However, some students have some difficulties in understanding mathematics so that it becomes the reason and it results in the difficulties to do math problems [1]. Understanding about the various concepts of fractions is challenging for all students and fractions are an area that students need extra support and instruction [2]. Difficulties are a symptom that appears to students characterized by a learning achievement that is low or below the established norm [3]. Difficulties can be interpreted as a condition in the learning process marked by certain obstacles to achieving learning outcomes [4]. Therefore, it is necessary to analyze the difficulties experienced by students in solving mathematical problems.

Fractions are the most important fundamental subjects for students and are important for many advanced mathematical topics such as algebra [5]. In fact fractions have always been a tough challenge for students. The lack of conceptual understanding of fractional material results in difficulties in terms of calculations with fractions and decimal concepts. If this concept is lacking, then the students will have difficulties in learning the next subject that has to do with fractions. Fractions is one of the most difficult mathematical skills for children to master, with and without difficulties [6]. The use of the basic concepts of fractions and skills in performing count operations on fractions is very important in learning. Counting operations on fractions can help students solve problems in the form of word problems or everyday problems that require numeracy skills to solve them. Solving operations on fractions will allow several ways to solve them, so the amount of time needed to solve the problem depends on the way students work on the problem. In addition, the importance of skills in performing various operations on fractions also becomes the right strategy that will help students become more efficient in solving problems.

To overcome the difficulties faced by the students in solving the problems, it is necessary to learn about the process or steps that are appropriate in solving fraction operations. Difficulties in performing count operations can be viewed from a number of things, for example from the difficulty of students understanding the material, difficulties in understanding the problem, difficulties in processing or performing count operations. Diagnosis of student difficulties in solving fractions of problems is carried out by researchers to students individually [7]. The diagnosis is done after students are given fractional problems related to the fractions that have been studied.

Analysis of students' difficulties in solving word problems in operation which involve whole numbers, fractions, and decimals are also a good way to improve the quality of student learning outcomes in the material, so that learning achievement can be reached with maximum results. Students begin to be introduced about whole numbers, fractions, and decimals since fourth grade. But when fourth grade students only identify and explain the form of fractions.Whereas according to the basic competencies of 3.3 and 4.3 for the sixth grade in the 2013 curriculum, students must be able to explain and perform mixed counting operation which involve whole numbers, fractions, and decimals in various forms according to the sequence of operations. Then students are also expected to be able to solve problems related to mixed counting operation which involve whole numbers, fractions, and decimals in various forms according to the order.

This is a concern that in learning mathematics, the initial concept of a material will be the basis for learning the next material. In mathematics a concept will support another concept, or a material becomes a prerequisite for studying other material. Lack of understanding in a concept causes a lack of understanding in other concepts, and this lack of understanding results in students having difficulty connecting to solve a problem [8] The National Council of Teachers of Mathematics Standards [9], recommends that fractional content incorporates understanding of fractions as part of the number line, understanding of the relationship of fractions to whole numbers, fraction equivalence, and proficiency and fluency with addition, subtraction, multiplication, and division of proper, improper, and mixed fractions. Their difficulties started from the fact that the students had not completely mastered the concepts that had been related to the problems [10]

From the description above, the researcher is interested in analyzing the difficulties of sixth grade students in solving word problems in mixed counting operation which involve whole numbers, fractions, and decimals. The purpose of this research was to describe the location of the difficulties of sixth grade students in solving word problems in operation which involve whole numbers, fractions, and decimals.

2. Methodology of Research

This research was conducted to describe the factual, accurate, and the conditions regarding student learning difficulties in mixed counting operations which involve whole numbers, fractions, and decimals of sixth grade students. In accordance with the description and objectives stated above, this research was categorized

as descriptive research. The subjects observed in this study were sixth grade students consisting of ten people.

The instruments and data collection were tests and interviews. The test was used to analyze students' difficulties in solving word problems related to the concepts, principles, and skills in mixed counting operation which involve whole numbers, fractions, and decimals. The interviews were conducted to trace the difficulties experienced by students more deeply and help researchers dig deeper information about the results of students' work. The interviews were conducted in an unstructured manner according to the mistakes made by the students, so the information obtained from the research results could be clearly explained.

3. Result And Discussion

The subjects were sixth grade students consisting of ten people. Below is the description of the difficulties experienced by students in solving math problems based on the results of tests and interviews. The students who have difficulties in solving word problems were identified based on the analysis of wrong answers and questions that were not answered by the students when the math test was a operation which involve whole numbers, fractions, and decimals. There was only one of ten students who succeeded in answering all the problems correctly.

The highest difficulty for students was operations between multiplication, subtraction and division. Based on the analysis on the students' answer sheet, the researcher found that there were difficulties in solving the word problems for students because they did not write the processes and errors since they did not answer the questions. Based on the results of tests and interviews conducted, there are several causes for the location of students' learning difficulties described below:

3.1 Students' difficulties in the word problem

Some students claim that sometimes it is difficult to understand the purpose of the word problem. Students feeling confused with how to write a mathematical sentence in the answer sheet. Many students ask what the questions mean to the researcher while reading the questions.

Below is the example in question number 4:

Mr Andi has 1,8 hectares of field. $\frac{1}{6}$ *part of the area is planted with corn. The remains are planted with green beans, soybeans, and cassava. The area are planted with green beans, soybeans, and cassava are as broad. How many area are planted with cassava?*

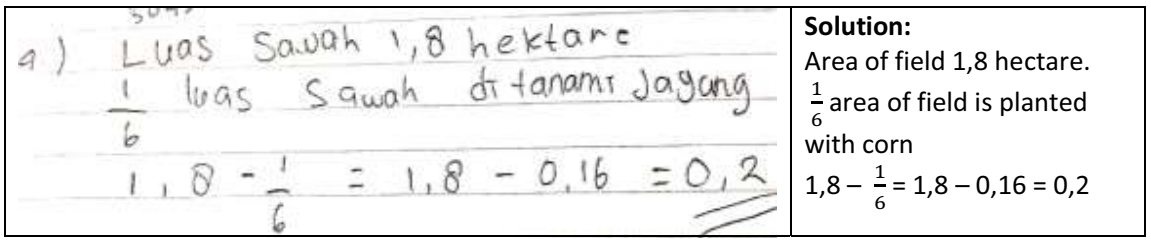
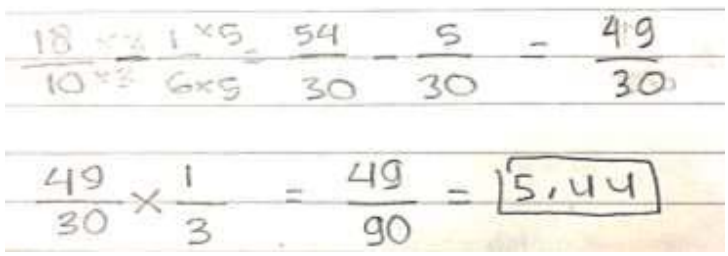


Figure 1. The answer of SP2, students with the difficulties in understanding the problems



Solution:

$$\frac{18}{10}-\frac{1}{6}=\frac{54}{30}-\frac{5}{30}=\frac{49}{30}$$

$$\frac{49}{30}\times\frac{1}{3}=\frac{49}{90}=5{,}44$$

Figure 2. The answer of SP4, students with the difficulties in understanding the problems

The researcher had the opportunity to ask SP2 students the questions while working on test questions.

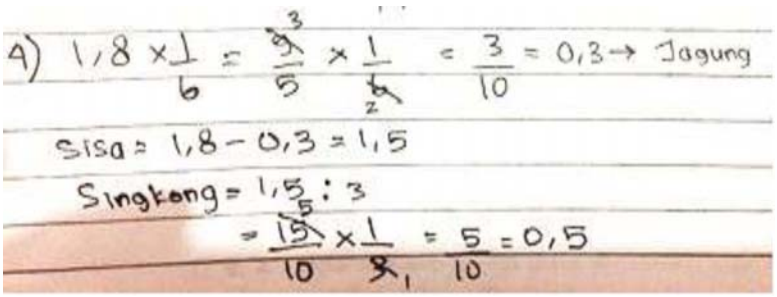
Researcher : *Please explain your answer for that problems!*

SP2 : *Mr. Andi has a 1.8 hectare rice field.* $\frac{1}{6}$ *the part is planted with corn, so it is 1.8 minus* $\frac{1}{6}$*. Then I don't understand what this means.*

Researcher : *Is that correct 1.8 minus* $\frac{1}{6}$*? Do you understand the problems of the question?*

SP2 : *I'm confused. The word problem is difficult to understand. I don't understand what it means.*

This SP2 student does not continue the work because of the difficulties in understanding the word problem . Likewise the answer from SP4 can be seen from the picture above that the answer from SP4 is almost the same as the SP2 answer. The SP4 students work until it was finished. From the students' answers above shows that students have difficulty in understanding the problem in the word problem in operation which involve whole numbers, fraction, and decimals. Most students do not understand the problem so that only the origin of writing an answer or choosing not to answer the question. In question number 4, out of ten students, there is only one student who can answer correctly, namely the answer from SP6. The picture below is a work picture of SP6 students who are correct in answering number 4 questions



Solution:

$=1{,}8\times\frac{1}{6}=\frac{9}{5}\times\frac{1}{6}$

$=\frac{3}{10}=0{,}3$ (area of field is planted with **corn**)

Remains = 1,8 – 0,3 = 1,5

Area of cassava = 1,5 : 3

$=\frac{15}{10}\times\frac{1}{3}$

$=\frac{5}{10}=0{,}5$

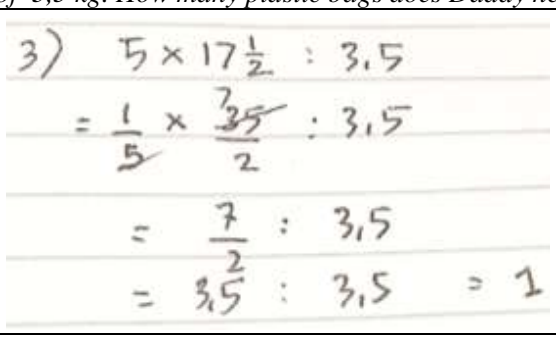
Figure 3. The correct answer of SP6 student

3.2 Students' difficulties in understanding the concept of fractional operations

The question of mixed fraction operation tests about multiplication and division is given to ten students. There is an answer to the chosen subject which is the answer that shows that students do not understand the

concept of multiplication and division of a fraction. The following SP3 answers to problem number 3 can be seen as follows:

Daddy has 5 bags of rice. Each sack contains $17\frac{1}{2}$*kg. The rice will be put into a plastic bag, each bag contains of 3,5 kg. How many plastic bags does Daddy need*?



Solution:

$= 5 \times 17\frac{1}{2} : 3{,}5$

$= \frac{1}{5} \times \frac{35}{2} : 3{,}5$

$= \frac{7}{2} : 3{,}5$

$= 3{,}5 : 3{,}5$

$= 1$

Figure 4. Answers of SP3, students who do not understand the concept of fraction multiplication and division

The researcher conducted an interview to obtain more information about students' difficulties in mathematical concepts. The following excerpts of interviews with SP3 have been reduced:

Researcher	: *Please explain your answer!*
SP3	: *5 is multipleed by 17.5, then it is divided by 3.5*
Researcher	: *That's correct , but why did you write 5 into* $\frac{1}{5}$ *?*
SP3	: *It's reversed when the number is multiplied.*
Peneliti	: *Is it correct that the multiplication is reversed to be like this?*
SP3	: *I don't know, I can't remember it. There was something reversed.*

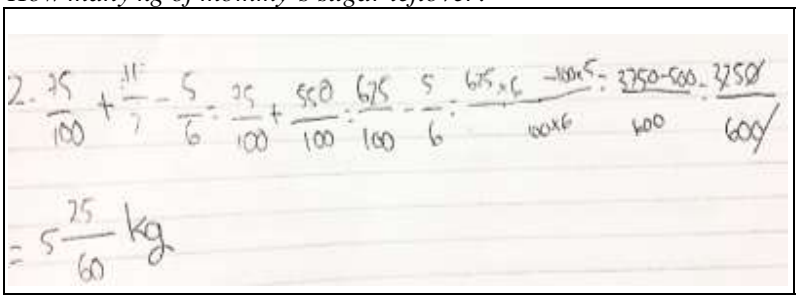
From the SP3 answer above, it shows that it is difficult to work on word problems because they do not understand the concept operation which involve whole numbers, fractions, and decimals.

3.3 Students have less numeracy skills

The word problems of the fractional mix operation given by students, requires students to use their numeracy skills in operations on fractions. Based on the results of the analysis of student work results, there are four students who perform calculations like the following:

Question number 2

Mommy has 0,75 kg of sugar. To make cakes, she buy more $5\frac{1}{2}$ *kg. It turned out that the sugar used was* $\frac{5}{6}$ *kg. How many kg of mommy's sugar leftover?*



Solution:

$= \frac{75}{100} + \frac{11}{2} - \frac{5}{6}$

$= \frac{75}{100} + \frac{550}{100} = \frac{625}{100}$

$= \frac{625}{100} - \frac{5}{6} = \frac{3750-500}{600}$

$= \frac{3250}{600} = 5\frac{25}{60}$

Figure 5. The answer of SP1, student have less numeracy skills

The answers from SP1 students need a long time to work, because the numbers are denominators in large-value fractions. So the results become less precise because they are not the simplest fractions. The researcher conducted an interview to obtain more information about student difficulties. Following are excerpts of interviews with reduced SP1 students

Researcher : *Is this the simplest fraction?*
SP1 : *I think so. The number is quite difficult. I was feeling difficult to make it simple.*

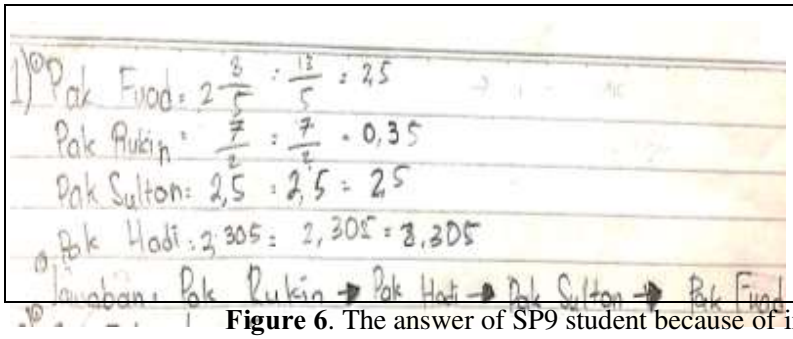
From the answers to SP1 above, it was shown that it was difficult to do the questions on mixed counting operation material because of the lack of skills in calculating addition and fraction reduction operations. Difficulties in calculation are often done by students because students are confused about the problem solving process. This can be seen when working on test questions, many students wonder how to solve the problem.

3.4 Inaccuracy

Inaccuracy experienced by students occurs because the students are in a hurry in working on the problem and tend to want to finish quickly, so students miss important information contained in the problem.

Question number 1

Mr. Sulton's rice harvest was 2.5 tons, Mr. Fuad has $2\frac{3}{5}$ *ton, Mr. Rukin has* $\frac{7}{2}$*ton and Mr. Hadi 2.305 tons. From the harvest of the four people, determine the ordering of the harvest from the greatest!*



Solution:
Mr. Fuad : $2\frac{3}{5} = \frac{13}{5} = 2{,}5$
Mr. Rukin: $\frac{7}{2} = 0{,}35$
Mr. Sulton: 2,5
Mr. Hadi: 2,305
So Mr Rukin, Mr. Hadi, Mr. Sulton, Mr. Fuad

Figure 6. The answer of SP9 student because of inaccuracy in order

The picture above is the result of the wrong SP9 student work. To obtain information in depth the researchers conducted interviews with SP9 students.

Researcher : *Take a look at your answer one more time, please. Is it correct already?*
SP9 : *Wait a moment.* $\frac{7}{2}$ *must be 3.5, not 0.35. So Mr Rukin is the last order.*
Researcher : *Is the fractional order was correct? Is it taken from the one whose harvest is the greatest?*
SP9 : *Oh yeah. I did it from the least, instead.*
Researcher : *Have you done the question like this inaccurately?*
SP9 : *I do it often. The correct answer went wrong.*

Based on the interview above, information was obtained that indeed SP9 students were not thorough in reading and working on questions. Interviews carried out on ten students also claimed that, they claimed they were often not careful because of hurry. Not carefully reading the questions, not carefully working on the questions. Therefore, if the students do not carefully do the counting, it will be difficult for them to solve word problems.

Based on the results of the tests and interviews above, it can be concluded that there are four causes of students' difficulties in working on word problems, students have difficulty understanding in word problems, students do not understand the concept of operations on fractions, students have less numeracy skills, and inaccuracy. The first contributing factor is the difficulty of understanding in word problems. This factor is the main factor that causes students difficulty in working on word problems. Students do not understand the meaning of the sentence about the word problem so that they cannot determine the calculation operation or the mathematical form that must be used in the problem. The high factor of difficulty causes students to be unable to determine information in the problem properly. This factor is indeed the most frequent factor that causes student difficulties in solving problems especially math problems.

The second causative factor is that students do not understand the concept of fractional operations so that students cannot process the fractions correctly. Whereas the basic concept of fractions is very important to be owned by students so that later they can do the fraction calculation process. This is known when students are unable to calculate multiplication and divide the fraction material correctly. The third factor is the lack of mathematical numeracy skills. Students are required to have good numeracy skills, especially in mixed counting operation which involve whole numbers, fractions, and decimals. This numeracy skill is needed when simplifying a fraction and determining the exact denominator in the fractional material. The last factor is inaccuracy. Inaccuracy due to haste is a common cause of error by students in answering questions, not only in working on word problems but also in other forms of questions, even in other subjects. In this study, the inaccuracy factor was caused by students hurrying in working on the problem.

Word problem in mathematics lessons are important to give to elementary school students, because word problems can train studnumerents' ability to solve problems, especially problems in everyday life. Mathematical word problem presented in the form of stories based on experience [11]. Mathematic word problem as mathematical problems expressed in meaningful sentences [12]. Mathematical word problems is not a basic math skill but a means to apply the mathematical skills that have been owned by students. Before being able to solve the mathematical word problem, there are some prerequisite skills that must be owned by the rest. The skills needed by students to solve math problems in the form of stories are to analyze and interpret information in the problem, form problem solving strategies, and apply concepts that have been mastered in various situations [13]

From the explanation of the results of the above research, the importance of giving and multiplying exercises to work on word problems for students so that students become accustomed to understanding word problems and can practice their numeracy skills. Analyzing students' difficulties in solving word problems in mixed counting Operation which involve whole numbers, fractions, and decimals, can be a good way to improve the quality of student learning outcomes in the material, so that learning achievement can be achieved with maximum. Then the information obtained from the research results is used to improve and improve the next teaching and learning process. Problems about students who have difficulty solving math word problems, especially fractions, indicate errors in the teaching and learning process so improvements are needed. Difficulties experienced by students in working on word problems that occur in sixth grade students must be minimized so that they can be reduced or even this does not happen again. Based on these causal factors, the teachers or educators should do a number of ways that can be done to minimize student errors in solving math word problems, especially operation which involve whole numbers, fractions, and decimals.

4. Conclusion

Based on the results and discussion of the research, students' difficulties in solving mathematics word problems on the operation which involve whole numbers, fractions, and decimals are caused by: 1) Students'

difficulties in the word problem, 2) Students' difficulties in understanding the concept of fractional operations, 3) Students have less numeracy skills, and 4) Inaccuracy.

This research is that the teachers or educators need to anticipate the difficulties experienced by students in operation which involve whole numbers, fractions, and decimals. Then the teacher should deepen the concepts and principles of fractions which are the basic mathematics that students must master in order to solve mathematical problems correctly. Students should be accustomed to solving the problems with complete completion steps to simplify fractions. Therefore, students become accustomed and able to understand word problem and can practice their numeracy skills. In addition, since the fraction learning is included in the abstract category, learning for elementary school students is still a concrete stage so that the teacher should teach fractions using concrete teaching tools. The process carried out in fractions is presented to students preferably through concrete models and real life problems. In addition, the logical reasons underlying the operation must be presented rather than giving rules about operations [14].

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