



## HOTS Question Analysis in Elementary Mathematics: Focus on Fractions, Geometry, and Comparison Topics in 6th Grade

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**Abstract:** This study aims to determine the mathematical ability of sixth-grade students in solving Higher Order Thinking Skills (HOTS) type mathematics problems. This study is a descriptive qualitative study. The study's subjects were sixth-grade students from 3 elementary schools in Pekanbaru City. The methods used in this study include tests, interviews, and documentation. The test consisted of 15 HOTS-type mathematics verification questions. The test results were then explained and supported by interviews and student documentation. The results showed that students' abilities to solve HOTS mathematics problems across three schools differed significantly. Category A schools had an average score of 49.5, which was in the high category. Category B schools (average 20.0, medium category) and Category C schools (average 17.6) showed abilities in Fractions, Geometry, and Comparison that were in the low category. From these results, it can be seen that students have different abilities in solving problems. From the perspective of problem description and solution, students have not fully used concepts and procedures to formulate and solve problems. From a communication perspective, students have not fully written their answers coherently or provided a solution to the problem.

**Abstrak:** Penelitian ini bertujuan untuk mengetahui kemampuan matematika siswa kelas VI dalam menyelesaikan soal matematika tipe Higher Order Thinking Skills (HOTS). Penelitian ini merupakan penelitian kualitatif deskriptif. Subjek penelitian merupakan siswa kelas VI dari 3 sekolah dasar yang ada di Kota Pekanbaru. Metode yang digunakan dalam penelitian ini meliputi tes, wawancara, dan dokumentasi. Tes yang diujikan terdiri dari 15 butir soal uraian matematika tipe HOTS. Hasil tes tersebut kemudian dianalisis dan didukung dengan hasil wawancara dan dokumentasi dengan siswa. Hasil penelitian menunjukkan bahwa kemampuan siswa dalam menyelesaikan soal-soal HOTS matematika pada tiga sekolah berbeda menunjukkan hasil yang memiliki perbedaan yang cukup signifikan. Sekolah kategori A memiliki rata-rata nilai sebesar 49,5 yang masuk dalam kategori tinggi. Sekolah kategori B dengan rata-rata 20,0 dengan kategori sedang dan sekolah kategori C dengan rata-rata 17,6 menunjukkan kemampuan yang berada dalam kategori rendah pada materi Pecahan, Geometri, dan Perbandingan. Dari hasil tersebut dapat terlihat jika siswa memiliki kemampuan yang berbeda-beda dalam menyelesaikan soal. Dari aspek merumuskan masalah dan menggunakan matematika, siswa belum sepenuhnya menggunakan konsep dan prosedur dalam merumuskan masalah dan menyelesaikan masalah menggunakan matematika. Dari aspek mengkomunikasikan, siswa belum sepenuhnya menuliskan jawaban dengan runtut serta tidak menuliskan penyelesaian masalah.

## A. Introduction

Mathematics has become a mandatory subject at every level of education, from elementary school (Liberna, 2018). The importance of teaching mathematics in elementary school lies in its direct relationship to everyday life (Hill et al., 2008). Mathematics can equip students with the ability to think logically, analytically, systematically, critically, and creatively, as well as the ability to collaborate in solving problems (Sholihah, 2020). The skills students acquire from the mathematics curriculum are expected to go beyond counting and memorization. Students are also expected to possess critical, creative, systematic, and logical thinking skills to apply the knowledge they have gained in everyday life (Hasyim & Andreina, 2019).

21st-century education demands that teachers connect knowledge, attitudes, skills, and information and communication technology (Putra et al., 2022). 21st-century learning focuses on producing a young generation with critical thinking and problem-solving abilities, creativity, communication skills, and the ability to work collaboratively, often referred to as the 4C skills (Hermita et al., 2024).

Bloom's taxonomy divides the thinking process into two groups: lower-order thinking skills (LOTS) and higher-order thinking skills (HOTS), which have six cognitive levels: remembering, understanding, applying, analyzing, evaluating, and creating (Krauthwohl, 2002).

Developing HOTS (Higher Order Thinking Skills) questions can be an effective way to improve the quality of mathematics learning. HOTS questions are not limited to testing students' memory skills; they also challenge them to analyze, evaluate, and create the best solutions to complex problems. HOTS questions are very effective in training critical, creative, collaborative, and communicative thinking skills, which are four important competencies in 21st-century learning (Zubaidah, 2018).

At the highest level in elementary school, the 6th grade, the application of HOTS questions becomes crucial because it provides students with the foundation to pursue the next level of education. The integration of HOTS questions in learning evaluations encourages teachers to focus not only on students' learning outcomes but also on the learning process and students' thinking (Majid, 2014). In addition, this is beneficial for teachers to design more meaningful learning experiences that align with the curriculum demands, emphasizing technological advancement and the strengthening of 21st-century competencies. However, many teachers still face difficulties in creating HOTS questions, which are caused by a lack of training and guidance from relevant authorities, as well as teachers' initial understanding of Bloom's taxonomy and HOTS question principles that is not optimal (Setyosari, 2015).

The implementation of HOTS questions in Indonesia is limited to national exams and assessments by educational institutions; there is no implementation by teachers in classroom instruction (Wardhani, 2020). The implementation had a very minimal impact on the students, as they were only required to answer exam questions and were not taught how to solve them quickly and accurately. Additionally, teachers' understanding of HOTS

questions remains an issue to this day. Many teachers still struggle to create HOTS questions because they lack understanding and knowledge about them. The government, along with all aspects of education, must support teachers by providing more intensive training both inside and outside of school (Pratiwi, 2019; Yustina, 2020). The implementation of HOTS questions in Indonesia has proven highly beneficial for improving students' thinking skills. However, in practice, it still faces significant challenges related to teachers' skills, school support, and integration into daily learning processes.

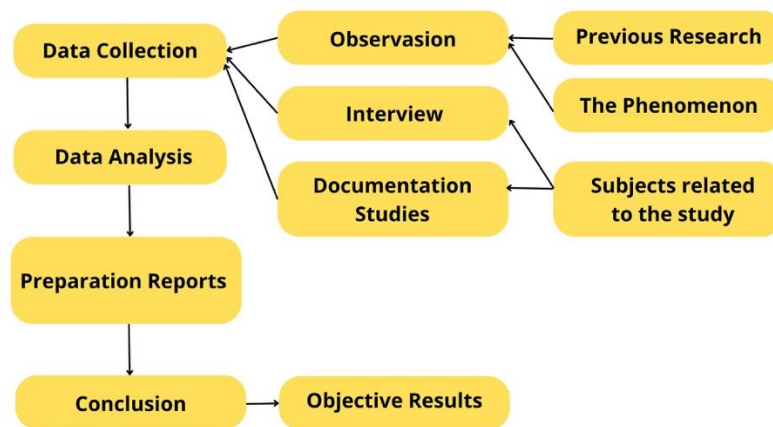
Although innovative instructional approaches such as Problem-Based Learning, Project-Based Learning, and discussion-based activities have been shown to enhance students' Higher Order Thinking Skills (HOTS), classroom practices in elementary mathematics remain dominated by conventional lecture-based methods that primarily foster lower-order thinking skills (LOTS). Previous studies have extensively examined students' ability to solve HOTS questions across broad school contexts, such as rural versus urban settings or public versus private schools. However, empirical research that specifically explores differences in HOTS performance across private elementary schools with varying academic strata, while simultaneously examining students' solution processes and the alignment of test items with HOTS criteria, remains limited. This gap indicates the need for a more focused analysis that goes beyond outcome comparison and addresses both the quality of HOTS questions and students' cognitive responses at the elementary level.

Responding to this gap, the present study offers a distinct contribution by analyzing students' HOTS performance through a comparative investigation of three private elementary schools representing different academic strata. Unlike prior studies that primarily report score differences, this research integrates an in-depth analysis of students' written responses with an evaluation of the characteristics and quality of HOTS questions based on revised Bloom's taxonomy. By focusing on specific mathematical domains fractions, geometry, and ratios. This study provides nuanced insights into topic-specific cognitive challenges and highlights how variations in school context influence students' higher-order thinking. This combined analytical perspective constitutes the novelty of the study and contributes to a more comprehensive understanding of HOTS implementation in elementary mathematics education.

Based on the identified gap and the proposed novelty, this study seeks to address the following research focus: how do sixth-grade students' abilities in solving HOTS-type mathematics questions differ across private elementary schools with different academic strata, to what extent do the HOTS questions used meet established HOTS criteria, and what challenges and opportunities arise in the development of HOTS-based mathematics questions at the elementary level. Accordingly, this study aims to determine the level of sixth-grade students' mathematical ability in answering HOTS questions, analyze the characteristics and quality of HOTS questions in fractions, geometry, and ratios, and identify key constraints as well as potential strategies for improving the design and implementation of HOTS questions in elementary mathematics learning.

## B. Method

This research is a descriptive study with a survey approach. The research was conducted from March to April 2025 at three elementary schools in Pekanbaru, namely SDI Al Azhar 54 Pekanbaru, SD Milatul Khoir Pekanbaru, and SD Jimboree Primary. Descriptive research was used because it aligns with the study's objective of objectively and systematically describing current phenomena. At the same time, the researcher chose the survey approach because it can collect more efficient and comprehensive perceptual data from respondents and generate quantitative data that is easy to analyze and present.



**Figure 1.** Research Flow Descriptive Study

The research population comprises all sixth-grade students in Pekanbaru for the 2024/2025 academic year. Sampling was conducted using the stratified proportional random sampling technique, a combination of stratified and proportional sampling followed by random sampling. The proportional sampling technique was used to determine the sample proportionally for each stratum. The sample comprised 42 students across three schools: 1 in the high category, 2 in the medium category, and 1 in the low category. The data collection technique used in the study is a test (Mahfuddin & Caswita, 2021). Tests are used to collect data on students' responses and the steps they take when solving HOTS questions in Mathematics. The test instrument consists of HOTS Mathematics questions. The blueprint for HOTS Mathematics questions includes two domains: the content domain, which covers fractions and geometry, and the cognitive domain, which involves ratios and proportions. There are 15 multiple-choice items. To test validity, two expert mathematics lecturers assessed content validity, and construct validity was analyzed using factor analysis. The validity test results showed that all items in the HOTS ability test instrument and the self-confidence questionnaire were valid.

The data analysis used was descriptive statistics (Silalahi et al., 2023). The analysis included a description of the scores obtained by each class in the form of averages, maximum scores, minimum scores, and standard deviations with the following steps: creating a score data tabulation, converting scores into a 0-100 scale, determining the ability

to solve HOTS questions, determining the maximum and minimum scores, determining the class average, and calculating the standard deviation.

**Table 1.** Category Distribution

Skor (X)	Interpretation
$X \geq \text{Mean} + 1 \text{ SD}$	High
$\text{Mean} - 1 \text{ SD} \leq X < \text{Mean} + 1 \text{ SD}$	Medium
$X < \text{Mean} - 1 \text{ SD}$	Low

**Explanation:**

X = The grades obtained by the students

SD = Standard deviation

**C. Result**

Higher Order Thinking Skills (HOTS) have become essential skills for students to master in facing challenges in the global era. This study aims to analyze sixth-grade students' ability to solve HOTS questions in Fractions, Geometry, and Ratios. To compete in the increasingly competitive digital era, students need higher-order thinking skills.

**Ability to Solve HOTS Questions**

The ability of 6th-grade elementary school students to solve HOTS questions in fractions, geometry, and ratios or proportions was assessed at three elementary schools in Pekanbaru: SDI Al Azhar 54 Pekanbaru, SD Milatul Khoir Pekanbaru, and SD Jimboree Primary. The data on the ability to solve HOTS Mathematics questions were obtained from a test comprising 15 items, divided into five fractions, five geometry, and five ratio or proportion questions. The HOTS questions are divided into several high-order thinking indicators. Based on data on the ability to solve HOTS questions, the highest score was 73.3, and the lowest was 0.00. The analysis results show a mean of 24.49, a median of 20.00, a mode of 20.00, and a standard deviation of 16.46. So, calculate the limits: Mean + 1 SD =  $24.49 + 16.46 = 40.95$ . Mean - 1 SD =  $24.49 - 16.46 = 8.03$ . Interpret it as follows: If  $X \geq 40.95$  (High). If  $8.03 \leq X < 40.95$  (Medium). If  $X < 8.03$  (Low).

Here is the categorization of the ability to solve HOTS questions at SD Pekanbaru. Based on Table 3, 7 students (17%) have high ability in solving HOTS questions, 31 students (73%) have moderate ability, and four students (10%) have low ability. Thus, the ability of 6th-grade elementary school students to solve HOTS questions in Fractions, Geometry, and Ratios is categorized as moderate.

**Table 2.** Categorization of HOTS Problem-Solving Abilities

Ability Category	Number of Students	Persentase
High	7	17%
Medium	31	73%

Ability Category	Number of Students	Persentase
Low	4	10%
<b>Total</b>	<b>42</b>	<b>100%</b>

Based on Table 2, the majority of students (73%) fall into the moderate ability category in solving HOTS questions, while only 17% fall into the high category and 10% into the low category. This indicates that, in general, sixth-grade students in the three schools studied already have a foundation in higher-order thinking skills, but further improvement is needed so that more students reach the high category. This ability is closely related to the mastery of higher-order thinking skills, such as analysis, evaluation, and creation.

Furthermore, the results of this study align with previous research indicating that students' abilities to solve HOTS questions, particularly in algebra, vary. Some students are not yet able to solve problems using analysis indicators, while others are almost meeting all higher-order thinking indicators (analysis, evaluation, and creation). This shows that mastery of HOTS questions at the elementary school level remains uneven and is influenced by factors such as students' basic math skills, the quality of teaching, and their experience with higher-order thinking questions. The results of the comparison of the average scores for solving HOTS questions are displayed in Table 4. The data show that school category A has an average score of 49.5, which is considered high, while school category B has an average score of 20.0, and school category C has an average score of 17.6. This difference underscores that the learning environment and the quality of education in each school significantly contribute to students' ability to think critically, analytically, and creatively when solving HOTS questions.

The results obtained are almost the same as those reported by Dewi et al (2023), who concluded that students' ability to solve HOTS algebra problems varies, with some students unable to solve problems involving the analysis indicator. However, some students can meet almost all the indicators of analysis, evaluation, and creation when solving HOTS problems. In this study, three schools were selected based on strata: 1 school from the high category (A), one school from the medium category (B), and one school from the low category (C). Based on these school strata, the average ability to solve HOTS problems in each stratum is presented below.

**Table 3.** Comparison of Average Scores for HOTS Problem-Solving Ability Across Different School Strata

No	Category	Mean	Explanation
1	A	49,5	High
2	B	20,0	Medium
3	C	17,6	Low

Based on Table 3, schools in category A achieved the highest average. Then, schools in category B obtained an average of 49.5. Schools in category C obtained the lowest average of 17.6. This means that schools in category A have a greater ability to solve HOTS questions

than schools in categories B and C. More specifically, the ability to solve HOTS questions based on school strata shows a significant difference. Category A schools, which are high-stratum schools, have an average score of 49.5, placing them in the high category. This indicates that most students in this school can think critically, can evaluate, and create solutions based on the HOTS quest. School category B (average 20.0) and school category C (average 17.6) show abilities that fall into the low and medium categories, respectively. This indicates that students in category B and C schools still need to strengthen their higher-order thinking skills, particularly in understanding, relating concepts, and solving complex problems in Fractions, Geometry, and Ratios. From these findings, it can be concluded that students' ability to solve HOTS questions is influenced not only by individual factors but also by the learning environment, the quality of teaching, and the school's readiness to foster critical and creative thinking. Support from teachers in preparing quality, tiered questions aligned with HOTS thinking levels is one of the keys to improving this ability.

4. Dalam sebuah tempat parkir terdapat 90 kendaraan yang terdiri dari mobil beroda 4 dan sepeda motor beroda 2. Jika dihitung roda keseluruhan ada 248 buah. Biaya parkir sebuah mobil Rp5.000,00, sedangkan biaya parkir sebuah sepeda motor Rp2.000,00. Berapa pendapatan uang parkir dari kendaraan yang ada tersebut?

Jawab: mobil = A      Motor = b

$$A + b = 90 \times 2 = 180 \quad 2A + 2b = 180$$

$$4A + 2b = 248 \times 1 = 248 \quad \underline{4A + 2b = 248} \quad -$$

$$\begin{array}{r} -2A = -68 \\ A = -68 \\ \quad -2 = 34 \end{array}$$

A = 34 x 5  
170.000

B = 56 x 2  
112.000

170 + 112.000  
= 282.000

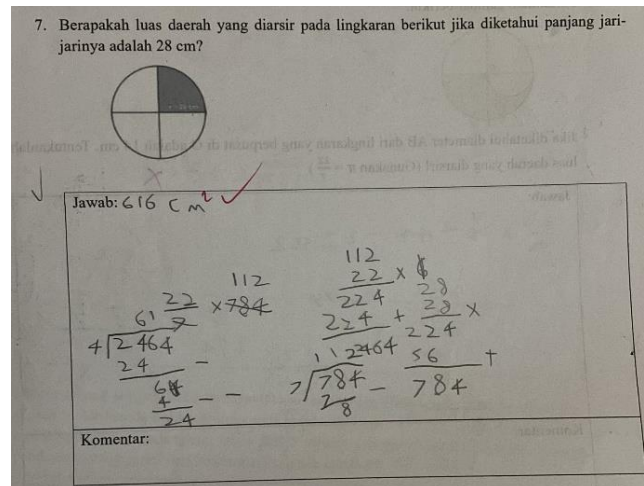
Komentar:

**Figure 2.** Student Work Results on Comparison Material

Based on the students' work on the HOTS questions provided by the researcher, not all research subjects completed all the questions within the allotted time. In Figure 1, for questions with ratio or proportion material, students were able to identify information in the questions, such as what was given and what was asked. The research subjects also appeared to be able to analyze the intent of the story problems, demonstrate the steps for solving them, use the correct formulas, and answer the questions accurately.

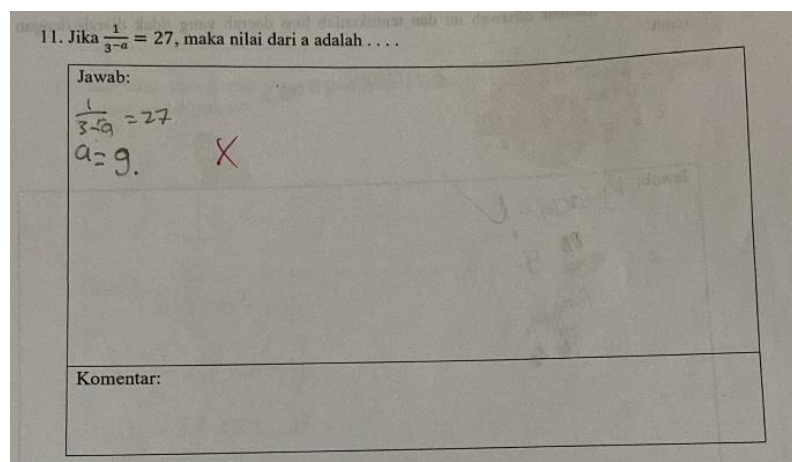
Based on the research subjects' notes at school A, some wrote the words "difficult" and "too long an answer," while others left the notes column blank. On average, the research subjects were able to answer questions on geometry and ratio or proportion, but were unable

to answer questions on fractions. In addition, the research subjects felt the time allotted to complete the questions was too short, leading them to rush through the questions and problems.



**Figure 3.** Student Work Results on Geometry Material

Based on students' answers to HOTS geometry problems, they are capable of solving the problems. However, the steps taken and the results of the students' work are not yet fully accurate and correct. Although the students are already able to solve math problems well, they tend not to formulate problem-solving steps, do not use symbols or mathematical formulas, tend not to write down the information in the problem in terms of known and asked elements, do not write down the formulas used, and do not write down the steps used in solving HOTS problems in order. From the image above, it is obtained that students experience difficulties when solving HOTS problems in the geometry category. Students are not accustomed to solving complex math problems. Although the student's answer was correct, he took a long time to solve the problem, leaving many subsequent questions unanswered.



**Figure 4.** Student Work Results on Fractions Material

Based on the students' answers to HOTS mathematics problems on fractions, it was found that the students are not yet capable of solving the given HOTS problems. The steps taken and the results provided by the students are not yet fully accurate and correct. The students are also not yet able to formulate solutions to problems. From the image, it can be inferred that students have great difficulty when solving HOTS questions in the fraction category. Students appear to be unaccustomed to solving complex math problems.

Research on the ability to solve HOTS (Higher-Order Thinking Skills) problems in fraction, geometry, and ratio or proportion material for 6th-grade elementary school students aligns with previous research conducted by [Kania & Sriwulan \(2024\)](#) using HOTS questions based on the latest Bloom's taxonomy, which tested: C4: analysis skills, C5: evaluation skills, and C6: creation skills. The research results indicate weaknesses in students' geometric reasoning and problem-solving skills. Research ([Nursyifa et al., 2020](#)) on HOTS in geometry materials in fourth-grade elementary school mathematics textbooks shows that many questions assess only the ability to know, understand, and apply, with scores still below 50%. In a previous study ([Dewi et al., 2023](#)), the researchers also identified various difficulties students experienced in solving Higher Order Thinking Skills (HOTS) problems. The results showed that 86% of students solved the problems, but they struggled to determine the correct answers. Therefore, the study suggested the need for tailored teaching methods to improve students' mathematical knowledge and performance. The research findings help understand students' cognitive thinking processes and their challenges, including those related to geometry.

Consistent with previous research, the researcher found that students still experience difficulties with HOTS questions, particularly in fractions, geometry, ratios, and proportions. These difficulties are evident in students' ability to analyze questions, evaluate information, and develop new solutions to the problems presented. The findings ([Yeo & Webel, 2024](#)) also support this analysis, showing that elementary school students often struggle to understand fractions, particularly in measurement, focusing more on division than on the relationship between parts and the whole. This reinforces the need for a more exploratory approach to teaching fractions to improve students' higher-order thinking skills (HOTS). The results of this study can confirm the importance of consistently using a HOTS-based learning approach to improve students' higher-order thinking skills at the elementary school level.

### **Analysis of the Suitability of 6th Grade Elementary School Mathematics Questions with HOTS Question Criteria**

Sixth-grade elementary school mathematics questions generally do not fully meet the criteria for HOTS questions ([Aisyah et al., 2021](#); [Alfiatin & Oktiningrum, 2019](#); [Subhan, 2020](#)). This is because math questions are still dominated by low to medium-level problems. Teachers should increase the proportion of questions that require higher-level analytical thinking, such as C4 (evaluation), C5 (evaluation), and C6 (creation), to develop students' critical thinking and problem-solving skills.

In this study, after the questions were created and pilot-tested with 6th-grade students at several elementary schools in Pekanbaru City, the researcher found that many students were still unable to answer all the math questions, and some could not answer any. However, some students answered the questions correctly. This indicates that the math problem is very difficult and requires a very high level of critical thinking. From the 6th-grade elementary school math questions that have been created and tested, it can be seen that the questions meet the criteria for HOTS questions.

According to the Directorate General for Teachers and Education Personnel (2020), HOTS questions consist of several criteria:

- 1) Transferring one concept to another;
- 2) Processing and applying information;
- 3) Finding connections between different pieces of information;
- 4) Using information to solve problems;
- 5) Critically examining ideas and information.

As for some criteria for preparing HOTS questions according to [Harahap et al \(2020\)](#), they are as follows:

- 1) Measuring high-level critical thinking skills such as analyzing (C4), evaluating (C5), and creating (C6) according to the revised Bloom's taxonomy;
- 2) Based on real-life contexts or genuine problems that require creative and critical problem-solving.

Additionally, according to [Alfiatin & Oktiningrum \(2019\)](#), some criteria for constructing HOTS questions are as follows:

- 1) They are open-ended questions that allow for more than one correct answer or multiple ways of solving them;
- 2) They require a high level of teacher ability and skill to design HOTS questions, including a deep understanding of Bloom's taxonomy and the process of developing indicators.

### **Challenges Faced by Teachers in Preparing HOTS Questions for 6th Grade Elementary School Students**

Learning mathematics is very closely linked to solving mathematical problems, including HOTS-type questions. HOTS (Higher Order Thinking Skills) is a series of thinking processes or steps for students with higher cognitive criteria in solving complex mathematical problems, so teachers must carefully consider the scheme for creating HOTS questions in mathematics lessons while paying attention to every indicator that can support students' critical, creative, and analytical thinking abilities ([Manik & Ngurah, 2020](#)). In creating HOTS questions, teachers are the most important factor in their design and development ([Hadi, 2021](#); [Manik & Ngurah, 2020](#)). The challenges teachers face in preparing HOTS questions for 6th-grade elementary school students in this study are as follows:

- 1) Teachers have difficulty understanding the concepts and characteristics of HOTS questions.

The first challenge faced by subject teachers in developing HOTS questions is the difficulty in understanding the basic concepts of creating HOTS questions. Additionally, teachers also have difficulty accurately connecting the questions with learning objectives and assessment standards.

- 2) Teachers have difficulty formulating and developing HOTS questions.

Teachers' unfamiliarity with using HOTS questions in classroom instruction makes it difficult for them to formulate and develop HOTS questions. Creating varied, more difficult questions is a significant obstacle. Additionally, crafting informative words in questions and contextual stimuli poses a unique challenge for teachers when formulating and developing HOTS questions.

- 3) Teachers find it difficult to adapt HOTS questions to students' varying cognitive abilities.

Students' diverse academic abilities, particularly in mathematics, pose a major challenge for the construction of HOTS questions. This diversity in students' abilities makes it difficult for teachers to determine which questions are suitable for all students' capabilities. This constraint significantly dominates teachers' difficulties in creating questions, as some low-ability students find it extremely challenging to answer HOTS questions.

- 4) Teachers have time constraints.

Teachers' busy activities outside school hours pose a particular challenge for them when creating HOTS questions. Additionally, the scarcity of HOTS question sources and reference materials makes it difficult for teachers to create HOTS questions effectively in a short time.

In line with the challenges faced by teachers in this study, findings from several studies on HOTS questions in elementary schools also show similar challenges, including that some subject teachers are not yet prepared to teach and assess HOTS questions (Schulz & FitzPatrick, 2016), teachers have difficulty and challenges in improving students' HOTS abilities and problem-solving skills in HOTS questions in elementary schools (Retnawati et al., 2018). There is a lack of comprehensive understanding among elementary school mathematics teachers in preparing HOTS questions, due to the absence of training in this area (Manik & Ngurah, 2020). The challenges faced by teachers in preparing these HOTS questions can be overcome by making several efforts, namely by providing intensive training or workshops on the steps for preparing HOTS questions for teachers, educational institutions can provide modules, books, teaching materials, and other references that can support the preparation of HOTS questions, and by providing training on teachers' understanding of the curriculum and other supporting aspects in preparing HOTS questions (Aini et al., 2023). It is hoped that these efforts will have a positive effect on teachers, motivating them to develop and create HOTS math questions and helping them face and overcome the challenges involved.

## D. Discussion

Research on the ability to solve HOTS (Higher-Order Thinking Skills) questions on fractions, geometry, and ratios or proportions among 6th-grade elementary school students, in line with the research previously conducted by (Kania & Sriwulan, 2024) which used HOTS questions based on the latest Bloom's taxonomy, testing: C4: analysis skills, C5: evaluation skills, C6: creation skills. The research results indicate students' weaknesses in geometric reasoning and problem-solving skills. The research (Nursyifa et al., 2020) found that HOTS questions on geometry material in fourth-grade elementary school mathematics textbooks were still below 50%, indicating that many questions still only measured the ability to know, understand, and apply. In previous research (Dewi et al., 2023), the researchers also identified various difficulties students experienced in solving Higher Order Thinking Skills (HOTS) questions. The results showed that 86% of students solved the questions, but they struggled to interpret the results, suggesting the need for tailored teaching methods to improve students' mathematical knowledge and performance. The research findings help understand students' cognitive thinking processes and their challenges, particularly in geometry.

In line with previous research, the researcher found that students still face difficulties with HOTS questions, particularly in fractions, geometry, and ratios or proportions. These difficulties are evident in students' ability to analyze problems, evaluate information, and develop new solutions. The findings (Yeo & Webel, 2024) also support this analysis, showing that elementary school students often struggle to understand fractions, focusing more on division of numbers than on the relationship between parts and wholes. This reinforces the need for a more exploratory approach to teaching fractions to enhance students' higher-order thinking skills (HOTS). The results of this study can affirm the importance of consistently using a HOTS-based learning approach to enhance students' higher-order thinking skills at the elementary school level.

The differences in students' HOTS performance across school categories A, B, and C indicate that higher-order thinking skills are not shaped solely by individual cognitive ability but are strongly influenced by school context and instructional practices. Students in category A schools demonstrated better performance, suggesting more frequent exposure to HOTS-oriented learning activities, structured problem-solving experiences, and assessment designs that encourage analysis, evaluation, and creation. In contrast, students in categories B and C tended to struggle, particularly in fractions and geometry, which may be attributed to limited familiarity with complex, non-routine problems and the dominance of procedural, algorithmic tasks in daily instruction. These findings imply that the observed difficulties are not merely student-related but are closely linked to the design and implementation of HOTS questions, including the lack of contextual stimuli, insufficient scaffolding, and minimal opportunities for reflective reasoning. Therefore, this study confirms that variations in school readiness and assessment practices significantly affect students' ability to engage with HOTS questions, while simultaneously demonstrating that students' challenges in solving HOTS tasks are rooted in both cognitive demands of the

content and the quality of question construction. In this way, the findings directly address the research questions by explaining differences in students' HOTS abilities, evaluating the effectiveness of HOTS question design, and identifying key challenges and opportunities for improving HOTS-based mathematics assessment at the elementary school level.

### **E. Implication**

The results of this research have significant implications for the development of mathematics instruction in elementary schools, particularly in fractions, geometry, and ratios. A finding is that HOTS (Higher Order Thinking Skills) questions are still not fully and optimally integrated into learning, indicating the need for improved teacher capacity to design questions that build students' higher-order thinking skills. Teachers are expected not only to focus on students' basic cognitive abilities but also to train students to a higher level. In addition, the use of curriculum and teaching media needs to be adjusted to more systematically support the integration of HOTS questions, while not neglecting the cognitive development stages of elementary school students.

### **F. Limitation and Suggestion for Further Research**

This research is limited to the analyzed material, which covers only three main topics in the 6th-grade mathematics curriculum: fractions, geometry, and ratios. The question analysis was conducted using high-order thinking indicators from the revised Bloom's taxonomy (analyzing, evaluating, and creating). Additionally, the data analyzed only came from the test results of a few elementary schools that were the subjects of the study. Teachers are expected to improve their ability to create HOTS questions, particularly for fractions, geometry, and ratios, by attending training and workshops. Schools also need to encourage the use of HOTS questions in daily learning and provide support through learning resources and teacher training.

Additionally, the government's role through the education department is equally important in developing relevant guidelines or modules for HOTS question development at the elementary school level and in integrating them into the curriculum and textbooks used in elementary schools. For future research, the researcher suggests not only analyzing the characteristics of the questions but also investigating the impact of using HOTS questions on students' learning outcomes and problem-solving abilities. Additionally, the research subjects could be expanded by including more schools to gain a more comprehensive overview. It is also necessary to conduct an analysis based on other factors, such as economic and social factors.

### **E. Conclusion**

Based on the research and discussion on the analysis of HOTS questions in fractions, geometry, and ratios for 6th-grade elementary school students, it can be concluded that students' ability to solve HOTS mathematics questions across three schools shows

significant differences. School category A has an average score of 49.5, which falls into the high category. School category B, with an average of 20.0, falls into the medium category, and school category C, with an average of 17.6, shows low ability in Fractions, Geometry, and Ratios. Interrelated factors certainly influence the differences in the results of the HOTS question trials across schools. Students' ability to solve HOTS questions is not only influenced by individual factors but also closely related to the learning environment, the quality of education, and the school's readiness to habituate students to think critically and creatively. In addition, teachers are the main players in the preparation and development of HOTS questions. However, in practice, teachers also face several significant challenges in preparing HOTS questions. One is the diversity of students' cognitive abilities, which makes it difficult for teachers to create appropriate questions. Nevertheless, teachers can make several efforts to develop good skills in creating HOTS questions. Teachers are expected to familiarize students with solving HOTS questions in mathematics lessons so that students can enhance their critical, analytical, and creative thinking abilities in elementary school.





















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