

Fifth grade students' difficulties in solving addition of fractions

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ABSTRACT

Fractions have been applied in daily life and become a prerequisite in learning mathematics, therefore students have to mastered fractions. Many studies state that learning fractions classified as a difficult topic including addition of fraction. The aim of this study was to determine fifth grade' difficulties in solving fraction addition problems, and to determine factors that cause their experiencing difficulties in learning addition of fractions. The method of this study was a mixed method. The participants were 29 fifth grade students from a public elementary school in Pekanbaru, Riau province, Indonesia. The results showed that many students got difficulties in solving the tasks. The study also showed that the difficulties were experienced by students in completing addition of fractions including mastering the concept of addition of fractions with 71.43% error. The students were not mastering the prerequisite knowledge of multiplication with 47.29% error and was not able to complete problem solving tasks of adding fractions with 42.53% error. The factors that cause students experiences the difficulties in completing adding fractions are the lack of students' motivation, students were low on interest of learning mathematics since they assume that mathematics is a difficult subject.

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INTRODUCTION

Fractions are an important material in learning mathematics, because they are often applied and found in everyday life. Fractions are one of the basic materials in studying mathematics and science related to the surrounding environment (Zabeta, 2015). Fractional material is a difficult topic to learn and teach (Depdikbud in Untari, 2013) and a difficult material for students around the world to learn (UNESCO in Palpialy & Nurlalelah, 2015). An important material about fractions and needs to be learned in elementary school is arithmetic operations on fractions.

A study conducted by Witri, Putra, and Nurhanida (2015) found that fifth grade elementary school students in Pekanbaru had difficulty solving number sense questions

related to fractions, more specifically they found that only 25% of students were able to solve number sense tasks related to fractions. Meanwhile, a study conducted by Li (2014) found that more than 30% of students in England used the wrong strategy in adding fractions, namely adding the numerator with the numerator and the denominator with the denominator. This study shows that most elementary school students still have difficulty in fraction operations, including addition of fractions.

Some previous studies focused on understanding students' conceptual and procedural/skills about fraction operations (Li, 2014), but have not seen students' problem-solving abilities in addition of fractions. Therefore, the present study investigates students' difficulties in solving addition of fractions in three aspects, namely concepts, procedures/skills, and problem solving. Based on the results of interviews conducted by first researcher with teachers at one of the public elementary schools in Pekanbaru on May 3, 2019, the teacher stated that many students also experienced difficulties in addition of fractions. Many students do not complete this lesson, which prevents them from understanding more complex fraction operations, such as multiplication and division of fractions. Thus, the formulation of this research is what are the difficulties of fifth-grade students in solving fraction addition problems? What are the factors that cause the fifth-grade students to have difficulty in learning addition to fractions?

LITERATURE REVIEW

Difficulties in learning mathematics in students are related to imperfect learning abilities. These shortcomings can be revealed from solving mathematical problems that are not complete or complete but incorrect. According to Learner (in Mulyono, 2012) there are three aspects in the field of mathematics studies, namely:

a. Concepts

Concepts refer to basic understanding. Students develop concepts when they can group or classify objects or when they are able to group a name with certain objects (Mulyono, 2012). In fraction material, student can be said to understand the concept of one of them by grouping which fractions have the same denominator as those that are not the same. For example, students can group $\frac{1}{2}$ and $\frac{3}{2}$ are fractions with the same denominator, while $\frac{3}{4}$ and $\frac{1}{3}$ are fractions with different denominators.

The concept can also be seen from students' ability to represent fractions in the form of figures. For example, in Figure 1 below which of the following figure corresponds to the operation of numbers $\frac{1}{2} + \frac{3}{4}$?

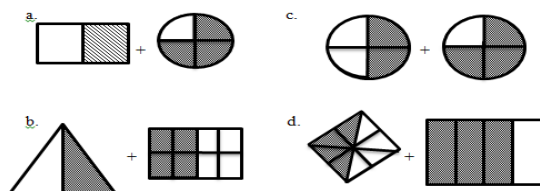


Figure 1. An example of addition of fractions using diagram representation (Li, 2014)

From that task, the correct answer is C because in choice C the units used have the same shape and size so that they can be added up. Even though the first circle is a fraction

of $\frac{2}{4}$, it is a fraction that is equivalent to $\frac{1}{2}$. Therefore, if students' understanding of concepts has not been properly embedded, they will make a mistake when answering that task.

b. Skills

Skills relate to something someone does (Mulyono, 2012). A skill can be seen from the student's performance is good or bad, fast or slow, and easy or very difficult. In the matter of adding fractions, students' skills can be seen from whether students are proficient in solving fractions problems, both in the basic process of adding and multiplying numbers. Students who have excellent skills will easily be able to determine least common multiple (LCM) as the common denominator. For example, students can solve addition problems with different denominators such as $\frac{1}{4} + \frac{1}{3} = \dots$

To solve the task, student have to find LCM of 4 and 3 that is 12. Then the denominator must be equated to 12. Where the denominator of $\frac{1}{4}$ is 4 which is then multiplied by 3 to make the number 12, while the denominator of $\frac{1}{3}$ is 3 which is multiplied by 4 to make the number 12. So both fractions have the same denominator. Furthermore, the numerator of the two fractions must also be multiplied by the number that has been multiplied in their respective denominators. So, $\frac{1}{4}$ is equivalent to $\frac{3}{12}$, and $\frac{1}{3}$ is equivalent to $\frac{4}{12}$. Thus, the task becomes $\frac{3}{12} + \frac{4}{12} = \frac{7}{12}$.

c. Problem solving

Problem solving is the application of concepts and skills. In problem solving usually involves several combinations of concepts and skills in a different situation or situation (Mulyono, 2012). The problem is in the form of a story where students are asked to be more careful in finding answers. Example: Father gets $2\frac{1}{2}$ kg of mango from his friend. Meanwhile, Mother got 0.5 kg of mango from the next-door neighbor. What is the total weight of the manga fruit obtained?

Difficulties in learning mathematics can indeed be said to come from the three aspects above. It is often found that elementary school students are not complete in solving math problems. Of these three aspects, improvements should be made as an effort to minimize the level of difficulty, which can be started from planting concepts, practicing skills and abilities to understand and solve problems. According to Hallahan, Kauffman, and Lloyd (in Suryani, 2010) special learning difficulties are one of many disorders in psychological processes that include understanding and applying spoken or written language. According to Fauziah (2017), psychological factors that affect children's difficulties in learning mathematics include interest, which is a persistent tendency to pay attention and remember some activities. Interest has a great influence on learning, because if the lesson is not in accordance with the student's interests, the student will not learn as well as possible because there is no attraction for him. Motivation is the impetus that makes every individual willing to engage in a learning process. Weak motivation or lack of motivation results in low quality and learning outcomes.

METHOD

This research was conducted at a public elementary school in Pekanbaru, Riau province, Indonesia. This research was conducted in the even semester of the 2019/2020 academic year. The type of research used in this study is a mixed method. Descriptive quantitative research is used in analyzing the data from the instrument test results to students (Sugiyono, 2017). While qualitative research is used to determine the extent of the difficulties experienced by students in solving fraction addition problems (Moleong, 2014).

The participants in this study were 29 fifth grade students and 1 fifth grade teacher. Initially 29 students were given a test about the addition of fractions, and from the test results, 10 students with the lowest score were selected. Next, the researchers conducted interviews. Interviews were conducted with students and teachers. The interview questions are 5 questions for students and 2 questions for teachers. The aim of the researcher was to conduct interviews with teachers to confirm the truth of the results obtained. The tests used in this study were objective and subjective tests. An objective test is a test that has short and precise answers, one of which is in the form of multiple-choice questions. While the subjective test is a test in the form of an essay question (Yudhanegara & Lestari, 2017).

The researchers used an objective test because the multiple-choice form provides an overview of children's understanding of concepts through fractional representation. While the subjective test in the form of an essay, researchers can measure skills and problem solving. Interviews are used as a data collection technique because the researchers want to know things from respondents in more depth (Sugiyono, 2017).

The data in this study are in the form of analysis of the results of the field test of the difficulty in completing the addition of fractions. The scoring technique used is 1 if the answer is correct and 0 if the answer is wrong. Meanwhile, for essay test questions, the scoring technique is in accordance with the assessment indicators in table 1.

Table 1. Essay question scoring guidelines

No	Indicators	Score	Examples of activities or contexts
1	Concept	0	No answer/ solution and procedure are incorrect
		1	Write the answer but not properly correct and also the procedure partly corrects
		2	Write the correct answer and procedure to solve the task
2	Skill	0	No answer/ solution and procedure are incorrect
		1	Write the answer but not properly correct and also the procedure partly corrects
		2	Write the correct answer and procedure to solve the task
3	Problem solving	0	No answer/ solution and procedure are incorrect
		1	Only write the information given by the task
		2	Write the information and give partly correct procedure
		3	Write the information and give correct answer and procedure

(Mawaddah, 2015)

Then, students' final score is categorised as presented in table 2.

Table 2. Categories of students' competences on addition of fractions

Score	Categories
85.00 or above	Excellent
70.00 – 84.99	Good
55.00 – 69.99	Moderate
40.00 – 54.99	Fair
39.99 or less	Poor

The researchers reduced the data by analyzing students' mastery of the concept, students' competence skills, and students' problem-solving abilities on fraction addition problems. Researchers processed the results of interviews to find the factors that caused students to have difficulty in solving the addition of fractions and found the obstacles experienced by students in solving fraction problems. In presenting the data, the researchers categorize the types of difficulties in learning fractions and the factors that cause students to have difficulty in learning fractions. Next, the researchers describe students' difficulties in the form of narratives about the difficulties experienced by students in learning fractions and the factors involved. factors that cause students to have difficulty in learning fractions.

After obtaining student test results, the researcher then identified, described, and analyzed each student's answer and described it into an analysis sheet table. Filling in the analysis table is based on student answer sheets and research indicators. Based on the results of data processing that has been done, the researchers draw conclusions about the difficulties experienced by students in solving fraction addition operations and the factors that cause students to experience difficulties in learning fraction addition.

RESULTS AND DISCUSSION

The first step that the researcher took was to present the results of students' knowledge of adding fractions. The purpose of this presentation is to provide an overview of students' knowledge of fractions. The results of the analysis of students' knowledge of adding fractions are presented in table 3.

Table 3. Students' knowledge of adding fraction

Score	Categories	Persentage
85.00 or above	Excellent	10.35
70.00 – 84.99	Good	17.24
55.00 – 69.99	Moderate	27.58
40.00 – 54.99	Fair	10.35
39.99 or less	Poor	34.48
Average	Moderate	55.66

Some students are in fair and poor categories (table 3). The overall average of students' abilities in solving addition of fraction problems is in the moderate category. Then, the researchers checked and observed the results of the tests that had been done. From these observations found errors made by students, because students' mistakes in answering questions can be used as an illustration of students' difficulties in solving the problem.

From the test results of students' knowledge about the operation of adding fractions, the researchers analyzed the data based on three indicators, namely concepts, skills, and problem solving. The results of the analysis are presented in table 4.

Table 4. Students' difficulties in solving addition of fraction tasks

Indicator	Percentage of correct answer	Percentage of incorrect answer
Concept	28.57%	71.43%
Skills	52.71%	47.29%
Problem solving	57.47%	42.53%
Average	46.25%	53.75%

Based on table 4, it is known that fifth grade students have difficulty in solving the addition of fractions. Fifth grade students are having great challenge and difficulties in concept rather than the other two indicators, which is 71.43%. This shows that students lack in understanding the concept of adding fractions.

Based on Figure 2, many students misunderstand that the addition of fractions in the form of diagrams is the same as representing/illustrating ordinary fractions. The correct concept in the representation of the addition of fractions in the form of diagrams must pay attention to the similarity of the shape and size of a unit that will be used as a representation of the fraction. Students also do not understand the use of GCD to add fractions.

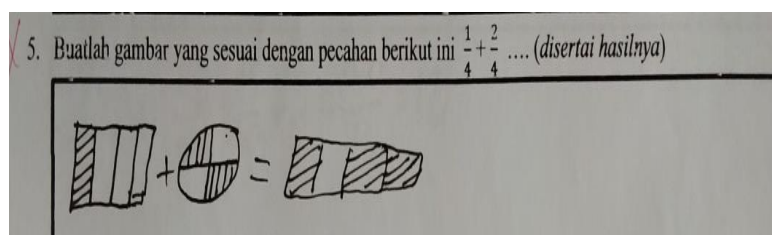


Figure 2. DS' answer to a conceptual task

Figure 3 presents an example of students' answers regarding the ability of skills or also called procedural in solving the problem of adding fractions that is still lacking. This is related to the way students solve problems. Some students in fifth grade are still wrong in writing answers, such as only equating the denominator while the numerator does not change. There are also students who cannot complete the answers to the end, are not proficient in prerequisite materials such as not memorizing multiplication and not proficient in adding, and do not equate the denominators. Students also have difficulty in problem solving skills, where students are often wrong in writing data that is known or asked. There are also students who have difficulty understanding the contextual tasks and the instructions

for the tasks. Students are also still not precise in planning and identifying ways to solve problems, and it is difficult to explain the results obtained.

$$10. 4\frac{1}{3} + 3\frac{2}{5} = \dots$$

$$\frac{13}{3} + \frac{17}{5} = \frac{30}{15}$$

Figure 3. DS' answer to a procedural task

From the general description of fifth grade students' competences related to the three aspects in solving the addition of fractions, then the researchers present the interview results from a student with difficulties in solving those tasks.

Figure 4 present an example of a student's answer in solving the addition of fractions. The student, called ANA, can convert mixed fractions and decimal fractions into ordinary fractions, but she has difficulty changing both fractions into the same denominator. In this case, ANA has difficulty finding equivalent fractions.

2. Ayah mendapat $2\frac{1}{2}$ kg mangga dari teman sekantornya. Sementara Ibu mendapat 0,5 kg mangga dari tetangga di sebelah rumah. Berat seluruh buah mangga yang didapat adalah

Diketahui: Ayah mendapat $2\frac{1}{2}$ kg mangga dari teman sekantornya. Sementara Ibu mendapat 0,5 kg mangga dari tetangga di sebelah rumah.

Ditanya: Berat seluruh buah mangga yang di dapat adalah

Di jawab: $2\frac{1}{2} + 0,5 = \frac{5}{2} + \frac{5}{10} = \frac{5+5}{20} = \frac{10}{20} = \frac{1}{2}$

Figure 4. ANA's answer to a procedural task

Figure 5 shows the mistakes made by ANA in representing the addition of fractions using a diagram. Although she was able to represent every correct fraction of the diagram, the two diagrams did not have the same shape.

5. Buatlah gambar yang sesuai dengan pecahan berikut ini $\frac{1}{4} + \frac{2}{4} \dots$ (disertai hasilnya)

$\frac{1}{4} + \frac{2}{4} = \frac{3}{4}$

Figure 5. ANA's answer to a conceptual task

In the concept of adding fractions, ANA represents the addition of fractions with different units. She also could not do correct procedure for solving the task, such as wrongly equating the denominators. ANA does not understand how to equalize the denominator if

the addition of fractions with different denominators. She only multiplies the denominators when equating the denominators but does not multiply the numerators and does not understand how to determine LCM to equalize the denominators.

To find out more about ANA, the first researcher interviewed the classroom teacher and the following excerpts from the interview between the researcher and the classroom teacher.

R : How was ANA during the learning process in the classroom, especially in mathematics?

T : ANA is good when studying in class.

R : How do you think ANA has difficulty doing the fraction addition tests?

T : ANA is difficult to find LCM, so to equate the denominator it is often wrong.

R : How about her learning motivation?

T : Her motivation to study is good.

Based on the interview with the classroom teacher, she agreed that ANA had difficulties in finding LCM, which had an impact on its ability to solve problems related to adding fractions. On the other hand, ANA is a student who has good learning motivation which is also shown in the learning process.

DISCUSSION

The present study analyze students' difficulties in solving addition of fraction tasks based on 3 indicators (Learner in Mulyono, 2012). The researchers elaborate each of them as follows:

a. Concept

Students who have difficulty can be seen from the way they answer questions, where students often make mistakes and forget to use concepts in arithmetic addition operations. This is in line with the opinion of Nursalma (2016) which states that the main problem in learning mathematics is the lack of concepts in each basic competency or subject matter, and it is true that this is in line with the results of the analysis of test questions and interviews. In addition to fraction operations, students make various types of errors in answering fraction addition questions because students do not master the concept of fractional addition operations. Students experience problems in representing the addition of fractions and problems in understanding the concept of fractional addition operations because students feel the concept of fractional counting operations is too much so that students often forget and make mistakes when solving fraction addition problems.

b. Procedures/Skills

This is related to students' arithmetic skills and mastery of prerequisite material. In performing addition operations students should master the prerequisite material. Based on the results of the study, students experienced problems in solving the addition of fractions because students did not master multiplication, namely multiplication from 6 to 9. solve the problem and students also do not answer the question until the end because they do not master the prerequisite material in fractions, this is in line with the opinion of Patih (2016:

184) which states that the concept of learning mathematics is hierarchically structured, so that to learn mathematical concepts it is necessary to have previous mathematical concepts that become further material prerequisites. Furthermore, students are also careless in counting, as evidenced by the results of the study, 3 students were often careless in counting, this resulted in the student's answer being wrong.

c. Problem-solving

Students who have difficulty in solving the story problems of adding fractions, this can be seen from the students' mistakes in answering all the story questions, including not understanding the questions so that they answer the questions with subtraction operations and errors in answering 4 to 5 story questions because students have problems changing story questions. addition of fractions into a mathematical model and students feel that the story problem of adding fractions is a difficult problem. One of the factors that make it difficult for students to solve fraction addition story problems is because these students do not master the concept of fraction addition operations.

The following are the factors that influence students so that they have difficulty in solving fraction addition problems are:

a. Low learning motivation

Learning motivation is the strength or encouragement that comes from a person's greetings to achieve learning goals, therefore learning motivation affects student learning outcomes. Based on the results of interviews conducted with fifth grade teachers at SD 67 Pekanbaru, there are students who have difficulty solving the addition of fractions and have low learning motivation. Students with low learning motivation can be seen from their learning style in class, students are not active in learning, remain silent when they do not understand, rarely ask questions, do not pay attention to the teacher while studying, even often make noise and do not do assignments.

Low learning motivation can affect learning outcomes, students whose learning motivation is low then the motivation in students to learn is also low this causes them to have bad study habits so that students have difficulty in learning and get low learning outcomes, this is in accordance with what stated by Lestari (2017: 83) which states that learning motivation will affect student learning outcomes.

b. Interest

Interest in learning is a person's interest or tendency towards learning. Interest affects student learning outcomes, it is evident from the results of interviews that have been conducted. Students who have difficulty in solving the addition of fractions are students who do not like mathematics, especially fractions because they think mathematics is a difficult subject.

Low learning interest results in low student motivation, so they are not serious in participating in learning. This is in line with Daryanto's opinion (in Fauziah, 2017, p. 22) that interest has a great influence on student learning outcomes because if the subject matter is not in accordance with the student's interests, students will not study as well as possible, because there is no attraction for them because of their interest. affect student motivation, a student who has a good interest in a particular lesson then his learning motivation will also be good because the student feels happy when following the lesson.

c. Ability in learning mathematics

Learning ability is a skill that a person has in mastering a lesson or learning material that can be seen from the learning outcomes. From the results of interviews that have been conducted with the fifth-grade teacher, it is known that students who have difficulty in completing the addition of fractions are students who have difficulty in learning mathematics as a whole, not only in fractional material, this proves that these students have weak abilities in mathematics.

The ability of each student is different, there are students who excel in one field but are weak in another. Similar to lessons, there are students who are able to master one lesson but are weak in other subjects. The weak ability of students in learning mathematics is one of the causes of students having difficulty in completing fractional addition operations. This is in accordance with the opinion expressed by Andri (2017: 421) which states that the ability of students to learn is talent if the subject matter studied is in accordance with their talents, then the learning outcomes are better because they are happy with their learning.

CONCLUSSION

Based on the results of the test questions that have been carried out, it can be concluded that the students are quite capable in solving the addition of fractions. But on the other hand, there were also difficulties experienced by fifth grade students. Difficulty understanding the concept of fractional addition operations. Difficulties because they do not master the prerequisite material, namely not mastering multiplication 6 to 9. Difficulty in solving fraction story problems, students have difficulty understanding and converting story questions into mathematical models. The factors that cause students to have difficulty in solving fraction addition problems are students' lack of interest in learning mathematics, especially fractional material because students think mathematics is a difficult subject, resulting in students not being interested and enthusiastic when learning this affects student learning outcomes. Low student motivation to learn from students affects student learning outcomes even though students get encouragement from parents and teachers. The weak ability of some students in mathematics causes students to experience difficulties in mathematics.

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