ELEMENTARY *Islamic Teacher Journal*
E-ISSN : 2503-0256 / ISSN : 2355-0155
Volume 11 Number 1 January - June 2023 (PP. 141-168)
http://dx.doi.org/10.21043/elementary.v11i1.19538
Diakses di : http://journal.iainkudus.ac.id/index.php/elementary

The Enhancing Student Mathematical Understanding through Differentiated Learning: A Study of Fifth Graders at Madrasah Ibtidaiyah

[1]**Kristi Liani Purwanti,** [2]**Mustofa,** [3]**Alvina Diah Ayu Failani,** [4]**Muh Syauqi Malik**

[1,2,3,4]**Universitas Islam Negeri Walisongo Semarang, Indonesia**

**coresponding author: kristi_liani@walisongo.ac.id*

Abstract

Investigating the impact of differentiated learning with experience, interaction, rommunication, and reflection approach of student mathematical understanding. The ability to comprehend mathematical concepts involves students' capacity to apply and utilize concepts in innovative ways based on their understanding. This research aimed to measure and to analyze the level of student understanding in mathematics, specifically focusing on the implementation of differentiation learning using the experience, interaction, communication, and reflection approach within the fifth-grade setting at Madrasah Ibtidaiyah. The differentiated learning, a well-known educational method, aimed to accommodate diverse student needs, ensuring comprehensive understanding. To conduct this study, the researchers divided students into three groups: the lowest common multiple (LCM) group, the butterfly group, and the origami group, based on initial ability diagnoses. Subsequently, the learning process employed experience, interaction, communication, and reflection strategies. A mixed research method was utilized for data collection and analysis. The results of study were assessed through five indicators of student mathematical understanding, demonstrated a notable improvement in students' conceptual comprehension. The average gain test value of 0.451442 indicated a medium-level increase, with a significance level value of 0.05. Consequently, students were receiving differentiated learning with the experience, interaction, communication, and reflection approach exhibited superior mathematical understanding compared to those receiving conventional instruction. Overall, this research provided empirical evidence supporting the effectiveness of differentiated learning, emphasizing the significance of incorporating experiential, interactive, communicative, and reflective methods to enhance students' mathematical comprehension.

Keywords: Mathematical Concepts, Differentiated Learning, Experience, Interaction, Communication, Reflection Approach, the Fifth-grade Students

INTRODUCTION

The world of education was a field that was affected by the Covid 19 pandemic; for about two years, Indonesia has been in a difficult position; everything was being done in a limited way (Churiyah et al., 2020). In this era of the Covid-19 pandemic inevitably requires education to replace the learning system where a pandemic, all learning processes were carried out in the classroom directly must change with the circulation of letters from the Ministry of Education and Culture issued a decree number 36962/MPK.A/HK/2020 which states that all levels of education, from elementary school to university, were taught virtually (Malik & Sukiman, 2021). Because the learning process was online and carried out in the long term, this results in a loss of knowledge where the ability of children to study at home cannot be measured properly (Singh et al., 2020).

The teacher cannot directly see the child's ability to grasp lessons. During the learning process, students faced several problems (Kim, 2020). There were three impacts experienced by children when they studied independently at home. Namely, 37% of children could not know when it was time to study because previously, they regularly studied at school and had to study independently. In addition, 30% of children have difficulty understanding lessons learned by themselves (Aminatun & Karyani, 2022). From these data, it can be said that children's abilities differ because some students have difficulty participating in independent/online learning (online).

A teacher must update his teaching method according to circumstances because the learning process continues to develop and differ from era to era; before the pandemic, learning was carried out normally face-to-face; changed when the pandemic became online, then after the pandemic, the teaching method had to be changed to overcome all the problems that have been described earlier. For this reason, teachers must be able to create active, innovative, and creative learning to meet the needs of students(Purwanti et al., 2022).

Children's abilities during a pandemic were different because the learning process was limited, so one student with another had different abilities. One of the learning models that can be used when students with different abilities are different is differentiation learning (Juliya & Herlambang, 2022). At the beginning of the new academic year, it was necessary to carry out a diagnostic analysis to Classifying three students' abilities, namely students with high abilities, students with moderate

abilities, students with low abilities, students with low abilities, students with low abilities (Alghadari, 2013). This research examines how differentiated learning was implemented due to the background of children's different abilities during a pandemic. Active learning will be created in the process of its approach using the experience, interaction, communication, and reflection approach. Experience, interaction, communication, and reflection (*MIKiR*) is an acronym for Experiencing Communication, Interaction, and Reflection.

Nefri Leni said the experience, interaction, communication, and reflection was a stage of learning that makes students active in participating in the learning process, namely with the following steps (Lenny, 2020): Experiencing (M) is an activity of carrying out activities (doing) and observing (observing) when the learning process is in progress, for example, making observations, experiments, and interviews. Interaction (I), namely the process of exchanging ideas between two or more people, for example, exchanging thoughts/ideas/ideas, discussing, and responding to other people's ideas/opinions. Communication (Ki), namely the process of conveying ideas/thoughts or feelings by one person to another; this communication can be oral or written, for example, conveying ideas, work results, experimental results, or group discussion results. Reflection (R) is the activity of looking back at learning experiences and taking lessons (lessons learned) to improve learning in the future.

Patria stated that conceptual understanding was an ability possessed by students in the form of mastery of several subject matters; when students did not just know or remind some of the concepts learned but are also able to re-express them in another form that is easier to understand and make the knowledge gained by applying the concepts well. Therefore, students' conceptual understanding of teaching materials needs to be improved in learning mathematics in this post-pandemic period (Patria, 2007).

Concepts become abstract ideas that allow us to classify objects and group these objects into the abstract. Therefore, improving your knowledge of mathematical procedures will be easier when you have strong conceptual knowledge. So understanding this concept, students can connect and solve mathematical problems based on basic abilities through concepts that students understand(Fatqurhohman, 2016). Based on interviews with grade 5 teachers and results of class observations, it was found that 56% of students' conceptual understanding skills in grade 5 students

were below the average ability to understand mathematical concepts. The other 44% were said to have above-average conceptual understanding abilities.

A prominent study by Gervasoni et al. examined the effectiveness of differentiated instruction in improving students' mathematical understanding across diverse learning environments. The findings highlighted the positive influence of differentiated learning on student engagement, motivation, and conceptual comprehension, supporting the premise of this research (Gervasoni et al., 2021).

Moreover, a comprehensive review conducted by Shamir-Inbal and Blau explored various strategies and approaches within differentiated learning. Their analysis revealed that incorporating experiential activities, fostering interaction, encouraging effective communication, and promoting reflection greatly enhanced students' mathematical understanding. These findings further reinforce the theoretical foundations of the experience, interaction, communication, and reflection approach utilized in this study (Shamir-Inbal & Blau, 2021).

Additionally, a meta-analysis by Riopel et al. synthesized findings from multiple studies on differentiated instruction in mathematics. The results indicated consistent positive effects on students' learning outcomes and conceptual understanding. The study emphasized the importance of tailoring instruction to meet individual student needs, aligning with the core principles of differentiated learning (Riopel et al., 2019).

By integrating insights from these reputable international journal articles, this research aims to contribute to the existing body of knowledge on differentiated learning and its impact on student mathematical understanding. Through empirical analysis and interpretation of data, this study seeks to provide practical recommendations for educators and policymakers to enhance instructional practices and optimize student learning experiences in mathematics education.

METHOD

In this study, combinations of qualitative and quantitative research methods were used, using a concurrent embedded design, which allowed for a balanced blend of both approaches. Qualitative research methods took precedence, focusing on primary data collection techniques as emphasized by Sugiyono (Sugiyono,

2015). The main objective was to explore how the differentiated learning model, incorporating the experience, interaction, communication, and reflection approach, influences the comprehension abilities of fifth-grade students at MI Nashrul Fajar Meteseh. The research procedure involved several key stages. Firstly, the researchers obtained ethical approval to ensure that the study adhered to ethical guidelines. Next, a suitable sample of fifth-grade students from MI Nashrul Fajar Meteseh was carefully selected to participate in the study.

To collect comprehensive data, a combination of qualitative and quantitative data collection techniques was employed. Qualitative data was gathered through classroom observations, student interviews, and reflections. These qualitative sources aimed to gain deeper insights into the students' experiences and perspectives during differentiated learning sessions. Quantitative data, on the other hand, was obtained through a mathematical comprehension test administered to the students. This test was designed to assess their understanding of mathematical concepts when taught using the differentiated learning model with the experience, interaction, communication, and reflection approach. The quantitative data provided the basis for statistical analysis to measure the impact of the differentiated learning model on students' comprehension abilities.

Data analysis involved separate treatment of both qualitative and quantitative data. Qualitative data was analyzed through coding and categorization, aided by thematic analysis, to identify recurring themes and patterns in the students' experiences and perceptions. For quantitative data analysis, statistical measures such as mean, standard deviation, and inferential statistics were utilized to explore the influence of the differentiated learning model on students' comprehension abilities. This allowed the researchers to draw meaningful conclusions and make inferences based on the collected quantitative data. This study uses indicators of understanding by combining several of the indicators above to become as follows (Kilpatrick et al., 2001; Krathwohl, 2002; Sanjaya, 2010):

1. Restating a concept
2. Classifying objects based on certain properties
3. Providing examples (exemplifying), namely finding specific examples.
4. Presenting concepts in various forms of representation
5. Applying the concept algorithmically

Quantitative research methods test the difference in the average used to test the average understanding of students' mathematics that obtain differentiation learning. The experience, interaction, communication, and reflection approach was compared to the average understanding of mathematics. The students obtained expository learning. This test is done by test t

The statistical hypothesis is as follows.

H0 (the average student's understanding of mathematics : $\mu_1 \leq \mu_2$ obtained differentiation learning. The experience, interaction, communication, and reflection approach is less than the average understanding of mathematics that students acquire through conventional learning)

H1 (the average student's understanding of mathematics is : $\mu_1 > \mu_2$ obtained differentiation learning. The experience, interaction, communication, and reflection approach more than the average student acquires a mathematical understanding of conventional learning). The criterion is to accept H0 if with = (n1 + n2 – 2) with a significant level of α. H0 is rejected for other prices $t < t_{(1-\alpha)} dkt$ (Sugiyono, 2011).

Hypothesis testing is a test of increasing students' conceptual comprehension skills before and after learning with a differentiated learning model with the experience, interaction, communication, and reflection approach. This test uses the gain test. The index criteria are as follows.

Table 1
Gain Score Criteria

Gain score	Criteria
-1<G<0	Down
G=0	Stable
0<G<0,3	Low
0.3≤G≤0.7	Average
G>0.7	High

Whereas qualitative data analysis design includes the following:

1. Data reduction

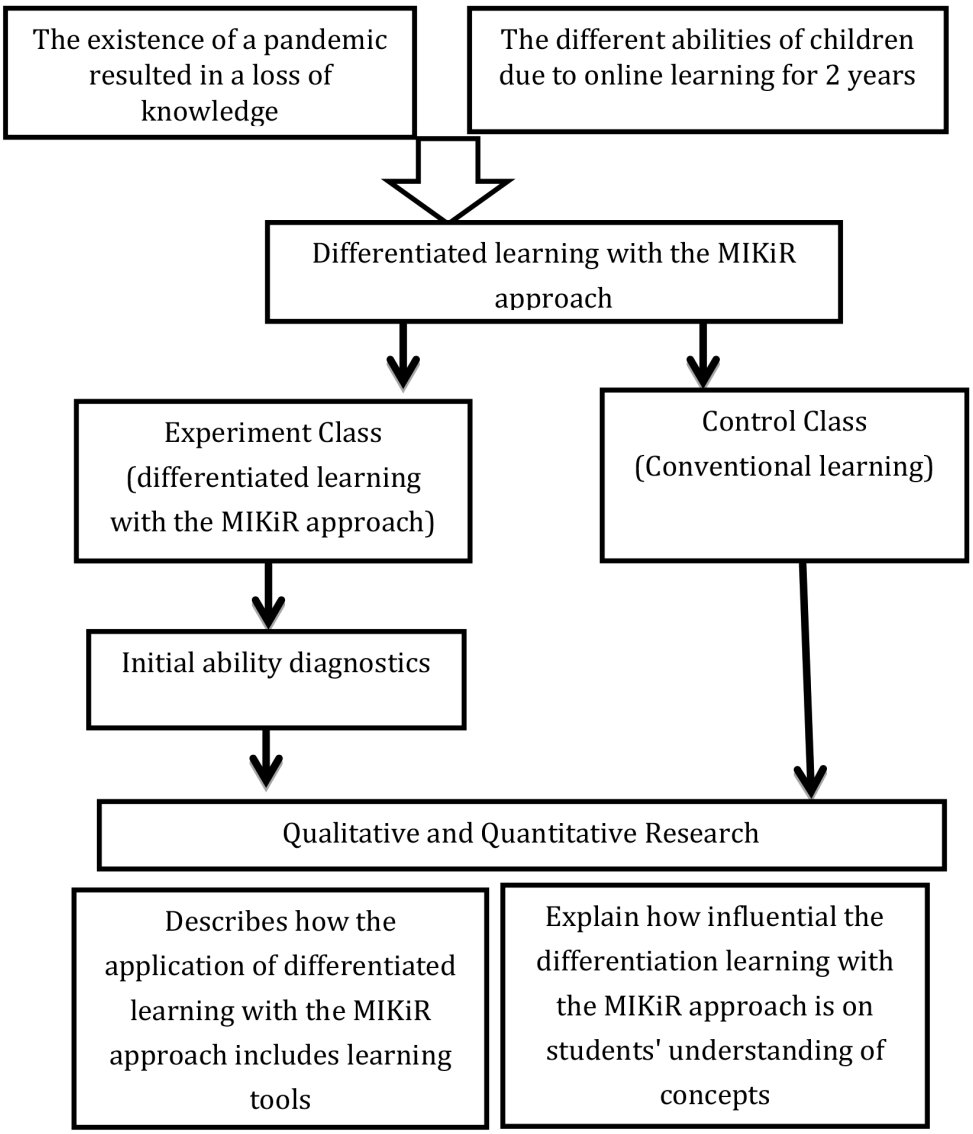
   Data reduction is an activity that refers to the process of selecting, focusing on simplifying the abstraction and transforming raw data in the field. If there is invalid data, the data is collected separately and can be used for verification. Data validation is carried out when collecting data using triangulation. The triangulations carried out in this study were (1) source triangulation, namely comparing and examining data from different subjects; (2) method triangulation, namely checking the results of data from a subject with different methods, namely from written tests and interviews.

2. Data Presentation

   Presentation of data includes classifying and identifying data, namely writing an organized collection of data so that it is possible to conclude the data. The presentation of data in this study is used to see an overall picture of research results regarding mathematical literacy skills.

3. Data verification

   The results obtained in the analysis process (mathematical understanding test, interviews) by students in the above-average group, the average group, and the below-average group are then concluded in a comparative descriptive way by looking at the findings of the data.



The existence of a pandemic resulted in a loss of knowledge: This phrase refers to the negative impact of the pandemic on students' educational progress. Due to the disruptions caused by the pandemic, such as school closures and the shift to remote learning, students experienced a loss of knowledge or a decline in their academic achievements.

The different abilities of children due to online learning for 2 years: This statement highlights how online learning for an extended period affected students' abilities differently. Some students may have adapted well to online learning, while others may have struggled to adjust, leading to variations in their academic performance and understanding of concepts.

Differentiated learning with the MIKiR approach: This phrase refers to a specific instructional approach called "Differentiated Learning with the MIKiR approach." It involves tailoring teaching methods, materials, and assessments to meet the diverse needs of students, taking into account their learning styles, interests, and abilities.

Control Class (Conventional learning): The term "control class" refers to a group of students who receive instruction using conventional teaching methods. In this context, it is used as a comparison group to assess the effectiveness of differentiated learning with the MIKiR approach.

Initial ability diagnostics: This phrase indicates the process of assessing students' initial abilities or baseline knowledge before implementing the instructional intervention. It involves conducting diagnostic assessments or tests to determine students' starting points and inform the grouping of students based on their abilities.

Qualitative and Quantitative Research: This refers to the research methodology employed in the study, which combines qualitative and quantitative data collection and analysis techniques. Qualitative research involves gathering non-numerical data through methods like interviews or observations, while quantitative research involves collecting numerical data and conducting statistical analyses.

Describes how the application of differentiated learning with the MIKiR approach includes learning tools: This statement suggests that the research study describes the learning tools or resources utilized during the implementation of differentiated learning with the MIKiR approach. These tools may include specific instructional materials, technology resources, or strategies tailored to support differentiated instruction.

Explain how influential the differentiation learning with the MIKiR approach is on students' understanding of concepts: This phrase indicates that the study aims

to explore and provide an explanation of the extent to which differentiated learning with the MIKiR approach impacts students' understanding of concepts. It seeks to assess the effectiveness and influence of this instructional approach on students' learning outcomes and comprehension of the subject matter.

RESULTS AND DISCUSSION

The results of this study obtained data, namely quantitative and qualitative.

Quantitative research data results

1. The mean difference test tests the average student's understanding of mathematics to obtain differentiation learning. The experience, interaction, communication, and reflection approach was compared to the average understanding of mathematics. The students obtained conventional learning. This test is done by test. The statistical hypothesis is as follows. t

   H0 (the average student's understanding of mathematics $: \mu_1 \leq \mu_2$ obtain differentiation learning the experience, interaction, communication, and reflection approach is less than the average understanding of mathematics that students acquire conventional learning)

   H1 (the average student's understanding of mathematics is $: \mu_1 > \mu_2$ obtain differentiation learning The experience, interaction, communication, and reflection approach more than the average student acquires a mathematical understanding of conventional learning.

Table 2.
Test of the Average Similarity on the Results of the Final Data of Experimental and Control Class Data

	Experiment	Control
Average	65.8333	38.0667
Variance	685,7299	549,7885
dk/df (n1+n2-2)		58
average difference	27.7667	

(na-1)*variant	19886,1667
(nb-1)*variant	15943,8667
n1+n2-2	58
1/n1+1/n2	0.0667
(na-1)*variaN +(nb-1)*variant/	617,7592
Denominator	41.1839
t count	4.3267
t table	2.0017

Based on the calculation of the t-test, it was obtained at 4.3267 consulted with $t_{hitung} t_{tabel}$ of 2.0017. Because $t_{hitung} > t_{tabel}$ Then the accepted hypothesis is H_1 , meaning that the average understanding of concepts using the differentiated learning model with. The experience, interaction, communication, and reflection approach is better than the average understanding of students' concepts using unconventional learning models in mathematics subject matter on addition and subtraction of fractions with different denominators in the fifth-grade students in the odd semester of the 2022/2023 school year.

2. Hypothesis testing is a test of increasing students' conceptual comprehension skills before and after learning with a differentiated learning model with the experience, interaction, communication, and reflection approach. The Results of Calculating the Gain Test, Average of Pretest : Posttest : N-gain test is 44.3: 65.83333 : 0.451442.

Table 3. Gain Test Recapitulation

Criteria	Amount
Down	1
Stable	1
Low	10
Average	8
High	10

From the table above, the average gain test value is equal to 0.451442, which is an increase in the medium category.

Qualitative research data

The following is a qualitative analysis of the ability to understand Student Mathematical concepts on the selected subjects in the experimental class based on the post-test results.

Subject 1 (Aliya Rida Cahyaningtyas, Above Average Group)

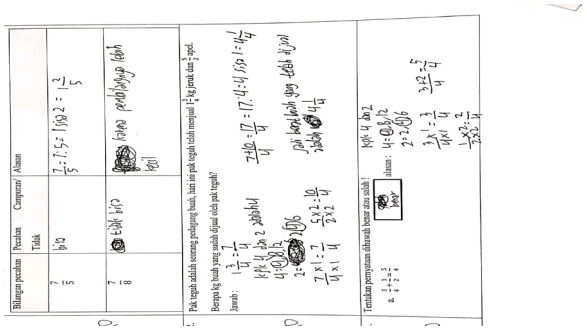


Figure 1. Question no 1 Posttest

Giving Examples without examples.

Students can determine examples of concepts and their reasons; they can determine non-examples of concepts and reasons why examples are inappropriate.

Implementing the concept

Students can apply the concept of changing mixed fractions from common fractions correctly.

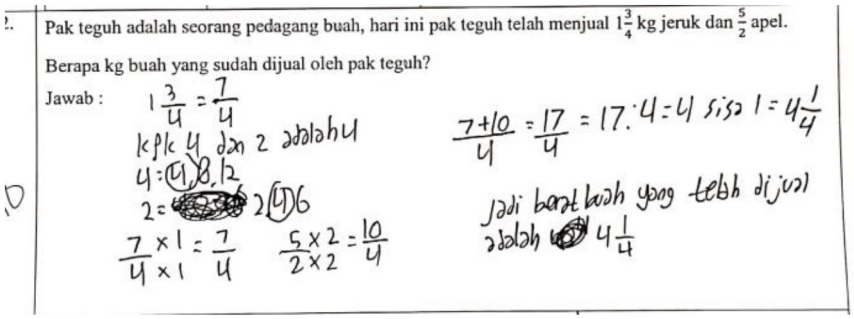


Figure 2 Question 2 Posttest

Presenting Concepts In Various Representations

Students can represent the concept of adding fractions in various forms; students can change mixed fractions into common fractions correctly.

Giving examples without examples

Students can correctly name examples of numbers that make up the LCM in the denominator. Moreover, they can determine which LCM is correct in the denominator by circling it.

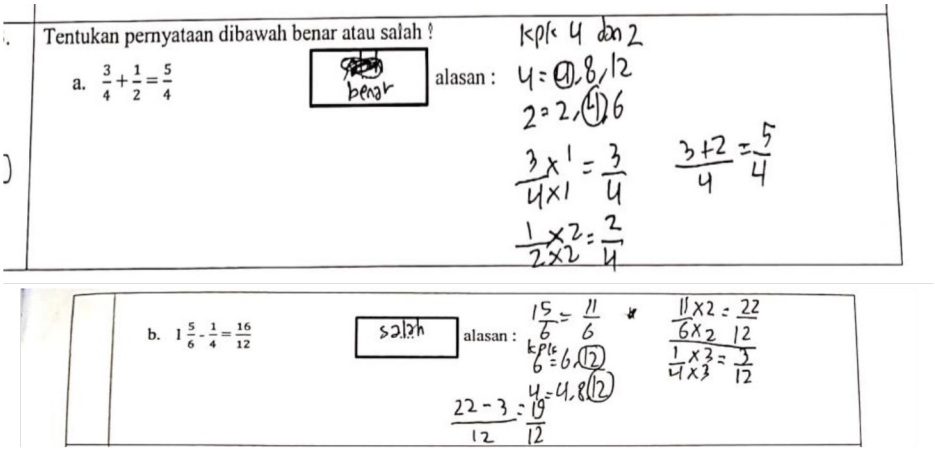


Figure 3. Question No. 3 of the Posttest

Restating a concept

After getting the differentiating model treatment, the subject can restate a concept, where students can correctly restate the concept of the problem in a mathematical concept.

Classifying objects based on certain properties

Students can classify which includes the LCM from the denominator of fractions, where scan find the LCM of fractions by Classifyinging whichever is the multiple of the denominator of the fraction.

Giving examples and non-examples

Students looking for the Lowest Common Multiple (LCM) can determine which is the Lowest Common Multiple (LCM) and which is not the Lowest Common Multiple (LCM) from the two denominators of fractions. Then, show examples of these non-examples by circling those that comprise the Lowest Common Multiple (LCM).

Presenting the concept in various representations

Students can express concepts using mathematical sign representations and mathematical models; in this case, students can provide concepts from questions in the form of subtraction correctly.

Implementing the concept

Students can apply the concept of subtraction using the Lowest Common Multiple (LCM) concepts well. The coherent and correct processing process shows this.

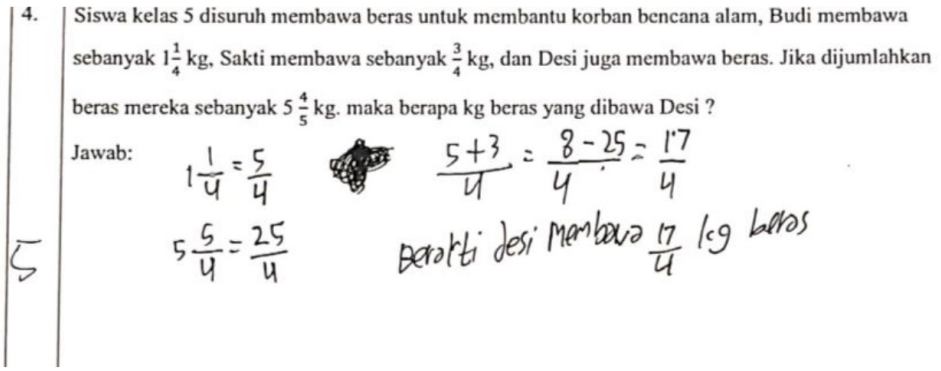


Figure 4. Question 4 of the Posttest

Restating a concept

From the problems in the question, students can restate the concept of subtraction by writing in a mathematical form using signs and models of addition and subtraction of fractions.

Classifying objects based on certain properties

In this problem, students can classify the quantifier and denominator; this is shown when fractions with the same denominator students go directly to the arithmetic operation and do not change the denominator again.

Presenting the concept in various representations

Students can present the concept of subtraction and addition in another representation, namely by using a minus sign and the fraction addition subtraction model. Moreover, they represent fractions into integers for ease of operation.

Implementing the concept

Students can apply or apply the concept of subtracting fractions with different denominators by writing problems in a mathematical form and not turning them upside down in rewriting the questions.

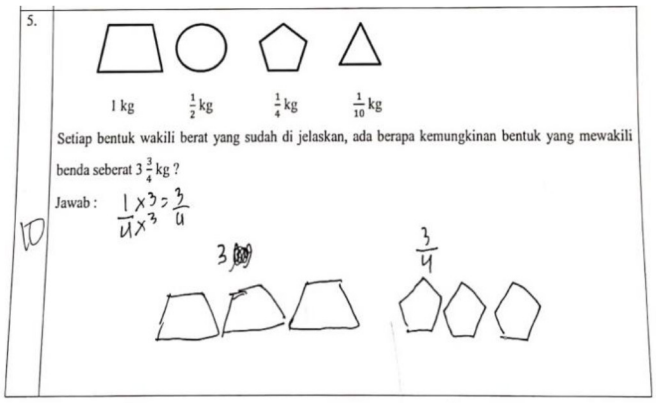


Figure 5. Question No. 5 of the Posttest

Applying Concepts Or Mathematical Algorithms

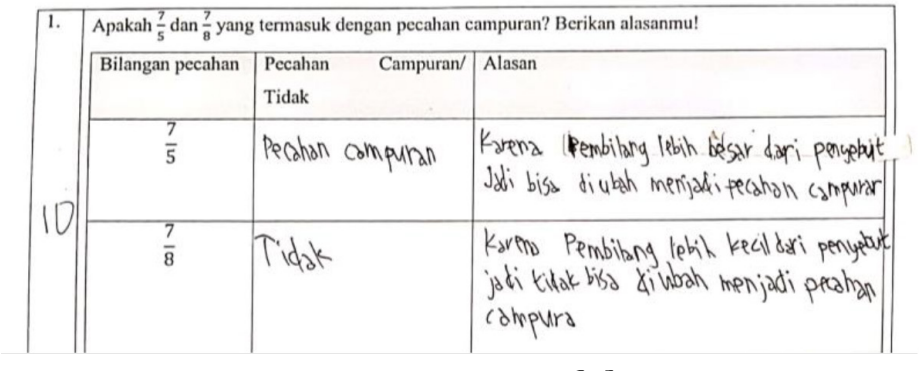
a. Students can apply mathematical concepts in various mathematical algorithms correctly.

b. Students can determine which shape represents the fraction size requested in the problem.

Classifying objects based on certain properties.

Students can correctly group shapes that represent the fractions' size in the problem.

Subject 2 (Alvino Maulana L, Average Group)


1. Apakah $\frac{7}{5}$ dan $\frac{7}{8}$ yang termasuk dengan pecahan campuran? Berikan alasanmu!

Bilangan pecahan	Pecahan Campuran/ Tidak	Alasan
$\frac{7}{5}$	Pecahan campuran	Karena Pembilang lebih besar dari penyebut Jadi bisa diubah menjadi pecahan campuran
$\frac{7}{8}$	Tidak	Karena Pembilang lebih kecil dari penyebut jadi tidak bisa diubah menjadi pecahan campura

10

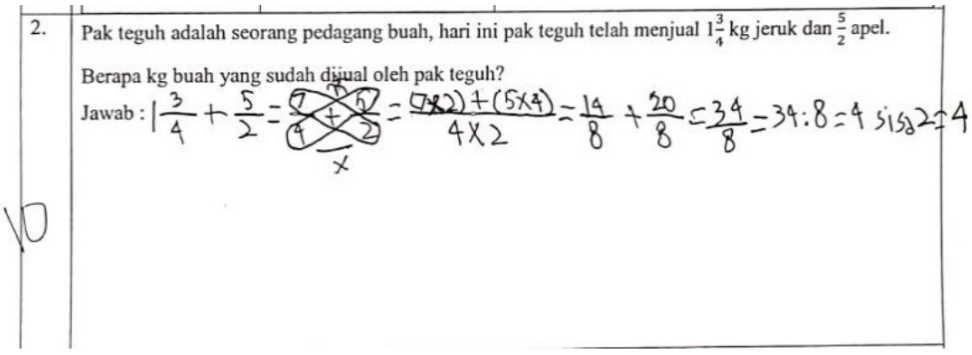
Figure 6. Question No. 1 of the Posttest

Classifying objects based on certain properties

In this problem students can classify or categorize which one is called the numerator and denominator, this is shown when multiplying crosses where the denominator is multiplied by the numerator correctly and not reversed.

Giving Examples and non-examples

Students can determine which examples are mixed fractions and which are not. In addition, students can give reasons for answers correctly.


2. Pak teguh adalah seorang pedagang buah, hari ini pak teguh telah menjual $1\frac{3}{4}$ kg jeruk dan $\frac{5}{2}$ apel.

Berapa kg buah yang sudah dijual oleh pak teguh?

Jawab : $1\frac{3}{4} + \frac{5}{2} = \frac{(7\times2)+(5\times4)}{4\times2} = \frac{14}{8} + \frac{20}{8} = \frac{34}{8} = 34:8 = 4$ sisa 2

10

Figure 7. Question No. 2 Posttest

Restating a concept

From the problems in the questions, students could restate the concept of subtraction by writing in a mathematical form using signs and fraction addition models.

Classifying objects based on certain properties

In this problem, students can classify or categorize the numerator and denominator, as shown when multiplying crosses where the denominator is multiplied by the numerator correctly and not reversed.

Presenting the concept in various representations

Students can present the concept of subtraction in another representation, namely by using the plus sign and the fraction addition model. Moreover, using the signs of the butterfly concept that forms is like a butterfly.

Implementing the concept

Students can apply or apply the concept of subtracting fractions with different denominators by writing problems in a mathematical form and not turning them upside down in rewriting the questions.

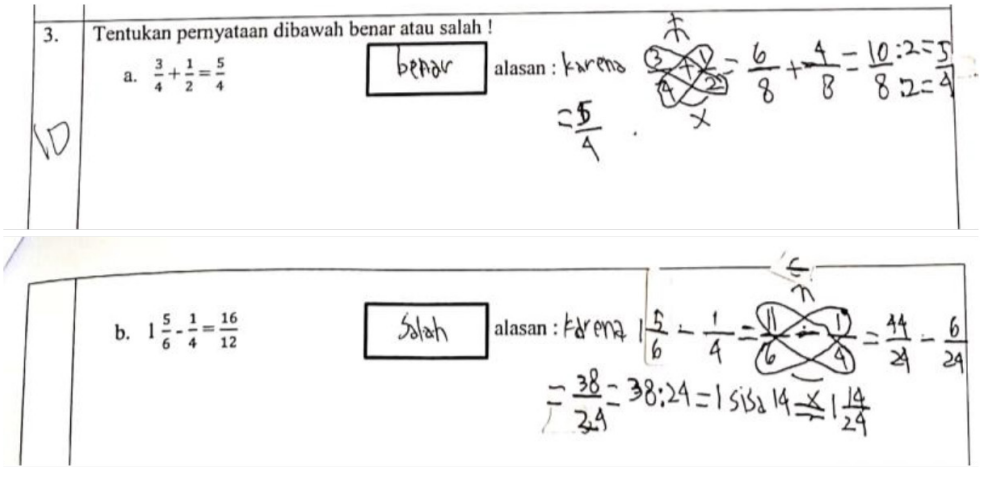


Figure 8. Question No. 3 of the Posttest

Restating a concept

From the problems in the questions, students can restate the concepts of subtraction and addition by writing in a mathematical form using plus and minus signs and the subtraction model for adding fractions.

Classifying objects based on certain properties

In this problem, students can classify or categorize the numerator and denominator, as shown when multiplying crosses where the denominator is multiplied by the numerator correctly and not reversed.

Giving examples and non-examples

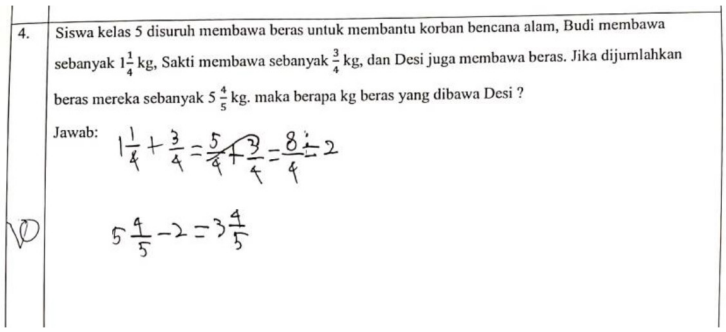
In this problem, students can determine which statements are true and which are wrong; this shows which examples are correct and justify answers from bad examples.

Presenting the concept in various representations

Students can present the concept of subtraction in another representation by using the minus and signs, and the subtraction model of adding fractions and using the signs of the butterfly concept that forms is like a butterfly.

Implementing the concept

Students can apply or apply the concepts of subtraction and addition of fractions with different denominators by writing problems in a mathematical form and not reversing in rewriting the questions.


4. Siswa kelas 5 disuruh membawa beras untuk membantu korban bencana alam, Budi membawa sebanyak $1\frac{1}{4}$ kg, Sakti membawa sebanyak $\frac{3}{4}$ kg, dan Desi juga membawa beras. Jika dijumlahkan beras mereka sebanyak $5\frac{4}{5}$ kg. maka berapa kg beras yang dibawa Desi ?

Jawab: $1\frac{1}{4} + \frac{3}{4} = \frac{5}{4} + \frac{3}{4} = \frac{8}{4} = 2$

$5\frac{4}{5} - 2 = 3\frac{4}{5}$

10

Figure 9. Question No. 4 of the Posttest

Restating a concept

From the problems in the questions, students can restate the concept of subtraction by writing in a mathematical form using signs and models of addition and subtraction of fractions.

Classifying objects based on certain properties

In this problem, students can classify which one is called the quantifier and which denominator; this is shown when fractions with the same denominator students go directly to the arithmetic operation and do not change the denominator again.

Presenting the concept in various representations

Students can present the concept of subtraction and addition in another representation, namely by using a minus sign and the fraction addition subtraction model. Moreover, they represent fractions into integers for ease of operation.

Implementing the concept

Students can apply or apply the concept of subtracting fractions with different denominators by writing problems in a mathematical form and not turning them upside down in rewriting the questions.

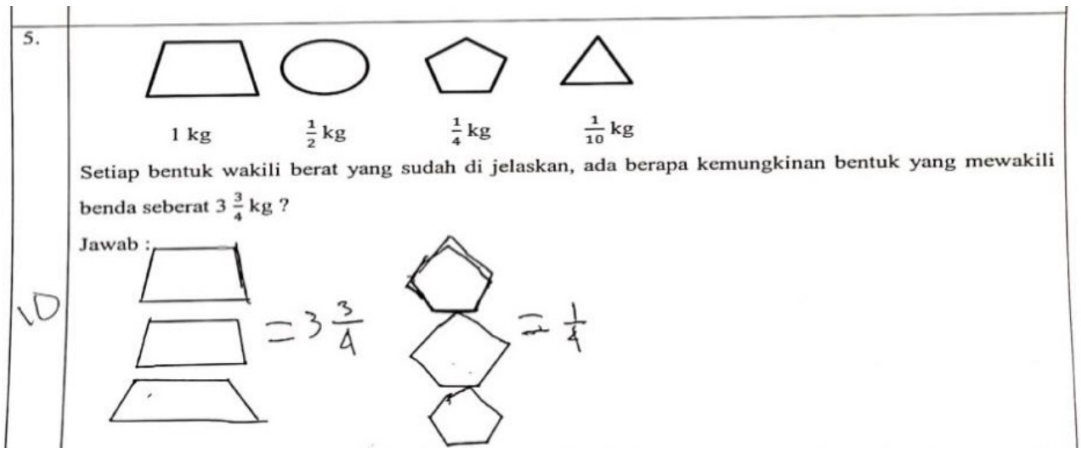


Figure 10. Question No. 5 of the Posttest

Applying Concepts Or Mathematical Algorithms

a. Students can apply mathematical concepts in various mathematical algorithms correctly.

b. Students can determine which shape represents the fraction size requested in the problem.

Classifying objects based on certain properties.

Students can correctly group shapes representing the size of fractions in the problem.

Subject 3 (Akhlis Azka Arroyan, Group below average)

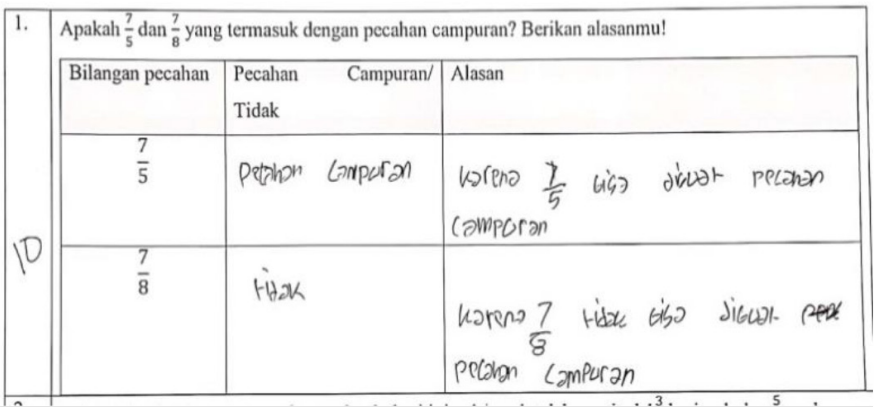


Figure 11. Question No. 1 of the Posttest

Classifying objects based on certain properties

In this problem, students can classify or categorize the numerator and denominator, as shown when multiplying crosses where the denominator is multiplied by the numerator correctly and not reversed.

Giving Examples and non-examples

Students can determine which examples are mixed fractions and which are not. In addition, students can give reasons for answers correctly.

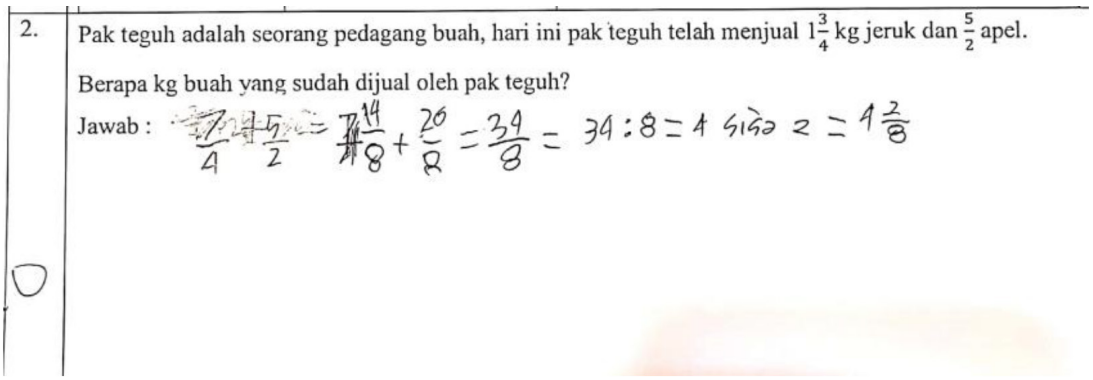


Figure 12. Question No. 2 of the Posttest

Restating a concept

From the problems in the questions, students could restate the concept of subtraction by writing in a mathematical form using signs and fraction addition models.

Classifying objects based on certain properties

In this problem, students can classify or categorize the numerator and denominator, as shown when multiplying crosses where the denominator is multiplied by the numerator correctly and not reversed.

Presenting the concept in various representations

Students can present the concept of subtraction in another representation, namely by using the plus sign and the fraction addition model. And using the signs of the butterfly concept that forms like a butterfly.

Implementing the concept

Students can apply or apply the concept of subtracting fractions with different denominators by writing problems in a mathematical form and not turning them upside down in rewriting the questions.

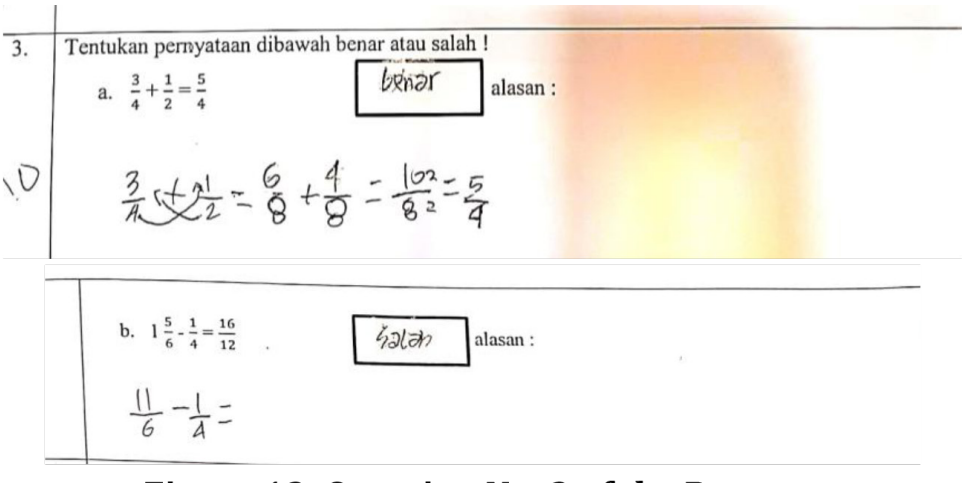


Figure 13. Question No. 3 of the Posttest

Restating a concept

From the problems in the questions, students can restate the concepts of subtraction and addition by writing in a mathematical form using plus and minus signs and the subtraction model for adding fractions.

Classifying objects based on certain properties

In this problem, students can classify or categorize the numerator and denominator, as shown when multiplying crosses where the denominator is multiplied by the numerator correctly and not reversed.

Giving Examples and non-examples

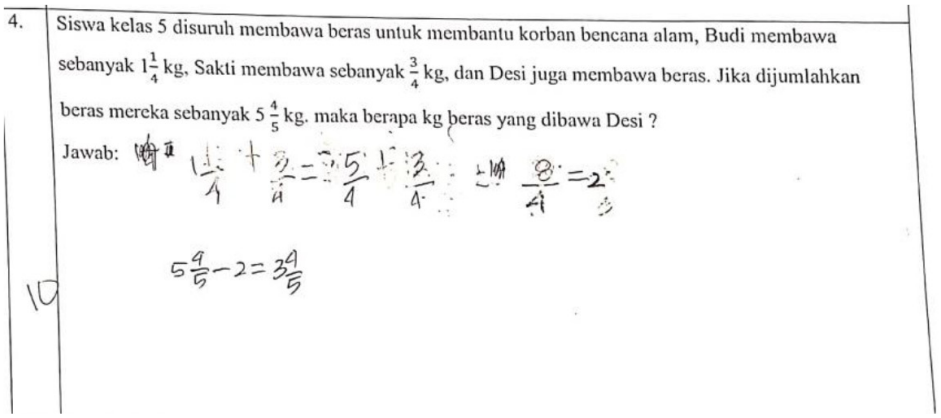
In this problem, students can determine which statements are true and which are wrong; this shows which examples are correct and justify answers from bad examples.

Presenting the concept in various representations

Students can present the concept of subtraction in another representation by using the minus plus signs and the subtraction model of adding fractions. Moreover, using the signs of the butterfly concept that forms is like a butterfly.

Implementing the concept

Students can apply or apply the concepts of subtraction and addition of fractions with different denominators by writing problems in a mathematical form and not reversing in rewriting the questions.


4. Siswa kelas 5 disuruh membawa beras untuk membantu korban bencana alam, Budi membawa sebanyak $1\frac{1}{4}$ kg, Sakti membawa sebanyak $\frac{3}{4}$ kg, dan Desi juga membawa beras. Jika dijumlahkan beras mereka sebanyak $5\frac{4}{5}$ kg. maka berapa kg beras yang dibawa Desi ?

Jawab:

$5\frac{4}{5} - 2 = 3\frac{4}{5}$

10

Figure 14. Question No. 4 of the Posttest

Restating a concept

From the problems in the questions, students can restate the concept of subtraction by writing in a mathematical form using signs and models of addition and subtraction of fractions.

Classifying objects based on certain properties

In this problem, students can classify the quantifier and denominator; this is shown when fractions with the same denominator students go directly to the arithmetic operation and do not change the denominator again.

Presenting the concept in various representations

Students can present the concept of subtraction and addition in another representation, namely by using a minus sign and the fraction addition subtraction model. Moreover, represent fractions into integers for ease of operation.

Implementing the concept

Students can apply or apply the concept of subtracting fractions with different denominators by writing problems in a mathematical form and not turning them upside down in rewriting the questions.

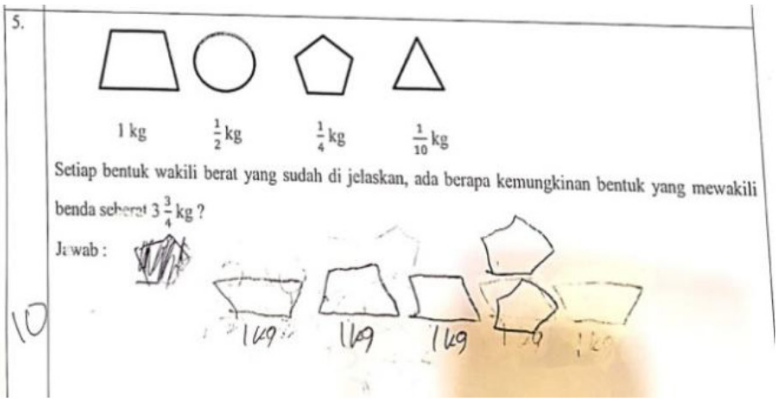


Figure 15. Question No. 5 of the Posttest

Applying Concepts or Mathematical Algorithms

a. Students can apply mathematical concepts in various mathematical algorithms correctly.

b. Students can determine which shape represents the fraction's size requested in the problem.

Classifying objects based on certain properties.

Students can correctly group shapes that represent the fractions' size in the problem.

The study titled "Enhancing Student Mathematical Understanding through Differentiated Learning: A Study on Fifth Graders at Madrasah Ibtidaiyah" aimed to explore how differentiated learning impacts the mathematical understanding of fifth-grade students. This discussion will present the key findings, implications, and

limitations of the study. The findings of this study indicate that differentiated learning, implemented through the MIKiR (Experience, Interaction, Communication, and Reflection) approach, significantly enhances students' mathematical understanding. The researchers analyzed data obtained from mathematical understanding tests and interviews conducted with students grouped based on their abilities (above-average, average, and below-average), allowing for a comparative and descriptive examination of the results.

The study identified several influential factors that shape students' mathematical understanding. Firstly, the ongoing pandemic had a detrimental effect on students' acquisition of knowledge as the sudden shift to online learning disrupted their learning processes. This finding highlights the need for effective instructional strategies, like differentiated learning, to mitigate the negative impact of such disruptive events. Secondly, the study acknowledged the diverse abilities of students that emerged from two years of online learning. While some students adapted well to this mode of learning, others faced challenges in independently grasping mathematical concepts. By implementing differentiated learning, which caters to individual needs and abilities, teachers can address these discrepancies and provide targeted support to enhance students' understanding.

The study focused on the effectiveness of the MIKiR approach within differentiated learning in promoting students' mathematical understanding. By incorporating experiences, interactions, communication, and reflection into the learning process, students actively engaged and deepened their conceptual understanding. This finding underscores the importance of incorporating these elements into instructional approaches to improve students' learning outcomes. Furthermore, a comparative analysis was conducted between the differentiated learning group and a control group that received conventional instruction. The results revealed that students who experienced differentiated learning outperformed those in the control group, further highlighting the benefits of implementing differentiated learning approaches in mathematics education.

However, it is crucial to acknowledge the limitations of this study. Firstly, the study focused solely on fifth-grade students at Madrasah Ibtidaiyah, limiting the generalizability of the findings to other grade levels or educational contexts. Additionally, the study relied on qualitative and quantitative data obtained through tests and interviews, which may have inherent biases and limitations in capturing the complexity

of students' mathematical understanding. To strengthen future research in this area, it is recommended to conduct longitudinal studies involving a larger sample size and diverse educational settings. Additionally, incorporating multiple data collection methods, such as observations and student work samples, could provide a more comprehensive understanding of students' mathematical comprehension (Dong, 2023).

CONCLUSION

Based on the implementation of the research titled The Enhancing Student Mathematical Understanding through Differentiated Learning: A Study on Fifth Grade at Madrasah Ibtidaiyah," it can be concluded that the differentiated learning, incorporating the experience, interaction, communication, and reflection approach, has a significant impact on enhancing the understanding of mathematical concepts among fifth-grade students at Madrasah Ibtidaiyah. The findings from the N-Gain test, with a significance level of 0.05 and an effect size of 0.4514, indicate a moderate-level influence of differentiated learning on students' mathematical comprehension. By diagnosing students' initial abilities through formative tests, the study ensured that students with different levels of mathematical understanding were grouped accordingly: above-average, average, and below-average. To facilitate the development of students' mathematical understanding, the learning tools employed in the differentiated learning model included differentiation-based lesson plans. These plans were tailored to the specific abilities and needs of each group.

This study focused on teaching three concepts: addition and subtraction utilizing the Lowest Common Multiple (LCM) approaches, Butterfly approach, and Origami approach. By acknowledging the diverse abilities of students and implementing differentiated learning, teachers can effectively cater to their student's individual needs. The results of this research emphasize the importance of considering students' initial abilities and employing targeted instructional strategies to enhance their mathematical understanding. In summary, this study provides valuable insights into the implementation of differentiated learning with the experience, interaction, communication, and reflection approach. The findings highlight its effectiveness in promoting students' comprehension of mathematical concepts and underscore the significance of individualized instruction in the educational context of Madrasah Ibtidaiyah.

REFERENCE

Alghadari, F. (2013). Pembelajaran Berbasis Masalah Untuk Meningkatkan Kemampuan Dan Disposisi Berpikir Kritis Matematik Siswa SMA. *Jurnal Penelitian Pendidikan*, *13*(2), Article 2. https://doi.org/10.17509/jpp.v13i2.3428

Aminatun, I., & Karyani, U. (2022). *Hubungan Antara Kecerdasan Emosional Dan Dukungan Sosial Dengan Resiliensi Pada Remaja Sman X Karanganyar Di Masa Pandemi Covid-19*.

Churiyah, M., Sholikhan, S., Filianti, F., & Sakdiyyah, D. A. (2020). Indonesia Education Readiness Conducting Distance Learning in Covid-19 Pandemic Situation. *International Journal of Multicultural and Multireligious Understanding*, *7*(6), Article 6. https://doi.org/10.18415/ijmmu.v7i6.1833

Dong, L. (2023). A Complex, Dynamic Systems Theory perspective on grit, grammar knowledge, and their relationship among high-school students: A longitudinal time series analysis study. *Current Psychology*. https://doi.org/10.1007/s12144-023-04918-1

Fatqurhohman, F. (2016). Representasi Matematis Dalam Membangun Pemahaman Konsep Pecahan. *Jurnal Math Educator Nusantara: Wahana Publikasi Karya Tulis Ilmiah di Bidang Pendidikan Matematika*, *2*(1), Article 1. https://ojs.unpkediri.ac.id/index.php/matematika/article/view/400

Gervasoni, A., Roche, A., & Downton, A. (2021). Differentiating Instruction for Students Who Fail to Thrive in Mathematics: The Impact of a Constructivist-Based Intervention Approach. *Mathematics Teacher Education and Development*, *23*(3), 207–233.

Juliya, M., & Herlambang, Y. T. (2022). Analisis Problematika Pembelajaran Daring Dan Pengaruhnya Terhadap Motivasi Belajar Siswa. *Genta Mulia : Jurnal Ilmiah Pendidikan*, *12*(1), Article 1. https://www.ejournal.stkipbbm.ac.id/index.php/gm/article/view/585

Kilpatrick, J., Swafford, J., Findell, B., & National research council. (2001). *Adding it up: Helping children learn mathematics* (Vol. 2101). National Academy Press Washington, DC.

Kim, J. (2020). Learning and Teaching Online During Covid-19: Experiences of Student Teachers in an Early Childhood Education Practicum. *International Journal of Early Childhood*, *52*(2), 145–158. https://doi.org/10.1007/s13158-020-00272-6

Krathwohl, D. R. (2002). A Revision of Bloom's Taxonomy: An Overview. *Theory Into Practice*, *41*(4), 212–218. https://doi.org/10.1207/s15430421tip4104_2

Leni, N. (2020). Efektifitas Pelatihan Metodologi Pembelajaran Dengan Pembelajaran Aktif MIKiR. *Lentera: Jurnal Diklat Keagamaan Padang*, *5*(1), 29–38.

Malik, M. S., & Sukiman, S. (2021). Development and Implementation of Curriculum Adaptation During The Covid-19 Pandemic. *Edukasia : Jurnal Penelitian Pendidikan Islam*, *16*(1), Article 1. https://doi.org/10.21043/edukasia.v16i1.10495

Patria, A. (2007). Teknik Probing dalam Pembelajaran Matematika untuk Meningkatkan Pemahaman Konsep Siswa SMP. *Skripsi. Bandung: UPI*.

Purwanti, K. L., Sukestiyarno, Y. L., Waluyo, B., Rochmad, R., & Ayu, A. D. (2022). Pemahaman Konsep Matematika Siswa pada Pembelajaran Berdeferensiasi dengan Pendekatan MIKIR di Kelas V Madrasah Ibtidaiyah. *Prosiding Seminar Nasional Pascasarjana (PROSNAMPAS)*, *5*(1), Article 1.

Riopel, M., Nenciovici, L., Potvin, P., Chastenay, P., Charland, P., Sarrasin, J. B., & Masson, S. (2019). Impact of serious games on science learning achievement compared with more conventional instruction: An overview and a meta-analysis. *Studies in Science Education*, *55*(2), 169–214. https://doi.org/10.1080/03057267.2019.1722420

Sanjaya, W. (2010). *Strategi Pembelajaran Berorientasi Standar Proses Pendidikan*. Kencana.

Shamir-Inbal, T., & Blau, I. (2021). Facilitating Emergency Remote K-12 Teaching in Computing-Enhanced Virtual Learning Environments During COVID-19 Pandemic—Blessing or Curse? *Journal of Educational Computing Research*, *59*(7), 1243–1271. https://doi.org/10.1177/0735633121992781

Singh, S., Roy, D., Sinha, K., Parveen, S., Sharma, G., & Joshi, G. (2020). Impact of COVID-19 and Lockdown on Mental Health of Children and Adolescents: A Narrative Review with Recommendations. *Psychiatry Research*, *293*, 113429. https://doi.org/10.1016/j.psychres.2020.113429

Sugiyono. (2011). *Metode Penelitian Kombinasi (Mixed Methods)*. Alfabeta.

Sugiyono. (2015). *Metode Penelitian Pendidikan Pendekatan Kuantitatif, Kualitatif dan R&D* (11th ed.). Alfabeta.