Remediating Students' Misconceptions on Fractions through Conceptual Change Theory and *Scaffolding*

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ABSTRACT

Students' misconceptions about fraction concepts remain prevalent and significantly impact their mathematical understanding. The purpose of this study was to provide remediation to students who were identified as having misconceptions about fractions based on the results of a diagnostic pre-test using a five-tier instrument. Remediation of students' misconceptions was carried out through learning using conceptual change theory and *scaffolding*. To determine the impact of the intervention, a post-test diagnostic was conducted using the five-tier instrument. This study employed a mixed-methods approach through a convergent parallel design. The quantitative subjects consisted of 26 students, while the qualitative subjects comprised three students selected through purposive sampling. Qualitative data were collected through observation, interviews, and documentation. The results of this study indicate that before remediation, the average scientific conception (correct answers) was low at 17.6%, and after remediation, it increased to 86.6%, representing an average increase of 69%. The findings indicate that integrating conceptual change theory with scaffolding is a promising strategy for addressing entrenched misconceptions in mathematics education.

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1. INTRODUCTION

Conceptual understanding is an essential element in learning mathematics. [1]. A correct understanding of mathematical concepts and their relationships is a prerequisite for achieving a good mastery of mathematics. A low knowledge of students' mathematical concepts is a problem often encountered in mathematics learning [2]. A student's understanding of a concept that conflicts with scientific concepts or the work of scientists in the field and is deeply ingrained in the student is referred to as a misconception [3]. Misconceptions are a big problem in mathematics learning, where students must understand concepts in depth [4].

The main cause of misconceptions is students' limited initial experiences. Misconceptions are also caused by teaching methods that do not support the development of appropriate concepts. One way that is often used to reduce student misconceptions is through remediation. If remediation is not carried out, misconceptions in mathematics can be a dangerous problem for students [5]. To identify misconceptions experienced by students, appropriate instruments are needed, one of which is a diagnostic test. The five-tier diagnostic test is a tool intended to reveal more about students' understanding of concepts and to determine their confidence in their answers [6]. However, few studies have systematically integrated conceptual change theory with multi-level scaffolding strategies using five-tier diagnostic tests in the context of fractions.

Based on the initial observations conducted through interviews with mathematics teachers, it was found that there were obstacles in the learning process, particularly in the subject of fractions. Teachers reported that students were having difficulty understanding the basic concepts of fractions, which resulted in errors when solving practice problems. To further identify the misconceptions that were occurring, the researcher gave two questions to the students. The first question given was a fractional addition problem, namely $\frac{2}{9} + \frac{1}{6}$, the results obtained from the students are $\frac{3}{15}$. When asked about the procedure used, students explained that they added the numerator to the numerator and the denominator to the denominator, without paying attention to the basic rule of fraction addition, which requires equalising the denominator first.

Furthermore, the second problem was given in the form of fraction multiplication operations, namely $\frac{3}{5} X \frac{1}{6}$ and students provide answers $\frac{18}{5}$. The strategy used by the students in solving the problem was explained, and they explained that the calculation was done by “cross multiplying”, i.e., multiplying 3 by 6 and 5 by 1. From their answers, it was clear that the students had misconceptions about the concepts they used

To overcome this misconception in fraction material, an appropriate approach is needed, one of which is to use the conceptual change theory developed by Posner et al., (1982). Conceptual change theory emphasises the importance of making students aware of imbalances and helping them rebuild their understanding by identifying and correcting misconceptions [7].

Additionally, scaffolding is also effective in helping students correct their misconceptions. *Scaffolding* is temporary assistance provided by teachers or peers to help students understand concepts independently [8]. *Scaffolding* can be provided in three levels. The basic level is the provision of a supportive learning environment, the next level is direct interaction between teachers and students, and the final level is an emphasis on conceptual thinking [9].

2. METHOD

This research employs a mixed-methods approach, combining quantitative and qualitative methods. The design used was a convergent parallel design. Convergent parallel design is considered appropriate in this study because it enables researchers to gain a comprehensive and in-depth understanding of student misconceptions in fraction concepts by simultaneously combining quantitative and qualitative data [10]. The research was conducted at SMPN 1 Jambi City in class VII A, consisting of 26 students. For taking interview subjects, three students who experienced misconceptions with high, medium, and low levels were selected using a purposive sampling technique.

The instrument used to collect quantitative data is a five-tier, researcher-formatted diagnostic instrument developed by Herliana et al. [12]. Validity and reliability can be seen below:

Table 1. Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.383	28.190	28.190	3.383	28.190	28.190	2.798	23.314	23.314
2	2.688	22.397	50.588	2.688	22.397	50.588	2.690	22.417	45.731
3	1.662	13.851	64.439	1.662	13.851	64.439	1.767	14.723	60.453
4	1.109	9.244	73.683	1.109	9.244	73.683	1.588	13.230	73.683
5	0.653	5.446	79.129						
6	0.594	4.949	84.078						
7	0.474	3.949	88.027						
8	0.406	3.382	91.409						
9	0.347	2.888	94.297						
10	0.309	2.572	96.869						
11	0.253	2.109	98.977						
12	0.123	1.023	100.000						

Based on the results of the factor analysis presented in Table 1, the construct validity of the five-tier instrument can be considered good. The analysis was conducted using the Principal Component Analysis (PCA) method, yielding four main components with eigenvalues greater than 1. This indicates that the four components are worth retaining based on the Kaiser criterion, which states that factors with an eigenvalue > 1 are considered significant.

Table 2. Rabilitas dengan *Alfa Cronbach* Reability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardised Items	N of Items
0.758	0.757	13

Based on the results of the reliability calculation in Table 2, the Cronbach's alpha value obtained is 0.758 for 13 items. This value indicates that the five-tier instrument developed has a good level of reliability.

Meanwhile, qualitative data were collected through observation, interviews before and after treatment, and documentation. Quantitative data analysis was conducted by processing the pre-test and post-test results to determine the percentage of correct answers (scientific conception) and to calculate the percentage of misconceptions described in incorrect answers. The purpose was to compare the results of the pre-test and post-test before and after learning to determine changes in students' concept understanding of fractional number material. Meanwhile, qualitative data analysis was conducted using the Miles and Huberman model [13], which comprised three stages: data reduction (filtering and selecting relevant data), data presentation (compiling data in narrative or visual form), and drawing conclusions based on findings obtained from interviews and observations.

3. RESULTS AND DISCUSSION

3.1 Research Results

3.1.1 Quantitative Data

Based on the results of quantitative data analysis, there was a significant increase in the percentage of correct scientific conceptions (correct answers) among students after misconception remediation was carried out through the application of conceptual change theory and the provision of scaffolding. In tier 1, the percentage of students' conceptual understanding increased from 27.6% in the pre-test to 88.7% in the post-test. Categories tier 1 and tier 3, which include correct answers and reasons, also experienced a significant increase from 15.7% to 85.5%. This shows that, in addition to answering correctly, students also provided correct reasons. Furthermore, categories tier 1 to tier 4, which show correct answers, confidence, and correct reasons, increased from 9.6% to 85.5%. After participating in learning using the theory of conceptual change and *scaffolding*, it was found that most students were able to understand the concept of fractions correctly. This can be seen in the summary of students' scientific conception percentages from the pre-test and post-test results of the five-tier diagnostic assessment in the table below:

Table 3. Recapitulation of Scientific Conception Percentage (correct answers) Students on Pre-Test and Post-Test

Categories	*Pre-Test* (%)	*Post-Test* (%)
Tier 1	27,6	88.7
Tier 1 and *Tier 3*	15,7	85.5
Tier 1 to *Tier 4*	9.6	85.5
Average percentage	17.6	86.6

Table 3 shows that the average percentage of scientific conception (correct answers) of students before remediation was low, with an average of 17.6%. After remediation using conceptual change theory and *scaffolding*, the average percentage of scientific conception (correct answers) among students increased to 86.6%, representing a 69% rise.

The increase in the average percentage of scientific conception (correct answers) in the post-test results shows that students' understanding of fractions has improved significantly. This is also evident from the pre-test and post-test results, as described in the section on misconceptions, where the majority of misconceptions experienced by students have decreased. The average percentage of misconceptions decreased from 22.5% to 5.3%, indicating that most students no longer made errors in understanding fraction concepts after participating in learning that incorporated the theory of conceptual change and *scaffolding*. This can be seen from the summary of the percentage of students' misconceptions from the pre-test and post-test results in the table below:

Table 4. Summary of Percentage of Students' Misconceptions on Pre-Test and Post-Test

Code	Description of Misconceptions	*Pre-Test* %	*Post-Test* %
M1	In the concept of fractions, the denominator is the remainder of the whole fraction.	11.5	3.8
M2	In the concept of fractions, the numerator is the remainder of the whole fraction.	15.3	7.6
M3	The smaller the denominator, the smaller the fraction	15.3	7.6
M4	The larger the denominator, the smaller the fraction, without involving the numerator.	57.7	3.8
M5	Operations on addition and subtraction of fractions are the same as operations on integers.	28.4	3.1
M6	Calculations involving fractions are performed by multiplying the numerator and denominator crosswise.	24.6	4.9
M7	Multiplication and division of fractions follow the same procedure as the addition and subtraction of fractions with the same denominator.	25	5.7
M8	Division of fractions by fractions is equivalent to multiplication of fractions by fractions.	9.2	7.6
M9	Division of fractions by fractions is equivalent to multiplication of fractions by fractions, then the numerator and denominator are multiplied crosswise.	15.3	3.8
	Average percentage	22.5	5.3

Table 4 presents a summary of the percentage of students' misconceptions about fractions before and after remediation, utilising conceptual change theory and *scaffolding*. Some misconceptions in M4, namely the assumption that the larger the denominator, the smaller the fraction, without involving the numerator, were initially held by 57.7% of students, but after learning, the percentage decreased dramatically to 3.8%. The same was observed in misconception M5, which is the assumption that operations involving the addition and subtraction of fractions are the same as operations involving whole numbers. Initially, 28.4% of students held this misconception, but it decreased to 3.1% after learning. Other misconceptions, such as M6 (cross-multiplying the numerator and denominator), M7 (multiplication and division of fractions have the same procedure as addition and subtraction of fractions with the same denominator), and M9 (division of fractions by cross-multiplication), also showed a decrease in misconceptions experienced by students. However, there are still some misconceptions that are relatively difficult to eliminate, such as M2 (the numerator is considered the remainder of the whole fraction) and M8 (division of fractions is considered the same as multiplication), which each persist at 7.6% despite a decrease from the pre-test results. This suggests that applying conceptual change theory and providing scaffolding can reduce most types of misconceptions in fraction number material.

3.1.2 Qualitative Data

Qualitative data analysis results were obtained through observation, interviews, and notes taken during the learning process, which focused on remedying students' misconceptions in fraction material. After the researchers analysed the results of the five-tier diagnostic pre-test administered to 26 students, 20 students were found to have misconceptions. Therefore, the qualitative data analysis focused on addressing misconceptions in 20 students. This research was conducted through five face-to-face sessions, based on the indicators of students' misconceptions. Using the theory of conceptual change and *scaffolding*, instruction is delivered simultaneously and in groups, based on the results of the pre-test.

In the remediation process, a conceptual change theory approach was employed, specifically Posner's theory [12], which comprises four theories: dissatisfaction, intelligibility, plausibility, and fruitfulness. Meanwhile, *scaffolding* has three levels: level 1, which involves environmental provisions; level 2, which involves explaining, reviewing, and restructuring; and level 3, which involves conceptual development [13]. In the first to fifth meetings, the LKPD was distributed according to the predetermined indicators. Each group immediately discussed and worked on the LKPD to identify initial misconceptions. At this stage, level 1 *scaffolding* is applied, namely, environmental provisions, by training students to learn independently.

Understanding the Concept of Fractions as Parts of a Whole (Part Concept to Whole) and Comparing Fractions

Based on the results of each group's discussion on the concept of fractions as parts of a whole, three groups had misconceptions: groups A, B, and C. These groups answered the questions in the worksheet by using colours to represent the numerator and non-colours to represent the denominator, or vice versa. With almost identical answers, these three groups were dissatisfied with the existing concept. See the image below:

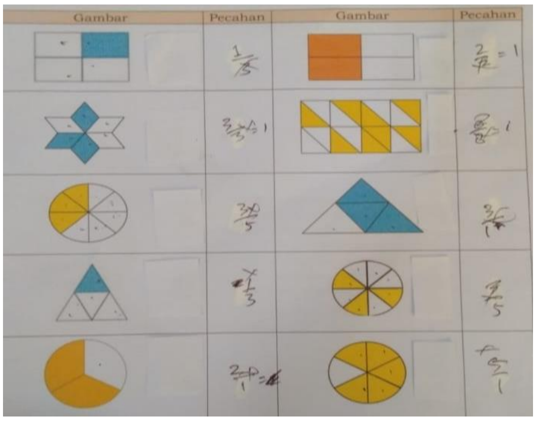


Figure 1. Group A Activities

Based on Figure 1 above, the results of Group A's discussion still rely on the incorrect concept. Thus, group A still experiences dissatisfaction with the existing concept. Therefore, the researcher provided *scaffolding* level 2, which includes explaining the details in depth, reviewing the students' discussion results and the correct concept, and restructuring to encourage the thinking process, so that students can learn independently without assistance or reach the intelligibility stage where the new concept can be understood. After that, the researcher provided level 3, which is conceptual development. The following is the researcher's treatment of group A:

P : *We can see from Figure 1 that a square is divided into four parts. This means that question no.1 is* $\frac{1}{4}$.

KA : *However, ma'am, there is no blue 1 and no color 3. Can it be 4*

P	:	*Okay, I'll explain it again using the paper you stuck with origami. On the HVS paper, I made four square boxes, so there are four, right? Then I gave pink origami to one of them, which means 1. So, the fraction obtained is...*
KA	:	$\frac{1}{4}$. *Oh, I see.*
P	:	*Yes, still confused.*
KA	:	*Understand, ma'am*

In Activity 1, only groups A and B experienced dissatisfaction with existing conceptions, so the treatment given was the same for both groups. At the intelligibility stage, the new conception must be understood, providing scaffolding that is introduced slowly and gradually, so that students are convinced of the new concept. At the plausibility stage, the new conception seems reasonable at first. *Scaffolding* is achieved by linking the subject matter to everyday life situations, so that students can more easily understand the new concepts they learn. At the same time, the fruitfulness stage of a new conception must suggest practical possibilities by illustrating the use of fractional numbers, for example, such as cutting a pizza into slices.

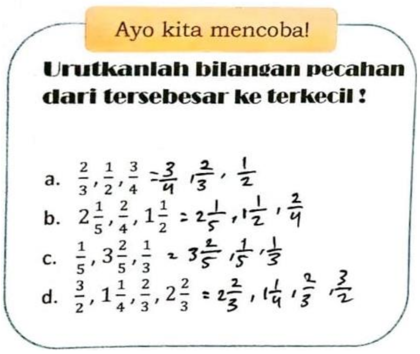


Figure 2. Group A Work Results

Based on Figure 2 above, this is the result of Group A's discussion about ordering fractions. Meanwhile, Groups B, C, D, and E experienced dissatisfaction with the existing concept when ordering fractions. Group A directly ordered the fractions without finding the denominator and converted mixed fractions to proper fractions. Group B found the denominator but did not find the numerator, and did not convert mixed fractions to common fractions. Group C had a misconception in finding the numerator and in converting mixed fractions to common fractions. Group D had a misconception regarding mixed fractions. Meanwhile, Group E only converted mixed fractions to common fractions, but did not initially change the denominator and numerator.

Scaffolding level 2 was applied through explaining, reviewing, and restructuring activities according to the needs of each group. Group A received an explanation on how to find different denominators and convert mixed numbers to improper fractions. Group B focused on finding numerators and converting mixed numbers to improper fractions. Group C received a combined explanation, similar to the one given to groups A and B. Group D was guided to convert mixed fractions into improper fractions. In contrast, Group E received an explanation of the denominator and numerator after converting mixed fractions into ordinary fractions. *Scaffolding* was provided gradually and in detail, so that by the intelligibility stage, students could clearly understand the new concept. A slow and systematic explanation helps students feel that the new concept makes sense (plausibility). Furthermore, at the fruitful stage, students are directed to apply the concept of fractions in everyday life contexts to make it more relevant and valuable in problem-solving. At this stage, level 3 *scaffolding,* namely conceptual development, is also implemented, where students and teachers jointly develop conceptual understanding to solve problems using the new concepts that have been learned.

Arithmetic Operations for Adding Fractional Numbers

In addition, operations involving fractions, almost all groups answered in the same way. Next, each group is asked to explain how they answered the question $\frac{3}{9}+\frac{1}{6}+\frac{4}{4}$. The majority of the group summed the numerator and denominator directly, 3 + 1 + 1, and 9 + 6 + 4. In this case, each group answered by adding the numerators and denominators, and then adding the results. As a result, each group experienced misconceptions and a stage of dissatisfaction with the existing concept. Therefore, the provision of level 2 *scaffolding* involves explaining, reviewing, and restructuring. Here is the provision of *scaffolding*:

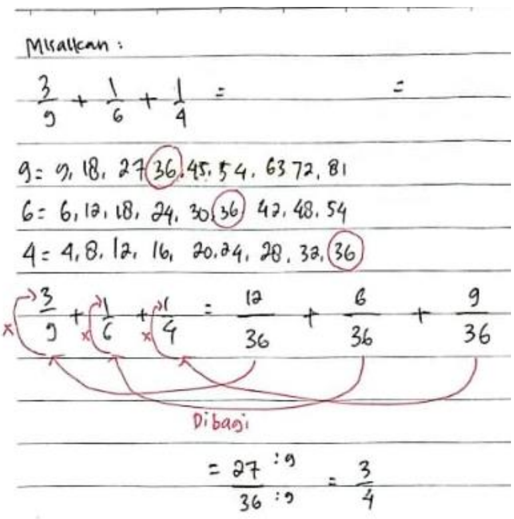


Figure 3. Explanation of *Scaffolding* Provision

Based on Figure 3 above, providing scaffolding to each group involves finding the same denominator using the KPK, then determining the numerator. Explanations were given using arrows to help students understand new concepts more easily, especially at the plausibility stage. After all groups received level 2 *scaffolding*, which involved explaining, reviewing, and restructuring, the learning process continued to level 3 scaffolding, specifically conceptual development. At the fruitful stage, new concepts are directed to have real benefits. Students are introduced to examples from everyday life, such as the use of measures in baking, to help them develop a deeper conceptual understanding of the material.

Arithmetic Operations: Subtracting Fractional Numbers

The results of each group's discussion, as shown in Figure 4, with the same question, indicate that three groups still held misconceptions with varying answers. Group A was at the dissatisfaction stage with the concept of different denominators. Group A still thought that the answer was to subtract the numerator from the denominator. Group A assumed that with different denominators, the answer would be different from addition.

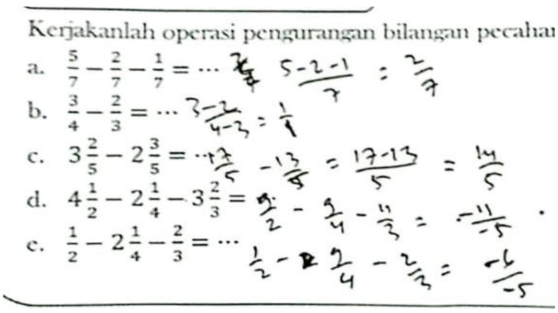
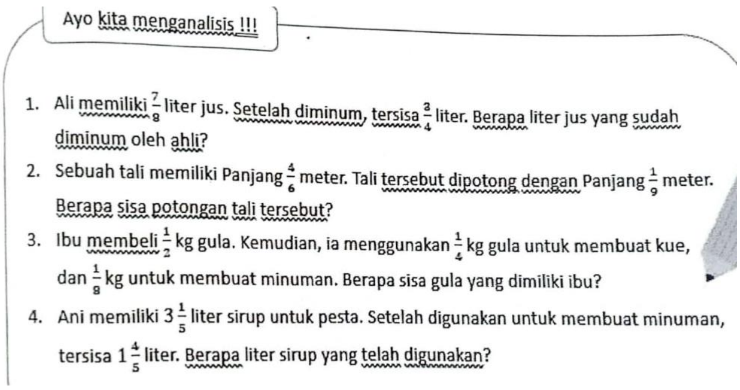


Figure 4. Group A Work Results

Based on Figure 4, the work of group A shows dissatisfaction with the concepts being learned. This dissatisfaction is also experienced by groups B and C, which indicates that all three are at the dissatisfaction stage. To overcome this, level 2 *scaffolding* was provided to groups A, B, and C, starting with an explanation that offers a detailed description, enabling them to understand the new concept correctly (intelligibility) and next, reviewing, which is reviewing the results of the discussion and comparing it with the right concept. This stage helps students see that the new concept given makes sense and is easy to understand (plausibility). Then, through restructuring, students are directed to think independently and learn without assistance. If groups A, B, and C manage to apply the new concept correctly independently, then they no longer experience misconceptions.

Furthermore, the work of groups D and E showed conceptual errors in solving story problems. The same thing was also found in groups A, B, and C, which used the wrong concept in the story problem section. This finding indicates that all groups are in the dissatisfaction stage, characterised by feelings of dissatisfaction or confusion with the concepts they have encountered. To overcome this, level 3 scaffolding (conceptual development) was given to help students develop conceptual thinking and build more meaningful understanding. At the fruitful stage, new concepts are directed to provide tangible benefits. *Scaffolding* level 3 is done together because story problems are directly related to the context of everyday life. This process can be seen in the following figure:


Ayo kita menganalisis !!!

1. Ali memiliki $\frac{7}{8}$ liter jus. Setelah diminum, tersisa $\frac{3}{4}$ liter. Berapa liter jus yang sudah diminum oleh ahli?
2. Sebuah tali memiliki Panjang $\frac{4}{6}$ meter. Tali tersebut dipotong dengan Panjang $\frac{1}{9}$ meter. Berapa sisa potongan tali tersebut?
3. Ibu membeli $\frac{1}{2}$ kg gula. Kemudian, ia menggunakan $\frac{1}{4}$ kg gula untuk membuat kue, dan $\frac{1}{8}$ kg untuk membuat minuman. Berapa sisa gula yang dimiliki ibu?
4. Ani memiliki $3\frac{1}{5}$ liter sirup untuk pesta. Setelah digunakan untuk membuat minuman, tersisa $1\frac{4}{5}$ liter. Berapa liter sirup yang telah digunakan?

Figure 5. Fraction Number Story Problems

Arithmetic Operations: Multiplication of Fractional Numbers

Based on the results of the discussion from each group, Group A, by answering the question, found that the method is the same as addition, but with different denominators. Group A equates the denominators using the KPK method and then multiplies all the denominators. Group B: how to find it by cross-multiplying the denominator and numerator. For mixed fractions, they first convert them to an improper fraction, then cross-multiply it. Group C changes the mixed fraction numbers correctly, but they do not write them in the form of a fraction, but as an integer. Group D separates between integers and fractions. The conceptual errors found in Group E are identical to those in the other groups. Look at the picture below:

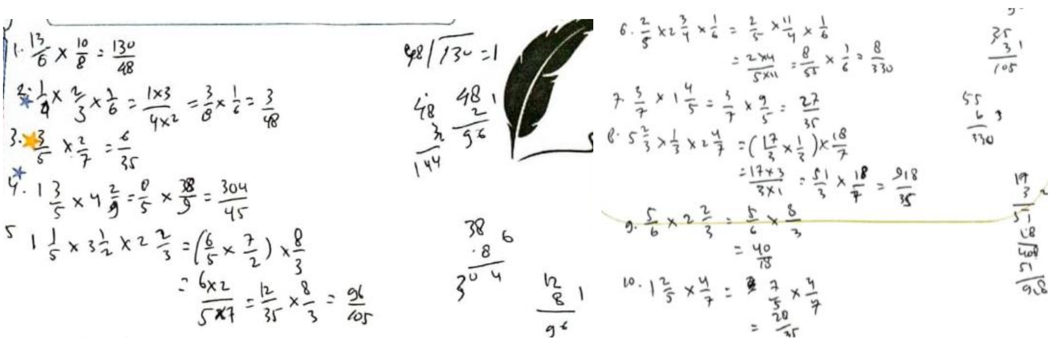


Figure 6. Group E's Work Results

Figure 6 above shows the results of Group E's discussion. The figure illustrates an example of each group experiencing misconceptions or dissatisfaction with the existing concept. Therefore, the researcher provided level 2 scaffolding, specifically explaining the details, to enable each group to understand the new (correct) concept or reach an intelligibility stage. After that, reviewing is done by comparing the results of student discussions with the correct concept. This activity aims to ensure that the new concept seems plausible from the start (plausibility) and is easily understood by each group. Furthermore, *scaffolding* at the restructuring stage encourages students to think independently and reflect on their learning without assistance. That is, if each group can already use the new concept correctly without guidance, then they no longer experience misconceptions.

After this stage, the process continues with level 3 *scaffolding*, specifically conceptual development, which aims to foster conceptual thinking and deepen understanding. At the fruitful stage, new concepts are directed to offer real benefits in students' lives. This process can be seen in the following figure:

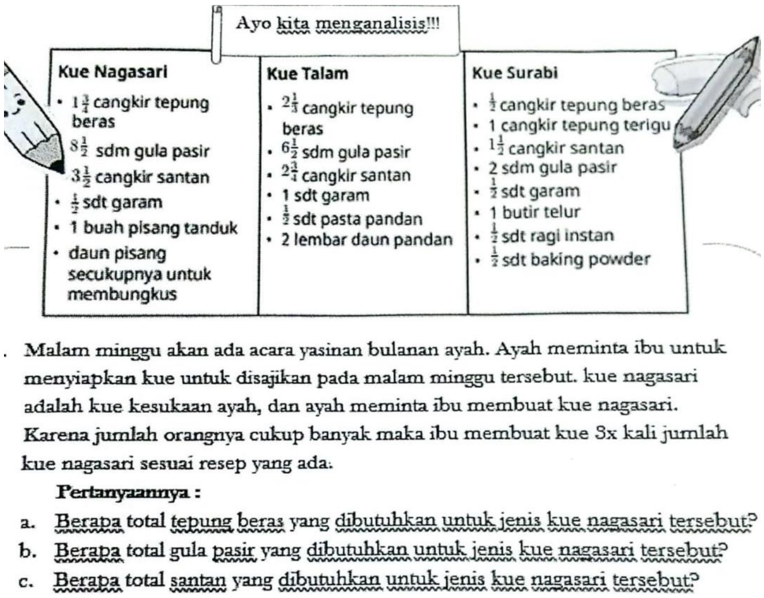


Figure 7. Multiplication Story Problem

Figure 7 above presents a story problem involving the multiplication of fractional numbers, which is solved collaboratively within each group. This story problem is very relevant to everyday life. To scaffold level 3 conceptual development, students can develop their conceptual thinking about how fractional numbers have a significant influence on everyday life, and at the fruitful stage, new conceptions suggest practical possibilities.

Arithmetic Operations for Division of Fractional Numbers

In the fifth meeting, the discussion results from the five groups showed nearly identical answers. Most students thought that the division operation of fractions could be solved by directly converting division into multiplication without flipping either fraction. In addition, many did not convert mixed fractions into ordinary fractions first. In problems involving three fractions, some groups reversed two fractions at once by swapping the positions of the numerator and denominator, while other groups reversed only one fraction. The picture below shows their work:

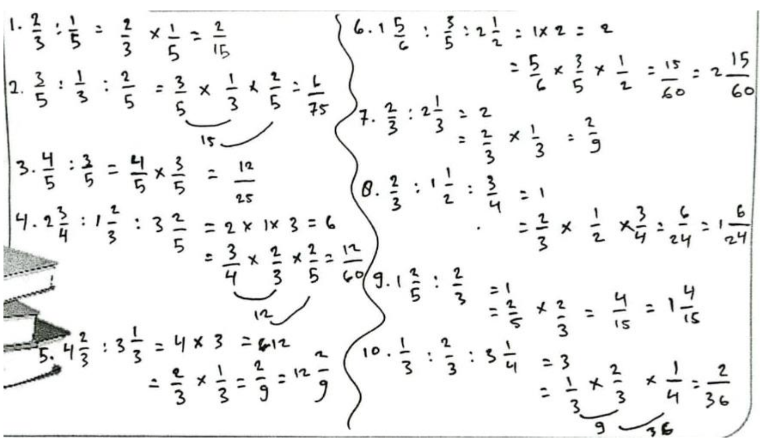


Figure 8. Group A Work Results

 https://doi.org/10.58421/misro.v4i2.530

Figure 8 shows the results of group A's discussion in solving fraction division problems. Group A experienced misconceptions or dissatisfaction with the concepts used. This condition is also experienced by other groups, all of which are in the dissatisfaction stage, characterised by dissatisfaction with the conceptions they hold, which leads to misconceptions. To overcome this, level 2 *scaffolding* was given, which consisted of explaining, reviewing, and restructuring.

At the explaining stage, the explanation was delivered slowly and in detail so that each group could understand the new concept correctly (intelligibility). Through reviewing, the results of each group's discussion are reviewed to ensure that they have used the right concept. This stage ensures that the new concept seems reasonable and easy to understand (plausibility). Furthermore, restructuring encourages students to rethink and learn independently. This means that if each group can apply the new concept correctly without assistance, then they no longer have misconceptions.

After that, *scaffolding* continues to level 3, namely developing conception, which encourages students to develop conceptual thinking. Students are invited to realise that the division operation of fractions also has relevance in everyday life. At the fruitful stage, new concepts are directed to provide tangible benefits and can be used to solve contextual problems. This means that each group can develop its own strategies for solving mathematical problems in its daily life. The following are interviews between researchers and students:

P : *Did you know that there are many examples of using fractions in division around us? For example, dividing food. Let us say there are three people in your mother's house, and she buys martabak (a type of Indonesian pancake) and asks the martabak seller to divide it into three portions. In the end, your mother gets one box of martabak with three portions inside. That means* $\frac{1}{3}$ *the portion received by the mother and family.*

KE : *Apart from that, is there anything else?*

P : *There is another thing, the measurement for making a layer cake. In a layer cake, the batter must be divided to differentiate the colours. Here is how to differentiate them: if you want to make a layer cake with five colours, then one batter is divided into five parts. That means* $\frac{1}{5}$ *part of each colour.*

KA : *Is there anything else, ma'am?*

P : *Here, I will give you another one. Have you ever seen me make a cake?*

KA : *Ever, ma'am*

P : *Suppose there is* $\frac{3}{4}$ *kg of flour, it turns out that the flour is used to make two cake batters, so each batter requires* $\frac{3}{4}$ *: 2 So what is the result?*

KC : $\frac{3}{8}$ *kg of flour*

P : *Yes, that is right. Try to explain where you got it from.*

KC : *The way to do it, ma'am, is to give it the number 1, ma'am,* $\frac{3}{4} : \frac{2}{1}$ *So* $\frac{2}{1}$ *reversed to times* $\frac{1}{2}$*. The fragments are finished* $\frac{3}{4} x \frac{1}{2}$ *can the result be* $\frac{3}{8}$ *ma'am.*

P	:	*Yes, that is right. So, do you understand up to this point? Fractional numbers in this division operation are found everywhere around us.*
ALL	:	*Understand, ma'am*

3.2 Discussion

Overall, the application of conceptual change theory supported by *scaffolding* has proven effective in overcoming students' misconceptions. The learning process becomes more meaningful as it encourages students to actively reflect on their understanding, gradually build new concepts, and apply them to other situations, such as using fractions in everyday life. By applying conceptual change theory and *scaffolding*, students not only memorise procedures but also truly understand the concept of fractions in depth.

This is reinforced by the finding that conceptual change is described as a process in which students transition from unscientific thinking frameworks or preconceptions to scientific thinking frameworks. This change occurs when students experience dissatisfaction with their old understanding and accept new concepts that are considered intelligible, plausible, and fruitful [11-16]. In addition to the above findings, other studies indicate that conceptual change strategies are highly effective in helping students understand scientific concepts more effectively, especially when they have misconceptions or initial misunderstandings. This means that, in addition to scientific concepts, these strategies can also be applied to mathematical concepts, such as fractions. In other words, the conceptual change theory employed is that of Posner et al. (1982) [17-22].

Furthermore, findings from numerous studies on the learning process indicate that the provision of scaffolding is effective in reducing misconceptions and incorrect concepts among students. Thus, scaffolding is a form of temporary support provided by teachers to students to help them understand difficult material that is initially beyond their independent ability [23-27]. Additionally, findings from studies [28-33]. Discuss in depth how scaffolding strategies can be effectively applied in mathematics learning.

The results of the discussion indicate that the application of conceptual change theory with scaffolding is effective in enhancing students' conceptual understanding. Therefore, in this study, the strategy employed to remediate misconceptions is based on the conceptual change theory approach and scaffolding. The conceptual change strategy encourages students to realise the discrepancy between their initial misconceptions and the correct scientific information, thus creating cognitive conflicts that trigger meaningful learning processes. Meanwhile, *scaffolding* serves as a gradual support to facilitate students' understanding of the correct concept. As a result, there was a significant increase in the percentage of students who passed both the pre-test and post-test, along with a decrease in the level of student misconceptions. Thus, this approach is relevant and effective in enhancing the quality of learning, particularly in the context of material on fractional numbers.

4. CONCLUSION

The conclusion of this study indicates that the application of conceptual change theory with scaffolding is effective in addressing students' misconceptions about fractional number material. This approach not only helps students in remediating misconceptions but also encourages more meaningful learning. This finding makes an important contribution to classroom learning by correcting initial misconceptions in fractions. The theory of conceptual change and *scaffolding* can be utilised as a contextual learning approach that suits the needs and abilities of students in understanding the concept of fractions.

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