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Research Article

Misconception of Fraction among Middle Grade Year Four Pupils at Primary School

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Abstract

Fraction can be defined by two definitions; part of whole and part of a set of objects. The addition of two fractions with different denominators is an interesting topic but often confuses the pupils. Hence, this study was implemented to identify the mistakes and misconceptions among middle grade Year Four pupils in solving this particular problem. A survey using qualitative-descriptive method was done involving five participants; two male and three female pupils. Meanwhile, the instruments used in data collection method were tests, document analysis using participants' written answers and interviews to support the gathered findings. Findings from the analysis of test document showed 10 types of mistake committed by the participants. In conclusion, mistake that was often committed by pupils when adding two fractions with different denominators is the misconception in fraction.

Key Words

Addition of two fraction with different denominators • Mistakes • Misconceptions

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Mathematics is a calculation process that requires clear understanding of concepts. It is a continuous learning process involving the conceptualisation of past knowledge, various skills and mastery on basic mathematical concepts (Sarwadi & Shahril, 2014). The formation of theories and concepts is not only achieved in learning, but also from experiments, survey studies and observations to reinforce knowledge (Mohyuddin & Khalil, 2016).

Mathematics is an abstract subject that requires systematic thinking in a rational way. Thus, there are often misconceptions in teaching and learning process of mathematics and become the barrier to pupils when solving mathematical problems. The meaning of misconception is the understanding that is against the true meaning (Kawulich et al., 2009). Meanwhile, the mistakes might be caused due to a misconception. Other factor of mistakes may include carelessness, problem in reading or interpreting the questions and lack of knowledge (Mohyuddin & Khalil, 2016)

Finding from Dhlamini & Kibirige (2014), tells that mistakes and misconception may related but they are in two different types of mistakes; systematic and unsystematic mistakes. Systematic mistakes are usually a consequence of misconception allows pupils to repeat the mistakes with systematically constructed over the period of time until the new knowledge learns by the pupils. Unsystematically mistakes are shown without the pupils' intention and it may not repeat such as misconception and pupils can correct them independently.

Pupils' mistakes are one way of assessing their understanding of concepts, problems or procedures that are used. The analysis findings allow teachers to uncover the problems they face and explain their understanding whether they are facing misunderstandings or mistakes.

One of concepts that pupils have difficulties is fractions. To understand the concept of fractions, pupils need to have a clear understanding on fractional properties. Pupils generally build fractional knowledge from existing knowledge. If their existing knowledge is contaminated with conceptual misconceptions, it will affect their future learning related to the concept (Alghazo & Alghazo 2017).

Ojose (2015), stated that misconceptions occur due to misunderstanding and misinterpretation of knowledge from inaccurate meanings. Ojose (2008) mentioned that a misconception occurs from the change of meaning by pupils to suit the instructions given. Azurah Mohd Johar et al., (2014), concluded that pupils often use the same rules in addition, subtraction, multiplication and division with the same procedures without considering the concept of association. These have caused them to be unable to determine the correct concept for solving fraction problems.

Fraction has two meanings, which are part of one whole and part of a set of objects (Bruce & Ross 2009). Primary pupils should have well mastered the concept of fractions before going to high school. However, a study has found that it was difficult them to understand fraction (Clarke, Roche & Mitchell, 2007). The concept of fractions in mathematics is always considered difficult by students as they assume that numerator and denominator are the whole numbers that need to be divided with each other (Alghazo & Alghazo, 2017).

Saragih (2011) found that the students did not master the topic since they only memorise the formula, examples of questions and similar exercises. Misconception will lead pupils to not mastering fractions, thus making this subject less favourable (Trivena et al. 2017). This will not only stave off the learning process, but can be chronic if the error repeats (Mohyuddin & Khalil, 2016). Hence, it is important for teachers to ensure that the understanding of fractional concept can be dominated by their pupils as early as elementary education. In

order to achieve optimum effectiveness in Teaching and Learning (TL), educators should identify the weaknesses of their pupils (Wong & Evans, 2011). Moreover, the choice of appropriate teaching strategies should be considered so that these weaknesses will not be repeated to improve teaching quality and facilitate learning activities (Alghazo & Alghazo, 2017).

Purpose of the study

This study was carried out to examine the misconceptions of fraction among middle-grade students in Year Four pupils at primary school.

Objectives of the research

i. To identify the common mistakes done by middle-grade pupils in the topic of addition of fraction with different denominators.

ii. To identify the common misconceptions perceived by middle-grade pupils in the topic of addition of fraction with different denominators.

Research questions

i. What are the common mistakes done by middle-grade pupils in the topic of addition of fraction with different denominators?

Method

This survey study used the qualitative-descriptive method aiming to detect mistakes and misconceptions often performed by primary pupils. The instruments used in data collection were tests, interviews and observations. The study was conducted at a school in the district of Kuala Langat, Banting, Selangor. A total of five middle-grade pupils from Year Four were taken as the sample of the study. The respondents were randomly selected using simple random sampling. Prior research from Frerichs (2008), discusses the highlights on this sampling technique as every person from the population has the same chance of being included in the sample. However, the respondents were choosing at the randomly selected location nearer to the researcher.

They were two male and three female pupils with prior ledge on addition of fraction. The respondents were named as Wan, Muiz, Areen, Haifa and Sofie (not the real name) were 10 years old pupils. They have learned the basic concepts of fractions with their subject teacher and still have problems in responding to fractional addiction questions. They are from the middle-class families who averagely work as laborers. Wan, Muiz, Haifa and Sofia did not attend any additional classes and only learned about fraction form school.

Misconceptions from the respondents can be identified through the results of the worksheet given after the learning process in a classroom. Worksheet is the fastest evidence to identify pupils' mistakes and problems in achieving learning objectives (Iseni, 2011). According to this, document analysis was used for examining the exercises conducted by the respondents. Although the pupils mentioned that they understood their teacher's explanation in front of the class, some of them failed to answer the questions when they were asked to do it on their own. The worksheet contains 10 open questions about the addition of fraction (see in the Appendix 1). The obtained data were analysed by looking at the way the respondents' answers for each questions and then the results were obtained.

After the respondents answered the worksheet, structured and semi-structured interviews were realized. The structured interviews include the "Yes/ No Questions" while the semi-structured interviews include the questions that are directly asked to explain the way they answered the questions. From that, their misconceptions were obtained. In addition, observation helped this study to get the idea of how the respondents learn throughout the learning process. Observation was done while the respondents answer the worksheet given including the way they answer the questions. The researcher observed how they answered the questions step by steps. From the observations, the researcher able to know how they managed to answered all the questions given.

Findings

After the data analysis, it was obtained 10 mistakes done by the respondents for the first research question. Analysis of error was then encoded to facilitate the revision process. So, it was explained below by the table of mistakes made by the respondents. The mistake codes are displayed as follow;

Table 1

Codes for Types of Mistake Done by the Respondents

Code	Type of Mistakes Done by the Respondents	Document Analysis (Frequency of the Respondents)
A	Unable to understand the concept of adding two fractions with different denominators.	1
B	Adding the numerators with the denominators.	3
C	Subtracting with the second fraction	1
D	Adding and subtracting the answers with any fractions	1
E	Only multiplying the denominators to equalise the value.	1
F	Choosing a bigger denominator as the answer.	1
G	Choosing any denominator as the answer.	1
H	Multiplying the numerators and denominators.	1
I	Adding with the first fractions.	1
J	Multiplying the denominator with 2 / 3	1

The following are the codes for the mistakes done by the respondents analysed from test results.

A. Unable to understand the concept of adding two fractions with different denominators.

Table 2

Mistake A by the Respondents

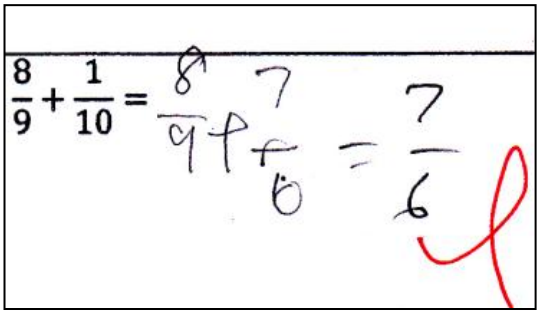
Respondent /Frequency (f)	Question Items	Respondent's work
Wan f (W) = 8	2,3,4,5,7,8,9,10	

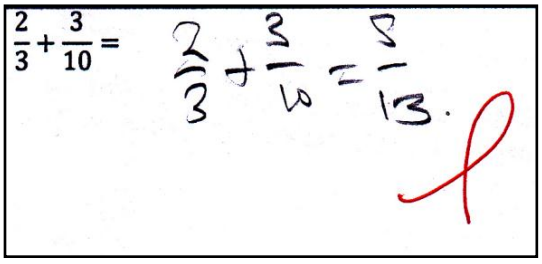
Table 2 above shows a mistake was done by the only one of respondents known as Wan who does not understand the concept of adding two fractions with different denominators. Wan repeated the mistakes for eight times. The problem occurred since Wan did not understand the concept of adding two fractions with different denominators. Besides, Wan has failed to show the work path of equalising denominator. In addition, Wan changed the question given by changing the second fraction in response to the given question. The answer was in the form of improper fraction, suggesting that Wan did not understand the concept of fractions.

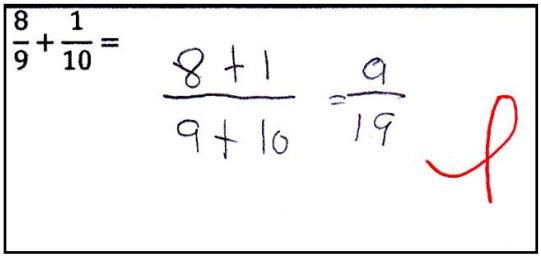
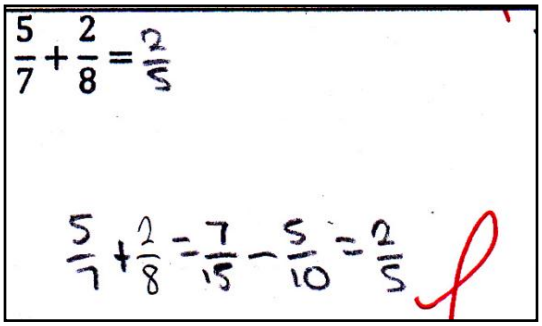
Interview result found that Wan answered the questions only to fill in the blank space. Wan also stated that these questions were difficult. This was because Wan still did not master the concept for adding two fractions with different denominators. Nevertheless, Wan showed his efforts to answer all the questions.

B. Adding the numerators with the denominators

Table 3

Mistake B by the Respondents

Respondent Frequency (f)	Question Items	Respondent's work
Wan f (W) = 2	1,6	

Areen f (A) = 7	1,4,5,7,8,9,10	
Sofie f (S) = 10	1,2,3,4,5,6,7,8,9,10	

Mistake B was done by the highest number of respondents. There were three respondents who made the same mistake; Wan, Areen and Sofie with the frequency of (f) W = 2, (A) = 7, (S) = 10.

Interview results revealed that these mistakes occurred because the students were confused by the concepts of adding two fractions with different denominators and the addition of whole numbers. They added the fraction by the place value of the whole number. This indicates that they did not understand the meaning of fractions and thought that the numerator and denominator were made up of different groups of place value. This was demonstrated by Areen's calculations where she has unified the numerators and denominators prior to adding them.

C. Subtracting with the second fraction.

Table 4

Mistake C by the Respondents

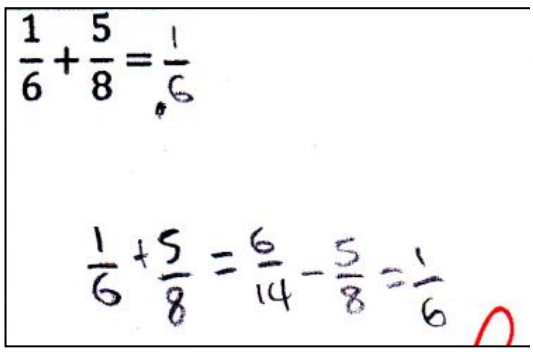
Respondent /Frequency (f)	Question Items	Respondent's work
Sofie f (S) = 1	1	

Table 4 displays the mistake of subtracting with the second fraction. Mistake C was done by only one of respondents, Sofie. Sofie added the numerator and subtracted the answer with the second fraction even when she was not asked to do so, which was due to her need to find the simplest fraction. Sofie was confused by the operation to find the simplest fraction where she supposed to divide it with the right number. Indirectly, Sofie made the next mistake of subtracting the numerator with the denominator.

Sofie stated on the interviews that fractional operations should be simplified even when it is not required, which suggests her misconception of finding the simplest fraction although she was supposed to divide the fraction with any suitable number to find the simplest fraction.

D. Adding and subtracting the answers with any fractions.

Table 5

Mistake D by the Respondents

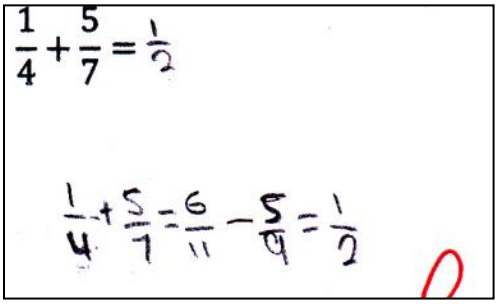
Respondent /Frequency (f)	Question Items	Respondent's work
Sofie f (S) = 9	2,3,4,5,6,7,8,9,10	

Table 5 displays the mistake was done by only one of respondents, Sofie. Sofie had done the mistakes the questions by subtracting fractions by any fraction throughout nine questions. In answering the questions given, Sofie added the numerator with the other numerator and denominator with another denominator, and then deducted the answer with any fraction. Similar Error C, Sofie wanted to find the simplest fraction to all questions.

Only multiplying the denominators to equalise the value.

Table 6

Mistake E by the Respondents

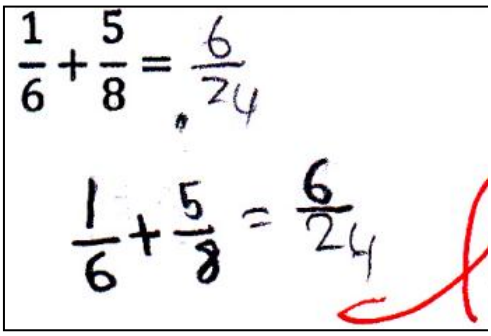
Respondent /Frequency (f)	Question Items	Respondent's work
Muiz f (M) = 1	1	

Table 6 is the mistake E was done by only one of respondents, Muiz. He illustrates the mistake by answering the question by multiplying only the denominators to equalise their value. Muiz did not understand the fractional concept where he needs to multiply the numerators and denominators before adding. Besides, he also did not understand that the multiplying factor is used to find the equivalent fraction. This can be clearly seen in the work path shown in Table 6.

Based from the interview, Muiz thought that when adding two fractions with different denominators, only the denominators should be equated. He forgot that he also needs to multiply the numerators to get the right answer.

E. Choosing a bigger denominator as the answer.

Table 7

Mistake F by the respondents

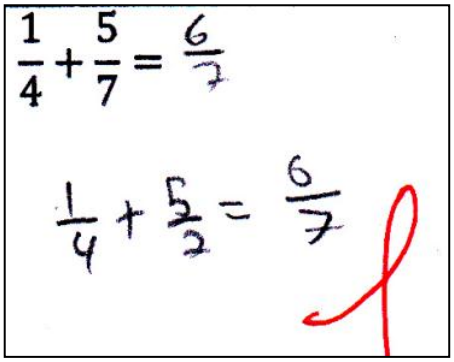
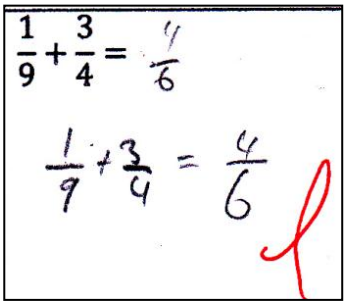
Respondent /Frequency (f)	Question Items	Respondent's work
Muiz f (M) = 3	2,4,8	

Table 7 show the Mistake F was done by only one of respondents, Muiz. He illustrates the mistake from choosing a larger denominator as the answer for the question given. He did not know that the correct way to equalise the fractions is to multiply both denominators. He only selected the larger denominator as a shortcut to answer the questions. This shows that Muiz has misunderstood the concept of equalising fractions. Additionally, he stated that the questions given were difficult.

F. Choosing any denominator as the answer.

Table 8

Mistake G by the Respondents

Respondent /Frequency (f)	Question Items	Respondent's work
Muiz f (M) = 6	3,5,6,7,9,10	

It was observed in Table 8 only Muiz made the mistake G of choosing any denominator as the answer where he added both numerators and then wrote any denominator as the answer. Muiz repeated this error throughout six questions. Finding from interview tells that Muiz was unable to think the correct way to answer, leading him to put any number as the denominator to answer the question.

G. Multiplying the numerators and denominators.

Table 9

Mistake H by the Respondents

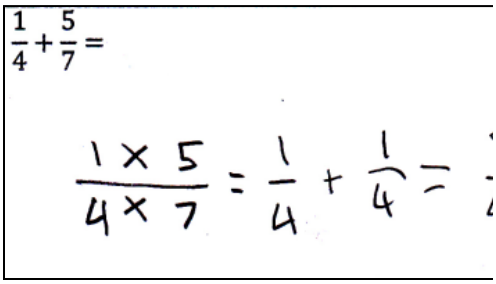
Respondent /Frequency (f)	Question Items	Respondent's work
Haifa f (H) = 10	1,2,3,4,5,6,7,8,9,10	

Table 9 shows the mistake made by only a respondent named Haifa who has multiplied the numerators and denominators. This was because Haifa wanted to find the same denominator value by doing multiplication operation for both fractions. Haifa was confused when adding the fractions and assumed that she only needs to

multiply the numerators and denominators to solve the question. Haifa left half of the work due to multiplication misconception and proceeded by adding the first fraction with the first fraction.

The interview revealed that Haifa misunderstood that she needs to multiply both fractions to equalise the denominators first before adding them. However, she did another mistake by adding those fractions.

H. Adding with the first fractions.

Table 10

Mistake I by the Respondents

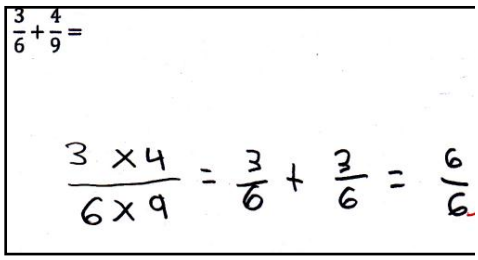
Respondent /Frequency (f)	Question Items	Respondent's work
Haifa f (H) = 10	1,2,3,4,5,6,7,8,9,10	

Table 10 displays the mistake made by only one respondent named Haifa from adding with the first fraction. Haifa made similar mistake throughout 10 questions. She understood that she needs to equate denominators before adding the fractions. However, she did not understand how to equate the denominators.

İ. Multiplying the denominators with 2 / 3.

Table 11

Mistake J by the Respondents

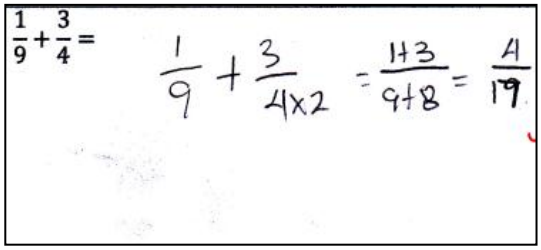
Respondent /Frequency (f)	Question Items	Respondent's work
Areen f (M) = 3	2,3,6	

Table 11 refers to the error of multiplying a denominator by two or three by only one respondent, Areen with a frequency of three questions, which was caused by her confusion in equalising the denominators. Areen thought that fractions need to be multiplied by 2 or 3 though it does not produce the same denominator. She also admitted that she had only memorised the times table of two and three. Nonetheless, Areen already understood that when adding two fractions with different denominator, the dominators must be equated first.

Discussion and Conclusion

The mistakes often done by middle grade pupils during the addition of fractions with different denominators, followed by the description on misconceptions faced by them were presented in this study.

Based on the data analysis, there were 10 mistakes made by the respondents. The first mistake was that they did not understand the concept of adding two fractions with different denominators since they do not well understand the meaning of fractions. This finding was supported by the results obtained by Kavramasi (2003), which stated that many students either at the primary or secondary level who still do not understand the concept of fractions failed complete the breakdown well.

The second mistake with the highest frequency of misconception was the addition of the numerators with denominators. A total of four respondents have made this mistake, which occurred since the students thought that the addition of whole numbers and fractions can be done according to the place values. In other words, they assumed that the numerators and denominators have different place values (Trivena et al. 2017).

The third mistake done by the respondents was subtraction with the second fraction. Finding on this mistake explained that the students did not understand how to find the simplest fraction and only wrote the work path just for fulfilling the need to answer the questions. Schoenfeld (1985), in his study presented several types of question that can be answered by the selected pupils. In the process of settlement, pupils often chose the wrong strategy. He suggested that the problem was related to the understanding and perception of pupils toward mathematics.

The fourth mistake of the respondents was the subtraction with any fractions, which illustrated the students that were trying to find answers in the simplest form of fractions by deducting fraction with any fractions. Although the questions did not require them to find the simplest fraction, they still try to find it. This finding was supported by Almeda et al. (2013), demonstrating that primary pupils are still struggling to simplify fractions with many of them solving fractional questions using the wrong algorithm.

The fifth mistake was observed when the students simply multiplied the denominator but failed to multiply the numerator. Hendra Saptra (2011), in the National Mathematics and Mathematics Education Seminar in Yogyakarta supported this finding by stating that primary pupils often equate fractions by multiplying the denominators and then forgot to multiply the numerators.

The sixth respondents' mistake was choosing a larger denominator as their answer. The pupils thought that a bigger denominator can be made as the answer to save their time. Without a strong understanding on the concept of fractions, it is hard for them to determine the procedures in solving mathematical problems (Azurah Mohd Johar & Effandi Zakaria 2015)

For the seventh mistake, the respondents had chosen any denominator as an answer because they just want to simply find the answer and expect it to be correct.

The eighth mistake was done when the respondents multiplied the numerators and denominators. They seemed unable to understand the concept of addition in fractions and assumed that they need to multiply the numerators and denominators. The finding of Wong and Evans (2011), supported that of this study by stating that the multiplication of numerators and denominators is a common mistake made by primary pupils.

The ninth mistake done by the respondents was observed when they added using only the first fraction. Norfarhana Mohamad Norizan (2010), proposed that the students who cannot accurately calculate or confused with the algorithm will produce an improper solution.

The tenth mistake done was when the students equalised the denominators using the multiplication of 2 or 3. The pupils' misconception was that multiplying the fraction should be done to equalise the denominators. Thus, they assumed that fractions need to be multiplied by any small numbers even though they do not produce the same denominator.

Conclusion

Every student tends to make mistakes. So, teachers need to practice reflective attitude to identify problems and analyse them carefully (Nor Hasniza 2006). Educators should always seek information and knowledge to solve any misconception issues that arise. It is teachers' responsibility to detect their students' mistakes to give them an idea on describing and selecting the appropriate teaching style to overcome the problems and ensure that their pupils do not repeat the mistakes again.

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Nama: _____ Kelas: _____

TAJUK: PECAHAN

Menambah dua pecahan dengan penyebut yang berbeza.

1) $\frac{1}{6}+\frac{5}{8}=$	2) $\frac{1}{4}+\frac{5}{7}=$
3) $\frac{1}{9}+\frac{3}{4}=$	4) $\frac{8}{9}+\frac{1}{10}=$
5) $\frac{2}{5}+\frac{1}{7}=$	6) $\frac{2}{5}+\frac{3}{10}=$
7) $\frac{5}{7}+\frac{2}{8}=$	8) $\frac{3}{6}+\frac{4}{9}=$
9) $\frac{5}{8}+\frac{2}{7}=$	10) $\frac{7}{10}+\frac{2}{7}=$