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Enhancing Higher Order Thinking Skills Among Elementary Students: A Classroom Action Research on Teaching Fractions

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Abstract

The aim of this research is to see how the implementation of HOTS-oriented learning can improve the mathematics learning outcomes of fifth grade elementary school students. The research method used was Classroom Action Research (PTK), with the research subjects being class V.b students at SD Negeri 16 Lubuklinggau, totaling 24 people, consisting of 9 men and 15 women. Data collection techniques use tests, observation and documentation. The data analysis techniques used are qualitative descriptive and quantitative descriptive. This research consists of three cycles and each cycle consists of four stages, namely planning, implementing actions, observing and reflecting. The results of this research show that the mathematics learning outcomes of class V students at SD Negeri 16 Lubuklinggau City have improved through the implementation of HOTS (Higher Order Thinking Skills) oriented learning. This is shown through the students' average scores, during the Pre-Cycle the average Pre-test score obtained by students was 42.91, Cycle 1 the Post-test average score was 53.95, Cycle 2 the Post-test average score was 69.58, Cycle 3 Post-test average score 79.58. Therefore, it can be concluded that the implementation of HOTS-oriented learning can be used as an effort to improve the quality of learning in order to form a higher level of thinking in students.
Keywords: Learning outcomes, Mathematics, HOTS orientation.

Abstrak

Tujuan penelitian ini untuk meningkatkan hasil belajar matematika materi pecahan pada siswa kelas V SD melalui strategi pembelajaran berorientasi *Higher Order Thinking Skills* (HOTS). Metode penelitian yang digunakan adalah Penelitian Tindakan Kelas (PTK). Subjek penelitian adalah siswa kelas V.b SD Negeri 16 Lubuklinggau berjumlah 24 orang yang terdiri dari 9 orang laki-laki dan 15 orang perempuan. Teknik pengumpulan data menggunakan observasi, wawancara, dokumentasi dan tes, dengan teknik analisis data statistik deskriptif. Penelitian ini terdiri dari tiga siklus dan setiap siklus terdiri dari empat tahap, yaitu perencanaan, pelaksanaan tindakan, observasi dan refleksi. Hasil penelitian ini menunjukkan bahwa hasil belajar matematika siswa kelas V SD Negeri 16 Kota Lubuklinggau mengalami peningkatan melalui penerapan strategi pembelajaran berorientasi HOTS. Hal ini ditunjukkan melalui nilai rata-rata, saat pra siklus 42.91, siklus 1 senilai 53.95, siklus 2 senilai 69.58, dan siklus 3 senilai 79.58. Oleh karena itu, dapat disimpulkan bahwa penerapan strategi pembelajaran berorientasi HOTS dapat dijadikan sebagai upaya meningkatkan kualitas pembelajaran guna membentuk tingkat berpikir yang lebih tinggi pada siswa.
Kata kunci: Hasil belajar, Matematika, berorientasi HOTS.

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Introduction

The improvement of the quality of education in Indonesia has become the main focus in efforts to develop superior human resources, with the aim of achieving national progress. The Indonesian government continues to innovate in the education system to produce a generation equipped with 21st-century skills that are relevant to the evolving times. Education is also increasingly emphasizing the importance of 21st-century skills, known as the 4Cs: Critical Thinking, Creativity, Collaboration, and Communication (Rusdin & Ali, 2019; Bedir, 2019; Khoiri et al., 2021; Selman & Jaedun, 2020). These four skills are crucial to equip students with the ability to adapt to global dynamics and solve complex problems in the future (Erdoğan, 2019; Pardede, 2020). These 21st-century skills can broadly be understood as components of higher-order thinking skills (HOTS) (Setyaningrum et al., 2024; Tobing et al., 2022). Higher Order Thinking Skills (HOTS) are recognized as essential at all levels of education, encouraging students to become thinkers and problem solvers. Educators must strive to overcome challenges in integrating technology, distributing textbooks, and developing HOTS in mathematics instruction (Abas & David, 2019; Kartika et al., 2019; Purwasi & Fitriyana, 2020).

Higher Order Thinking Skills (HOTS) is part of the revised Bloom's Taxonomy, as proposed by Krathwohl & Anderson (2010), which includes the skills of analysis (C4), evaluation (C5), and creation (C6). These skills strongly support the development of the 4Cs in the context of mathematics learning. The development of HOTS presents an educational challenge, and the most important skill for students is the ability to solve mathematical problems (Raiyn & Tilchin, 2015). Teachers play a key role in the implementation of HOTS in the classroom, as the right teaching strategies can help students develop higher-order thinking skills, which in turn support the achievement of better education quality (Suhendro et al., 2021). Furthermore, integrating HOTS into the learning process means that students are not only taught to memorize information but also to think critically, creatively, and collaborate in solving complex problems (Pamungkas et al., 2024). One of the mathematical topics that influences students' development in school mathematics is fractions (Copur-Gencturk, 2021).

Fractions are numbers written in the symbolic form a/b, referring to the part-whole meaning of rational numbers, which facilitates students’ understanding of the concepts and basic operations of fractions such as equivalence, addition, subtraction, multiplication, and division in rational computations (Lamon, 1999; Ni & Zhou, 2005; Lortie-Forgues et al., 2015). In addition, the topic of fractions is one of the key mathematical topics to be taught, as it is widely applied in measurement and calculations such as percentages, ratios and proportional reasoning, rates, and decimals (Ndalichako, 2013; Van de Walle et al., 2013; Wijaya, 2017). However, fractions are also considered one of the more difficult mathematical topics for teachers to teach and for students to comprehend, particularly in relation to operations (Yilmaz et al., 2010). In fact, a proper understanding of fractions should be instilled from the elementary school level (Hariyani et al., 2022). Some operations involving fractions are not intuitively easy to grasp, such as division operations that result in a number greater than the dividend. This recurring issue highlights the need for change in mathematics instruction (Warsito et al., 2019). The implementation of HOTS-integrated learning in the mathematics curriculum needs to be emphasized, particularly in the teaching and learning of the topic of fractions (Tangkui et al., 2023).

Students’ higher-order thinking skills (HOTS) can be effectively developed when they are consistently engaged in HOTS-integrated learning (Nurani et al., 2017; Ndiung et al., 2024). Sustained implementation of HOTS-based instruction can motivate students, yet it poses significant challenges for both teachers and learners (Zana et al., 2024). International assessments such as TIMSS and PISA have frequently ranked Indonesia low, indicating that Indonesian students' HOTS remain underdeveloped (Hadi et al., 2018). A preliminary survey conducted by the authors involving 10 high school mathematics teachers in Indonesia revealed that only 2 teachers (20%) had implemented HOTS-oriented mathematics instruction (Apino & Retnawati, 2017). As a result, students were generally only capable of solving problems that required understanding and application (Kairuddin et al., 2020). This presents a particular challenge for teachers to further explore HOTS-based learning. Seman et al. (2017) emphasized that the main challenges faced by teachers lie in the preparation and instructional processes. One contributing factor is the teaching methods that have yet to adopt or focus on HOTS, as outlined in the curriculum (Abdullah et al., 2025), especially considering the demands of the Merdeka Curriculum, which requires the development of both HOTS-oriented instruction and assessment instruments (Asmana, 2023; Huda & Marhayati, 2024). The ability of individuals to apply mathematical concepts and solve problems in various real-life situations can be enhanced through the use of HOTS questions that challenge students to think critically, creatively, and analytically (Abidinsyah et al., 2019; Khan & Setyaningsih, 2024).

Based on classroom observations in Grade V at SD Negeri 16 Lubuklinggau, it was found that most students experienced difficulties in understanding and solving mathematical problems, particularly in the topic of fractions. This was due to a lack of understanding of basic fraction concepts, such as how to divide, find common denominators, or convert fractions into decimal form. Students also struggled to apply fraction concepts in word problems or real-life contexts. The Merdeka Curriculum mandates the development of learning activities oriented toward Higher-Order Thinking Skills (HOTS). However, the learning practices implemented in the classroom tend to insufficiently emphasize HOTS aspects such as analysis, evaluation, and creation. Instruction remains focused on basic procedures and memorization of formulas, without actively engaging students in problem-solving that requires higher-order thinking. Learning that prioritizes the exploration of fraction concepts through activities that encourage students to think critically and creatively can help them better understand and apply fraction material. This approach may contribute to improved learning outcomes in mathematics. Several studies have found that the integration or collaboration of HOTS is effective when applied to fraction topics. Abidin et al. (2017) found that learning activities emphasizing HOTS can facilitate problem-solving in fraction topics. Munawaroh et al. (2024) concluded that problem-based learning integrated with HOTS can enhance students' mathematical problem-solving skills and effectively improve learning outcomes in fraction material. Furthermore, Aurelia (2024) emphasized that HOTS-based instruments for fraction topics can be used both to evaluate students' higher-order thinking abilities and to identify their mathematical comprehension skills.

Although research on HOTS in fraction material has been conducted, its implementation in the context of elementary school learning still faces several challenges. Previous studies have not emphasized a continuous classroom action approach to directly improve the learning process. Many teachers still struggle to implement HOTS due to limited practical strategies and appropriate evaluation instruments. Therefore, this study contributes to the development and testing of a HOTS-based learning strategy through Classroom Action Research (CAR), aiming to improve the quality of fraction learning in Grade V in a contextual, measurable, and sustainable manner, in accordance with the demands of the Merdeka Curriculum. Hence, it is necessary to conduct research that enhances students' thinking abilities and learning outcomes in mathematics through the application of HOTS-oriented learning strategies as an effort to improve the thinking skills and mathematics achievement of Grade V students at SD Negeri 16 Lubuklinggau.

Method

This study is a type of Classroom Action Research (CAR). According to Sugiyono (2017), CAR is a research approach conducted by teachers to improve the quality of classroom learning. This study implements a HOTS-based learning strategy gradually through three cycles of action. Each cycle is designed to stimulate students' higher-order thinking skills, starting from analysis (C4), followed by evaluation (C5), and culminating in creation (C6). The stages of each cycle include (1) Planning, (2) Implementation of Action, (3) Observation, and (4) Reflection. The study was conducted at SD Negeri 16 Lubuklinggau. The research subjects were all students of class Vb in the first semester of the 2023/2024 academic year, totaling 24 students, consisting of 9 boys and 15 girls.

The plan for Cycle I focused on the topic of multiplying proper fractions using real-life word problems. The test instruments included contexts such as distributing longan fruit to neighbors, donating leftover rice, using flour for packaging, and inheritance distribution. The learning strategy was designed to integrate HOTS into three phases. In the analysis phase (C4), students were trained to identify key information, differentiate between parts and wholes, and understand the meaning of multiplication operations. The evaluation phase (C5) involved comparing their solutions with peers and assessing the most appropriate strategies. In the creation phase (C6), students were guided to make illustrations, write their own explanations, and design problems relevant to their personal experiences.

The action plan for Cycle II focused on the topic of multiplying mixed fractions through contextual problems such as fertilizer application, baking, rope measurement, and sugar distribution. Students were trained to analyze mixed number forms and construct appropriate steps for the operation (C4). They were also asked to evaluate two solution methods direct multiplication or conversion to improper fractions and explain the most efficient strategy (C5). In the creation stage, students constructed similar problems based on daily life experiences and presented independent solutions (C6). The Cycle III action plan focused on multiplying decimal fractions using a scientific approach through contextual problems related to weight, product pricing, liquid volume, and height growth. In the analysis phase, students were encouraged to examine the context of the problems in greater depth. In the evaluation phase, students were asked to justify their answers. Finally, in the creation phase, students were trained to complete missing parts of the problems and then reconstruct them in a coherent and relevant manner. Data collection techniques used in this study included observation, interviews, documentation, and test results. The analysis of students' learning outcomes is conducted by calculating the average score of the students using the following formula:

$$\bar{X} = \frac{\Sigma xi}{n}$$

$\bar{X}$ is denoted as the average score, Σ represents the summation (total), xi (the value of x from i to n), and n is the number of data. Then, individual completeness is calculated within the range of 0-100 with the criteria of very poor (0-49), poor (50-59), fair (60-69), good (70-80), and excellent (81-100) (Jihad dan Haris, 2014) using the following formula:

$$\text{Learning Mastery} = \frac{T}{Tt} \times 100\% \quad \text{(Sitepu et al., 2021)}$$

Learning mastery, T represents the total score obtained by the student, and Tt = total score. Classical mastery is calculated with the following success levels: less than 20% qualifies as very poor, 20-39% qualifies as poor, 40-59% qualifies as fair, 60-79% qualifies as good, and more than 80% qualifies as excellent (Mahmudah et al., 2021) using the following formula:

$$P = \frac{\Sigma \text{ Students who achieve learning mastery}}{\text{The total number of students}} \times 100\% \quad \text{(Bahar \& Afdholi, 2019)}$$

The analysis of teacher and student activities is based on the percentage of activities with the following criteria: < 54% is very poor, 55 – 59% is poor, 60 – 75% is fair, 76 – 85% is good, and 86 – 100% is excellent (Nurpratiwi et al., 2015) determined using the following formula:

$$S = \frac{R}{N} \times 100\% \quad \text{(Nurpratiwi, 2015)}$$

The indicators of success in this study are the improvement of mathematics learning outcomes for Class V students in mathematics lessons in each cycle. The success criteria for the actions in this study are assessed based on student learning outcomes and teacher/student activity data: 1) Student mathematics learning outcomes with scores ≥ 70, and 2) Teacher and student activities reaching ≥ 75%.

Result and Discussion

The action implementation was carried out over three cycles across six meetings, aimed at identifying improvements in students' mathematics learning outcomes in each cycle. During the pre-cycle stage, the researcher prepared instructional steps and implemented actions based on the planned procedures. After delivering the instructional intervention, the teacher administered an initial test to assess students' ability to solve the given problems. In the pre-cycle phase, the initial condition of mathematics learning indicated that many students had difficulty understanding the material and solving the problems, especially non-routine questions aligned with Higher-Order Thinking Skills (HOTS). HOTS instruments were presented through non-routine problems (Widana et al., 2018). The Merdeka Curriculum emphasizes HOTS-integrated learning (Suryana et al., 2022; Irwan et al., 2024), yet most students were still unable to solve HOTS-type questions effectively (Tanujaya & Mumu, 2020). This was evident from the pre-test results, where the majority of students did not meet the Minimum Mastery Criteria (KKM), with only 12% achieving the required score. Only a few students were able to master the material and score above the KKM.

In the implementation of Cycle 1, the planning stage began with the development of instructional steps aligned with HOTS-oriented learning on the topic of multiplying proper fractions. The researcher designed and prepared various learning tools, including: the Lesson Plan (RPP), learning outcome test sheets, observation forms for teacher and student activities, and instructional materials related to fractions. In the implementation stage, during the analysis phase (C4), students identified key information in problem scenarios, such as distributing longan fruit to neighbors. Some students were able to relate this information to mathematical concepts, but many struggled to understand how multiplication operations were applied in real-life contexts. Group discussions provided students the opportunity to assist each other in solving problems (Lambert & Sugita, 2017). Although some students were able to grasp the context of the problem, others still required additional guidance to fully understand how to apply the concept in different situations. In the evaluation phase (C5), students were asked to compare their results with their peers and assess the most appropriate problem-solving strategies. More active students in group discussions showed the ability to evaluate both their own and their peers' strategies, and to understand alternative methods that might be more efficient. However, the majority of students tended to follow methods they were already familiar with and found it difficult to assess whether there were better strategies available. They appeared more comfortable with known procedures, even if those were not entirely accurate. In the creation phase (C6), students were asked to propose their own problems or illustrations based on their personal experiences, such as inheritance distribution. While some students demonstrated creativity in designing their problems, many found it difficult to create problems that were relevant to their own experiences. Several students appeared confused and needed additional support in constructing questions that matched real-life contexts. Most students still required significant guidance at this stage in order to confidently formulate problems or explanations independently. The learning outcomes obtained in Cycle 1 are presented in Table 1

Table 1. Cycle 1 Learning Outcomes of Grade V Students

Description	Score
Class average	53.95
Highest score	90
Lowest score	30
Number of students who passed	9
Number of students who did not pass	15
Percentage of students who passed	38%
Percentage of students who did not pass	63%

Based on Table 1, the learning outcomes of students in Cycle I show that 9 out of 24 students, or 38%, achieved a passing score of ≥ 70, while 15 students, or 63%, did not meet the minimum criteria. The average score obtained was 53,95. Furthermore, the observation of teacher and student activities can be seen in Table 2.

Table 2. Observation Results of Teacher and Student Activities in Cycle 1

Aspect	Percentage	Category
Teacher Activity	51,66%	Poor
Student Activity	38,63%	Fairly Good

Based on the observation results in Cycle 1, teacher activity data showed a percentage of 51.66%, categorized as poor, indicating that there are still many aspects that need improvement in the implementation of learning. Meanwhile, student activity recorded a percentage of 38.63%, categorized as fairly good, suggesting that although students participated, their understanding of the material remained limited. Despite efforts to engage students and improve the quality of instruction, none of the indicators reached 75%. Therefore, it can be concluded that all aspects of teacher and student activities have not yet been considered successful in Cycle 1. In the reflection stage, although HOTS-oriented learning had been implemented, the results indicated that many students still struggled to understand the concept of fraction multiplication. Only 38% of students achieved mastery, with a class average score of 53.95. Overall, the reflection revealed that this approach requires improvement, and in Cycle 2, the researcher will enhance guidance and adjust the learning materials accordingly.

In Cycle II, during the planning stage, the researcher prepared improved instructional steps by integrating HOTS. Based on the evaluation results of Cycle I, the researcher revised the planned actions, including the development of evaluation sheets, observation forms for teacher and student activities, and the preparation of more appropriate instructional materials, namely on the topic of multiplying mixed fractions. The implementation stage showed varied responses from students. In the analysis phase (C4), most students were able to easily identify the parts and whole in mixed fractions through contextual problems, such as fertilizer application and baking. However, some students had difficulty connecting these concepts to real-life situations and required further guidance. In the evaluation phase (C5), students were more active in comparing solution methods and selecting more efficient strategies, though some still tended to rely on familiar methods without considering potentially more effective alternatives. In the creation phase (C6), many students succeeded in constructing problems based on their daily experiences, though some still struggled to relate mathematical concepts to their own lives. Despite increased engagement and creativity, several students continued to need support in developing problems and explaining strategies independently. Overall, the implementation of HOTS in Cycle II succeeded in enhancing students' active engagement, although challenges remained in ensuring that all students could fully understand and apply the material. Despite improvements, some students still had difficulty grasping the concepts, as reflected in the learning outcomes shown in Table 3.

Table 3. Cycle II Learning Outcomes of Grade V Students

Description	Score
Class average	69,58
Highest score	90
Lowest score	45
Number of students who passed	14
Number of students who did not pass	10
Percentage of students who passed	58%
Percentage of students who did not pass	42%

In Cycle II, there was an improvement in learning mastery, with 58% of students achieving the passing score, although 42% of students had not yet reached mastery. The class average score also increased to 69.58, although it still did not meet the classical mastery standard set at 75%. Observation results showed that teacher activity reached 68.33%, categorized as sufficient, while student activity reached 65.90%, categorized as good. Although these results showed improvement compared to Cycle

I, both percentages still fell short of the 75% success target. This indicates that while there were enhancements in the implementation of instruction, there remains room for further improvement.

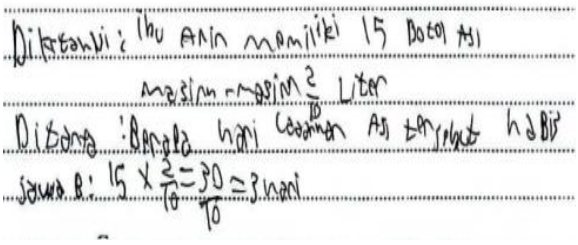
Table 4. Observation Results of Teacher and Student Activities in Cycle II

Aspect	**Percentage**	**Category**
Teacher Activity	68,33%	Fair
Student Activity	65,90%	Good

Reflection: A significant improvement was observed in the number of students who achieved mastery. Fourteen students (58%) successfully met the learning criteria with an average score of 69.58. However, ten students (42%) still did not achieve mastery, indicating that challenges in understanding the material particularly in multiplying mixed fractions persist. Therefore, in Cycle III, the researcher will focus on enhancing students' understanding through more tailored and interactive teaching techniques to ensure that more students can meet the expected learning standards

The results of student responses that experienced errors in answering HOTS questions are as follows:

> *Mrs. Ani has 15 bottles of breast milk stored in the refrigerator as a backup for her baby's food when she is away from home, with each bottle containing 2/10 liters of breast milk. On average, the baby drinks breast milk 5 times a day, consuming 1/20 liter each time. Calculate how many days the breast milk supply will last to meet the baby's needs, assuming the baby consumes breast milk according to their daily requirement.*



Given: Mrs. Ani has 15 bottles of breast milk, each containing 2/10 liters.
Question: How many days will the breast milk supply last?
Answer: $15 \times \frac{2}{10} = \frac{30}{10} = 3\ day$

Figure 1. Student Answer Sheet (S1)

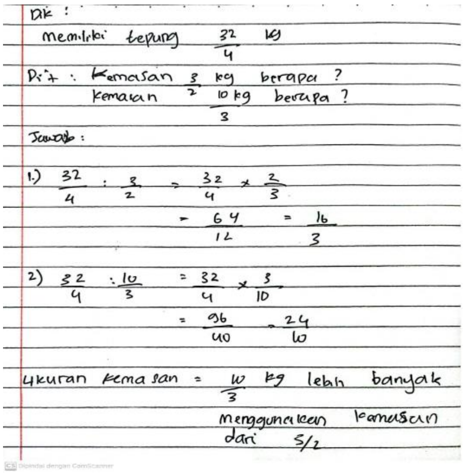
In Figure 1, Student (S1) assumed that the total breast milk was the same as the number of days, when, in fact, the total volume of breast milk should be calculated first, followed by determining how many days the supply would last based on the baby's daily consumption. The results of the interview conducted to confirm the cause of the error are as follows.

Teacher: In this question, how did you calculate the breast milk supply you have?
Student: I multiplied 15 bottles by 2/10 liters, the result was 3 days, then I assumed that was the number of days the breast milk could be used.
Teacher : So, you thought the total breast milk was the same as the number of days? In fact, that's the total volume of breast milk, not the number of days. How should you calculate the number of days?
Student: Oh, now I understand. After calculating the total breast milk, which is 3 liters, I should divide it by the baby's daily consumption, which is 1/4 liter per day. So, 3 liters divided by 1/4 liter gives the result of 12 days.
Teacher: Exactly! What did you learn from this mistake?
Student: I learned that I need to distinguish between total volume and the number of days.

In Cycle III, the researcher continued to improve the learning process based on the results from Cycle II. The instructional steps were revised to better align with the implementation of HOTS, this time focusing on the topic of multiplying decimal fractions. The instructional activities began with attendance checking and a review (aperception), followed by core learning activities including group discussions, observations, assignments, and Q&A sessions. Although some students still experienced difficulties, the students' learning outcomes showed significant improvement, with the class average rising to 79.58 and 79% of students achieving mastery. Observation of teacher activities showed a percentage of 81.66%, indicating enhanced implementation of effective teaching strategies. Likewise, student activity reached 77.27%, reflecting greater engagement in the learning process. Despite these improvements, the results had not yet fully met the desired classical completeness standard of 75%. However, the reflection from Cycle III showed a substantial increase in student learning outcomes, with 75% of students reaching the mastery level. Based on these results, the success indicators have been met, and no further revisions to the learning process are deemed necessary

Next, Student (S2) made an error in adding the package sizes.

Mrs. Safa has 32/4 kg of flour that she plans to package into 3/2 kg packages for sale. If Mrs. Safa wants to ensure that each package is full and there is no leftover flour, and if she also wants to increase the package size to 10/3 kg per package, which package size is more efficient? Explain your reasoning!


Dik :
memiliki tepung 32/4 kg
Di t : Kemasan 3/2 kg berapa ?
Kemasan 10/3 kg berapa ?
Jawab :
1.) 32/4 : 3/2 = 32/4 x 2/3
= 64/12 = 16/3
2) 32/4 : 10/3 = 32/4 x 3/10
= 96/40 = 24/10
ukuran kemasan = 10/3 kg lebih banyak
menggunakan kemasan
dari 3/2

Given: Mrs. Safa has 32/4 kg of flour.
The question is: How many packages of 3/2 kg and how many packages of 10/3 kg can be made?
Answer:
1. $\frac{32}{4} \div \frac{3}{2} = \frac{32}{4} \times \frac{2}{3} = \frac{64}{12} = \frac{16}{3}$
2. $\frac{32}{4} \div \frac{10}{3} = \frac{32}{4} \times \frac{3}{10} = \frac{96}{40} = \frac{24}{10}$

The package size of 10/23 kg uses more packaging than the 3/2 kg size.

Figure 2. Student Answer Sheet (S2)

In figured 2**.** This mistake is related to the understanding of fraction comparison and the concept of packaging efficiency. In this problem, the student made an error in choosing the more efficient package size, even though they performed the correct calculations in the first step. The mistake lies in the student's understanding of the concept of comparing fractions. Below is the interview session conducted with the student.

Researcher: "Which is larger, 16/3 or 24/10?"
Student: "I think 24/10 is larger because its numerator is bigger."
Researcher: "What if we convert the fractions to decimals? What do you find?"
Student: "Oh, it turns out 16/3 is larger because 5.33 is greater than 2.4."
Researcher: "That's correct. Even though 24/10 has a larger numerator, the fraction 16/3 is larger because its denominator is smaller."

Initially, the students mistakenly assumed that a fraction with a larger numerator would always be larger, but after converting the fractions to decimals, they realized that the value of the fraction is more influenced by the ratio of the numerator to the denominator. The chart showing the average student learning outcomes for each cycle is presented in Figure 3.

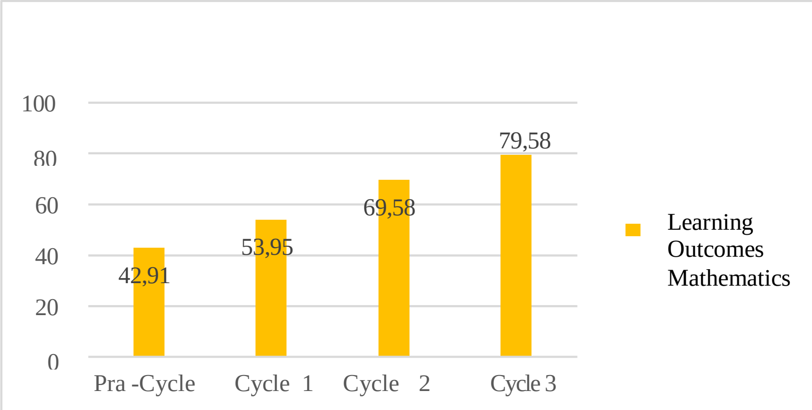


Figure 3. Student Learning Outcomes in the Pre-Cycle, Cycle 1, Cycle 2, and Cycle 3

Furthermore, Figure 4 shows the improvement in teacher and student activities during the Pre-Cycle, Cycle 1, Cycle 2, and Cycle 3

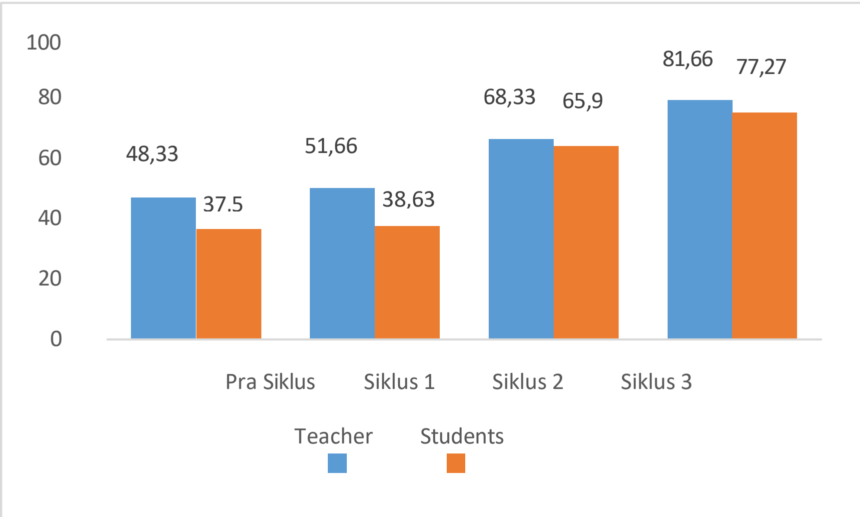


Figure 4. Teacher and Student Activities in the Pre-Cycle, Cycle 1, Cycle 2, and Cycle 3

Based on Figure 3, it can be seen that there was an improvement in student learning outcomes from the Pre-Cycle to Cycle 1, Cycle 2, and Cycle 3. This consistent improvement indicates that the approach applied in each cycle had a positive impact on student learning outcomes. In line with the findings of Agusta (2020), it is shown that through the HOTS-based learning model, student learning outcomes improved from Cycle I to Cycle III, and had a positive impact on students' problem-solving skills. Learning and the use of HOTS-integrated media can improve student learning outcomes (Widiarti et al., 2021). Several relevant studies also support the results of this research. Launuru et al. (2021) found that the PjBL-HOTS learning model significantly improved students' cognitive learning outcomes. Budiastuti et al. (2023) revealed that implementing self-assessment using higher-order thinking skills regarding work attitudes during practical learning can enhance students' learning motivation and develop relevant competencies. Through integrated STEM activities, HOTS can facilitate the development of students' soft skills such as problem-solving, higher-order thinking, communication, collaboration, and motivation (Wahono et al., 2020). Sutarni & Aryuan (2023) demonstrated that RME (Realistic Mathematics Education) models oriented toward HOTS improved students' mathematical problem-solving abilities, as reflected in the improved indicators across each cycle. Similarly, Sulistyawati et al. (2023) found that HOTS-integrated PBL (Problem-Based Learning) facilitated students' mathematical problem-solving skills.

Based on Figure 4, there was a notable increase in both teacher and student activities from the Pre-Cycle through to Cycle III. Kahar et al. (2021) stated that students can be actively engaged in the HOTS-integrated learning process. Furthermore, Indah (2020) showed that HOTS-oriented instructional tools were proven effective in enhancing student learning activities and outcomes. This study has several limitations, such as the absence of a control group and the small sample size, which limit the generalizability of the results. Future research should involve a control group and a larger sample to provide a more valid comparison. In addition, further studies could introduce other innovative approaches to enrich student learning experiences, such as project-based learning or more challenging problem-based learning (PBL) strategies. Research should also address the availability of HOTS-based teaching materials, instructional tools, and supporting media and technology to ensure that students are actively engaged and gain deeper, more applicable understanding of the subject matter

Conclusion

This study is a Classroom Action Research (CAR) that examines the implementation of HOTS-Oriented Learning to improve mathematics learning outcomes of fifth-grade students at SD Negeri 16 Lubuklinggau City. Based on the results obtained from the implementation of the pre-test and post-test in Cycles 1, 2, and 3, a significant increase in students' average scores was found, indicating that the implementation of HOTS-oriented learning succeeded in improving students' high-level thinking skills in solving mathematics problems. Although these findings show positive results, future research can further deepen the analysis of the validity of the assessment to ensure that HOTS abilities are truly measured, not just memorization abilities. In addition, it would be very useful to combine qualitative data, such as student interviews or written reflections, to provide a more holistic picture of how HOTS is implemented and accepted by students. For further research, it is highly recommended to explore the long-term impact of the implementation of HOTS-oriented learning, especially in other subjects or at higher levels of education. These findings provide important implications for education policy, which can encourage the development of more comprehensive HOTS tools and support the integration of HOTS in the curriculum to facilitate the development of high-level thinking skills in students.

Referensi

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