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Analysis of Elementary School Teachers' Ability in Compiling HOTS Questions in Mathematics Subjects

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Abstract

Higher Order Thinking Skills (HOTS) is one of the essential competencies that must be developed from an early age because it plays an important role in forming students' critical and logical thinking skills. However, students' abilities in this aspect are still low, one of the influencing factors being the limited facilitation of HOTS questions provided by teachers. This study aims to determine: (1) the comparison of HOTS and LOTS questions made by teachers; (2) teachers' understanding of HOTS questions; and (3) teachers' difficulties in compiling HOTS questions. This study employed a qualitative research approach with a qualitative case study. The respondents consisted of 6 teachers selected based on certain criteria. Data were obtained through interviews and reviews of daily test documents, with a total of 51 questions analyzed using the revised Bloom's taxonomy framework**.** Data analysis referred to Miles and Huberman's stages, namely data reduction, data presentation, and conclusion drawing. The results showed that the percentage of HOTS questions appearing in teachers' daily test items was still low. Only 4 out of the 51 analyzed questions (8%) were classified as HOTS questions, while the remaining items were categorized as lower-order thinking skills (LOTS) questions. In addition, only 1 teacher (17%) correctly understood the definition of HOTS questions, while 5 teachers (83%) did not. Teachers also experienced difficulties in developing stimuli and finding references related to HOTS questions. These findings indicate that teachers require structured training in distinguishing procedural application questions (C3) from authentic HOTS tasks at the C4–C6 levels.

Keywords: Analysis; Primary school teachers; Higher order thinking skills; Mathematics subjects

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INTRODUCTION

Higher Order Thinking Skills (HOTS) are an essential competency that must be developed from elementary school because they play a crucial role in fostering critical, logical, and creative thinking in students. The application of HOTS-based learning has been proven to improve conceptual understanding and foster student motivation to learn. Research Abakar (2025) shows that the application of HOTS concepts in the implementation of the Independent Curriculum in elementary schools has a significant impact on students' ability to analyze problems and connect concepts between topics. Through learning activities that challenge reasoning, students are able to understand more than just formulas or steps to solve problems, but also understand the meaning behind the concepts learned and apply them to new situations.

Research Novita et al. (2023) confirms that mastery of HOTS also contributes significantly to improving students' evaluative and creative thinking. Therefore, HOTS

development is an essential aspect of 21st-century education because it equips students with the higher-order thinking skills necessary to adapt and innovate in an ever-changing era. Through HOTS, students are encouraged to analyze a problem, evaluate various alternative solutions, and create new, innovative ideas relevant to everyday life. This aligns with the goals of 21st-century education, which emphasize the development of critical, creative, collaborative, and communicative thinking skills.

The importance of HOTS for students is not aligned with the higher-order thinking skills possessed by today's students. Several studies have found that students' HOTS is still relatively low (Fauziana et al., 2021; Gunawan et al., 2024; Saraswati & Agustika, 2020; Setiawan et al., 2023). Students with low HOTS certainly require special attention, considering that higher-order thinking skills are critically needed by students in the future. Students' low HOTS comprehension is undoubtedly due to several factors, including a lack of familiarity with HOTS questions. Several studies have shown that HOTS questions appear at a lower rate than LOTS questions in the End-of-Semester Assessment (PAS) (Naqiyah, 2023; Putri, 2022; Zahra & Solihati, 2023). Another contributing factor is teachers' difficulty in developing HOTS questions (Aini et al., 2023; Pratiwi, 2022; Sinta et al., 2022).

In mathematics learning, the types of questions or problems used by teachers play an important role in stimulating students' thinking processes because the cognitive demands of the questions influence how students understand and solve problems. Students who are more frequently given procedural questions tend to become accustomed to memorizing solution steps rather than developing analytical and reasoning skills. In contrast, the use of HOTS-based questions has been proven to enhance critical thinking and problem-solving skills among elementary school students. This is in line with the study by Darmadi et al. (2022) and Sundi et al. (2021), which showed that the implementation of HOTS questions in mathematics learning had a positive effect on elementary school students' understanding and thinking abilities. In addition, a study by Mutmainnah et al. (2025) found that critical thinking skills significantly influence students' ability to solve HOTS-based mathematics problems. Another study by Aprilia et al. (2024) also demonstrated that learning oriented toward higher-order thinking activities can improve elementary school students' mathematical critical thinking skills. These findings indicate that the quality of mathematics questions developed by teachers functions not only as a tool for evaluating learning outcomes, but also as an important means of developing students' higher-order thinking skills. Therefore, an analysis of the characteristics of teacher-made mathematics questions is important to determine the extent to which the questions provided have facilitated the development of elementary school students' HOTS.

The difficulties teachers experience in developing HOTS questions are undoubtedly related to their understanding and skills regarding HOTS itself. Several studies have shown that teachers' abilities to understand and apply HOTS criteria in developing test instruments are still low (Sinta et al., 2022). Several studies have been conducted on analyzing teachers' abilities in developing HOTS questions, including one Andria (2022), which found that only 5 out of 25 questions were HOTS questions according to Bloom's Taxonomy characteristics and the HOTS question characteristics according to Rohim (2019). Meanwhile, Ifadah et al. (2023) found that factors influencing teachers' abilities in developing HOTS questions at SMK AL Azhar Menganti were teachers' limited time to develop HOTS questions, inappropriate selection of core competencies, and minimal socialization regarding HOTS question development.

Based on the discussion presented in the preceding paragraphs and considering the importance of investigating teachers' abilities in developing HOTS questions, this study was conducted to analyze elementary school teachers' abilities in constructing Higher Order Thinking Skills (HOTS) questions in mathematics. Through this study, it is expected to provide answers regarding the proportion of HOTS questions in mathematics assessments, teachers'

understanding of HOTS and Lower Order Thinking Skills (LOTS), and the challenges faced by teachers in developing HOTS-based mathematics questions.

METHOD

Research Design

This study employed a qualitative research approach with a qualitative case study design to investigate elementary school teachers' ability to construct Higher-Order Thinking Skills (HOTS) questions. This method was selected because it enables an in-depth exploration of the practices and challenges that influence teachers' ability to develop HOTS questions. The research design was specifically aligned with the three main objectives of the study: (1) to analyze the percentage of HOTS questions included in assessments, (2) to examine teachers' ability to construct HOTS questions, and (3) to identify the difficulties encountered by teachers in developing HOTS questions.

Participants

The study involved six teachers selected from 25 elementary schools in Pademawu District, which employed a total of 148 teachers, consisting of 63 male teachers and 85 female teachers. From this population, three male teachers and three female teachers who met the criteria presented in Table 1 were selected to participate in the study:

Table 1. Indicators of Participants in Research

Indicator	Criteria
Teaching Experience	More than 10 years.
Educational Background	Primary Teacher Education Teacher or Bachelor's Degree in Mathema Education.
Gender	Three male and three female teachers.
Willingness	Willing to participate voluntarily.
Communication	Good communication skills.

The criteria listed in Table 1 were determined to obtain participants with good qualifications, relatively long teaching experience, and educational backgrounds suitable for teaching mathematics. Gender bias was controlled through fair participant selection, with three male and three female teachers. The selected teachers were subsequently assigned unique identification codes: TM1, TM2, and TM3 for the male participants, and TF1, TF2, and TF3 for the female participants.

Data Collection

Data were collected during the 2024/2025 academic year from six elementary school teachers who participated in the study. Two types of data were obtained: teacher-made daily mathematics test documents and semi-structured interview data. The daily test documents were collected to identify the cognitive levels of the questions based on the revised Bloom's Taxonomy, particularly to distinguish LOTS and HOTS items. Semi-structured interviews were conducted to explore teachers' understanding of HOTS questions, their strategies for developing such questions, and the difficulties they experienced during the item-construction process. The use of document analysis and interviews allowed the researchers to obtain both written evidence of teachers' assessment practices and explanatory data regarding the reasoning behind those practices.

Document Analysis

The collected documents were in the form of daily tests created by teachers and tested on students in the 2024/2025 academic year, then analyzed using a rubric adapted from the revised Bloom's Taxonomy framework Anderson et al. (2001), this framework provides specific indicators for each cognitive level. The analyzed questions were then categorized according to the revised Bloom's taxonomy levels, namely Remembering (C1), Understanding (C2), Applying (C3), Analyzing (C4), Evaluating (C5) and Creating (C6). The Table 2 presents the

key indicators and examples of action verbs commonly used to classify learning objectives within the C1–C6 cognitive categories of Bloom's Taxonomy.

Table 2. Key Indicators and examples of action verbs commonly used to classify learning objectives within the C1–C6 cognitive categories of Bloom's Taxonomy

Cognitive Level	Category	Key Indicator	Examples of Action Verbs
C1	Remember	Retrieving relevant knowledge from long-term memory.	define, identify, list, recall, recognize, name, match.
C2	Understand	Constructing meaning from instructional messages, including oral, written, and graphic communication.	explain, interpret, classify, summarize, compare, exemplify, infer.
C3	Apply	Using a procedure in a given situation.	apply, use, calculate, solve, demonstrate, determine, implement.
C4	Analyze	Breaking material into its constituent parts and determining how the parts relate to one another and to an overall structure or purpose.	analyze, differentiate, organize, compare, distinguish, examine, relate.
C5	Evaluate	Making judgments based on criteria and standards.	evaluate, judge, critique, justify, assess, defend, verify.
C6	Create	Putting elements together to form a novel, coherent whole or make an original product.	create, design, develop, formulate, construct, generate, produce.

Analysis of the percentage of HOTS questions in the daily test questions used by participants was carried out, using the following percentage formula:

$$f = \frac{n(A)}{n(S)} \times 100\%$$

Description
$n(A)$: total number of questions included in the HOTS category (C4-C6)
$n(S)$: total number of questions created

Semi-structured Interviews

Interviews were conducted to determine teachers' understanding of HOTS questions and to identify the challenges they faced when developing HOTS questions. Table 3 presents questions designed to explore teachers' understanding and challenges in developing HOTS questions.

Table 3. Questions of Semi-structure Interviews

Section	Question
Understanding of HOTS	1. How would you define Higher-Order Thinking Skills (HOTS), Do you think they are important in education? 2. Can you provide an example of a HOTS question that you have developed?
Identifying Difficulties in Compiling HOTS Questions	1. What is your strategy for preparing HOTS questions? 2. Describe the difficulties you experienced when compiling HOTS questions!

Data Analysis

This research is a qualitative study with a descriptive approach, with data collection techniques utilizing document review and interviews. Data analysis techniques followed the

Miles & Huberman (2014) model, with data validity tested through method triangulation. Method triangulation was employed through document analysis and semi-structured interviews. Semi-structured interview guidelines were developed based on observations of daily test documents that had been created and tested on students by the teacher.

The research process begins with a review of exam documents created and used by teachers. The classification of test items into HOTS and LOTS categories conducted by the researcher was subsequently validated by an expert to ensure the accuracy of the classification. Based on this review, preliminary questions are developed for use during the interview sessions. Several areas of interest will be explored during the interviews, including: 1) Teachers' understanding of HOTS questions; 2) Differences between HOTS and LOTS questions; and 3) Identification of teacher difficulties in developing HOTS questions. Furthermore, based on the interview results, a report will be prepared to address the research questions formulated in this study.

The Figure 1 presents the flow of research activities that will be carried out in order to analyze the ability of elementary school teachers in compiling HOTS questions in the Mathematics subject.

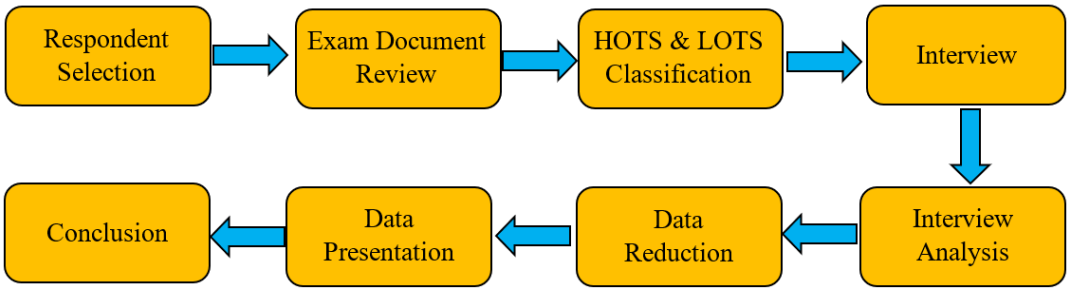

Figure 1. Research Process

RESULTS AND DISCUSSION

Six respondents consisting of three male teachers and three female teachers were selected based on the Participant Indicators as per table 1. The six respondents were selected from a total of 148 teachers spread across 25 schools in Pademawu District. In accordance with the research activity flow in figure 2, an analysis or review of the exam/test documents made by the participants was then carried out.

Theme 1. Analysis of the percentage of HOTS questions

Table 4 presents a recapitulation of the daily tests developed by the six selected respondents. These daily test documents were subsequently analyzed and evaluated to classify each item into the cognitive levels C1–C6 of the Revised Bloom's Taxonomy. The classification results were then validated by an expert to ensure the accuracy and appropriateness of the classifications.

Table 4. Recapitulation of the Analysis of the Percentage of HOTS Questions

Teacher Code	Number of Items	Category						Percentage	
		LOTS			HOTS				
		C1	C2	C3	C4	C5	C6	LOTS	HOTS
TM1	15	1		14				7%	93%
TM2	10			10				0%	100%
TM3	4			4				0%	100%
TF1	5			5				0%	100%
TF2	5			5				0%	100%
TF3	12			8	4			67%	33%

Based on the analysis of the daily test questions developed by the teachers selected as respondents in this study, only one question was identified as belonging to the C1 category.

The question classified as C1 was: “Draw an angle measuring 90 degrees!” This question is categorized as C1 because students are only required to reproduce previously learned knowledge (i.e., recognizing that a 90° angle is a right angle) and are not required to apply the concept to a new situation or engage in problem-solving. Most of the questions developed by the respondents were classified as C3. One example of a C3 question created by TF2 was: “The ratio of Ani's and Beni's cakes is 5:3. If the total number of their cakes is 64, how many cakes does each of them have?” This question falls into the C3 category because it does not merely require students to recall a formula (C1) or explain the concept of ratios (C2), but rather to apply the concept in order to solve a problem.

Referring to Table 3, only TF3 developed a question categorized as HOTS, specifically at the C4 level. One example was: “Train A has 6 carriages carrying 1,080 passengers. Train B has 8 carriages carrying 1,640 passengers. Which train is more crowded?” This question is classified as C4 because students must organize the information, perform calculations, and compare the results in order to make a decision. The task involves analyzing the relationships among the given data. This finding is consistent with the view of Efendi (2015), who stated that the C4 category includes the cognitive processes of differentiating, organizing, and attributing information.

Based on the identification of questions prepared by teachers TM1–TM3 and TF1–TF3, it was found that the majority of the questions fell into the LOTS (Lower Order Thinking Skills) category. This finding is consistent with several previous studies conducted by Abosalem (2016), Ramadhani et al. (2021), and Zamsir et al. (2022), which revealed that most teacher-developed questions tend to focus on memorization and simple procedures rather than on analytical, evaluative, or creative thinking skills. Furthermore, Zamsir et al. (2022) argued that teachers continue to construct LOTS questions because they have not yet fully understood the characteristics of HOTS questions. This condition is undoubtedly one of the factors contributing to students' low higher-order thinking skills.

In addition to the finding regarding the predominance of LOTS questions over HOTS questions developed by teachers, another important finding concerns the variation of questions across cognitive domains. Based on the analysis of the identified questions, it was found that 90% of the questions prepared by teachers were classified within the applying cognitive domain (C3), 2% within the remembering cognitive domain (C1), and the remaining 8% within the analyzing cognitive domain (C4). This finding is particularly interesting and warrants further investigation. Similar results were reported by Sinta et al. (2022), Yessi et al. (2022), and Zana et al. (2024), who found that the variety of questions developed by teachers remained limited and was largely dominated by questions requiring the application of formulas (C3). This limitation was also reflected in the formats of the questions constructed by teachers, as there was a tendency for teachers to rely more heavily on multiple-choice questions.

Theme 2. Analysis of teachers' abilities in compiling HOTS questions

The data in this section was obtained through semi-structured interviews with participants. Two issues will be explored through these interviews: (1) How is HOTS defined? Is this ability important? and (2) How do we differentiate between HOTS and LOTS questions? The following are the results of the interviews with participants.

How is HOTS defined? Is this ability important?

Several teachers defined HOTS differently. The following are the results of interviews regarding the definition of HOTS from male teacher participants. TM1 stated that higher-order thinking, or HOTS, is a student's ability to not only memorize formulas but also understand concepts and use them to solve problems different from the examples given. TM2 stated that higher-order thinking is when students are able to connect several mathematical concepts simultaneously. TM3 stated that HOTS is a student's ability to explain the reasoning behind their answers. Based on the three definitions from male teachers above (TM1-TM3), it appears

that teachers do not yet have a good understanding of HOTS. The statement that HOTS is related to understanding concepts and using them to solve problems that are different from the examples that have been given (TM1) is certainly not correct because understanding is still in the LOTS category (C2) while using them to solve problems is included in the LOTS category (C3).

Similarly, the statement that higher-order thinking occurs when students are able to connect several mathematical concepts simultaneously (TM2) is inaccurate because HOTS encompasses more than just connecting several mathematical concepts, which naturally leads to the process of analysis (C4). It should be noted that HOTS is related to the cognitive domains of analysis, evaluation, and creation (C4-C6) (Abakar, 2025; As'ari et al., 2019). Therefore, the definition provided does not address analysis and creation and is therefore inaccurate. The definition of HOTS as students' ability to explain the reasons behind their answers (TM3) falls under justification or reasoning skills, which are part of HOTS, but not the entire HOTS concept. As stated in the previous section, HOTS relates to the processes of analysis, evaluation, and creation.

Meanwhile, female mathematics teacher participants provided the following definitions of HOTS. TF1 stated that HOTS is students' ability to think critically and logically. TF2 stated that HOTS relates to the ability to analyze, evaluate, and create. TF2 further stated that HOTS questions typically do not have readily apparent answers and require in-depth thought. TF3 stated that HOTS occurs when students are able to solve contextual problems related to everyday life or story problems. Based on the three definitions from the female teachers above (TF1-TF3), it appears that TF2 has correctly defined HOTS, but TF1 and TF3 have not.

The statement that HOTS is a student's ability to think critically and logically (TF1) does indeed point to higher-order thinking. Critical and logical thinking represents C4 and C5, but does not yet encompass C6 (creating). Similarly, the statement that HOTS occurs when students are able to solve contextual problems related to everyday life or story problems (TF3) is certainly inaccurate. Not all contextual or story problems are HOTS. For example, "Yusuf bought a kite for Rp 3,000. If he gives Rp 5,000, how much money does Yusuf have left?" This question is a story problem and contextual, but it is not considered HOTS because it only requires students to create a mathematical model and then perform a subtraction procedure.

Based on the interview results regarding teachers' understanding of the HOTS question definition, it was apparent that out of six teachers, only one (17%) answered the definition correctly. Consequently, five teachers (83%) were unable to answer correctly. This finding aligns with Hamdi et al., (2022) and Khotimah et al. (2021), who found that teachers' understanding of HOTS is still low and needs improvement. Definition errors will undoubtedly lead to errors in constructing HOTS questions.

When asked, "Is this skill important?" all respondents agreed that providing HOTS questions to students is important and necessary. This aligns with the research findings of Gradini et al. (2025) and Sulaiman & Ayub (2023), which showed that teachers have a positive perception and stated that providing HOTS questions is very important for students. Providing HOTS questions is important because it is relevant to the demands of 21st-century skills such as critical thinking, creativity, and reasoning. The OECD report through the PISA program emphasizes that reasoning and problem-solving skills are more important than mere memorization of knowledge (OECD, 2023).

How do you differentiate between HOTS and LOTS questions?

Several teachers provided statements regarding the differences between LOTS and HOTS. The following are the results of interviews with male math teachers. TM1 stated that the difference between LOTS and HOTS is that LOTS requires students to memorize formulas, while HOTS focuses on understanding concepts and applying them to different problems. TM2 stated that the difference between LOTS and HOTS lies in the concepts they connect. HOTS requires students to connect several mathematical concepts simultaneously, while LOTS only

requires one concept. Meanwhile, TM3 stated that the difference between LOTS and HOTS lies in the argumentation students provide when answering questions. LOTS does not require arguments for their answers, unlike HOTS questions, which require students to provide reasons behind their answers.

TF1 stated that the difference between LOTS and HOTS is that HOTS questions require students to analyze or evaluate, not just perform calculations like LOTS questions. TF2 stated that the difference between LOTS and HOTS questions lies in the difficulty level of the questions. HOTS questions require deeper thinking and longer calculations. TF3 stated that the difference between LOTS and HOTS lies in the question type. HOTS questions are contextual or story problems, while LOTS questions involve more direct application without converting the story problem into mathematical sentences like HOTS questions.

Based on interviews with both male and female math teachers, it can be concluded that teachers are not fully able to differentiate between HOTS and LOTS questions, such as statements that HOTS are story problems, difficult questions, or questions that require students to provide their arguments. This is in line with research by Isrokatun et al. (2023), which found teacher misconceptions about HOTS questions, such as stating that HOTS questions are the same as story problems, HOTS are related to difficult questions, and statements that HOTS questions are only appropriate for upper-grade students. This misconception apparently occurs among prospective elementary school teachers, as evidenced by research by Wibowo et al. (2024), who found that prospective teachers rely on KKO for HOTS questions, even though KKO only facilitates cognitive level measurement. However, if they are not careful in using auxiliary verbs, the question content does not reflect the cognitive level being measured, a phenomenon known as Bloom's Flip Chart Addicts (Stobaugh, 2013).

Theme 3. Identification of teachers' strategies and difficulties in compiling HOTS questions

The data in this section was obtained through semi-structured interviews with participants. There are two things that will be explored through the interviews, namely: (1) What is your strategy in compiling HOTS questions? and (2) Describe the difficulties you experienced when compiling HOTS questions! The following are the results of the interviews with participants.

What is your strategy in preparing HOTS questions?

This section will identify the strategies or methods used by participants in developing HOTS questions. The following interview excerpt presents the conversation between the researcher (R) and TM1:

R : How do you develop HOTS questions for your students?
TM1 : I usually look for examples of HOTS questions from books or online sources. After studying their characteristics, I create similar questions and modify the context, numbers, or wording to fit my students' needs.
R : So, what strategy do you use?
TM1 : I use the ATM strategy—Observe, Imitate, and Modify. I observe existing HOTS questions, use them as references, and then modify them before using them in class.

The interview findings indicate that TM1 relied on the ATM (Observe, Imitate, and Modify) strategy when constructing HOTS questions. Rather than creating questions entirely from scratch, TM1 adapted existing HOTS questions by modifying their content, context, and wording to align with the instructional goals and students' needs.

The following interview excerpt presents the conversation between the researcher (R) and TM2:

R : How do you develop HOTS questions for your students?
TM2 : I usually start by identifying the learning objectives and determining the cognitive level that I want students to achieve.
R : What do you consider when formulating the questions?
TM2 : I pay close attention to the operational verbs used in the questions. I select verbs that correspond to higher cognitive levels.
R : What reference do you use when selecting those operational verbs?
TM2 : I refer to the revised Bloom's Taxonomy. The operational verbs help me determine whether a question measures higher-order thinking skills or not.

Based on the interview excerpt above, TM2 stated that the strategy used in developing HOTS questions involved selecting appropriate operational verbs based on the revised Bloom's Taxonomy. TM2 considered the use of operational verbs as an important guideline for ensuring that the questions targeted higher-order cognitive processes.

The following interview excerpt presents the conversation between the researcher (R) and TM3:

R : How do you develop HOTS questions?
TM3 : First, I analyze the learning objectives. Then, I prepare a question outline and select problems related to students' everyday lives.
R : What do you do after that?
TM3 : Finally, I write the questions based on the outline and the context that I have selected.

Based on the interview excerpt above, TM3 developed HOTS questions through four main steps: analyzing the learning objectives, preparing a question outline, selecting everyday-life contexts, and writing the questions.

The strategies used by the female mathematics teachers who participated in this study were as follows. The following interview excerpt presents the conversation between the researcher (R) and TF1.

R : How do you develop HOTS questions?
TF1 : First, I identify the learning competencies that can be developed into HOTS questions. Then, I determine the cognitive level, such as C4, C5, or C6.
R : What kind of questions do you create?
TF1 : design questions that cannot be solved using routine procedures and require higher-order thinking.

Based on the interview excerpt above, TF1 developed HOTS questions by identifying relevant learning competencies, determining the target cognitive level (C4–C6), and constructing questions that could not be solved through routine procedures alone.

The following interview excerpt presents the conversation between the researcher (R) and TF2:

R : How do you usually develop HOTS questions?
TF2 : I begin by selecting an appropriate stimulus, such as a real-life case, graph, table, data set, or everyday phenomenon
R : Why do you focus on the stimulus first?
TF2 : A good stimulus encourages students to think more deeply and analyze the information provided before answering the question.
R : What makes a question a HOTS question?
TF2 : In my opinion, HOTS comes from the context presented in the stimulus, not merely from the operational verbs used in the question.

Based on the interview excerpt above, TF2 emphasized the importance of using meaningful stimuli, such as real-life cases, graphs, tables, data, and everyday phenomena, when developing HOTS questions. TF2 believed that HOTS is primarily generated through the context embedded in the stimulus rather than through the use of operational verbs alone.

The following interview excerpt presents the conversation between the researcher (R) and TF3:

R : How do you develop HOTS questions?
TF3 : I usually start with existing questions that I find in textbooks, worksheets, or other learning resources.
R : What do you do with those questions?
TF3 : I modify them by changing procedural questions into questions that require students to analyze a situation or problem.
R : How do you ensure that the questions become HOTS questions?
TF3 : I add requirements such as asking students to provide arguments, justifications, or make decisions based on the information given.

Based on the interview excerpt above, TF3 used the ATM (Observe–Imitate–Modify) strategy in developing HOTS questions. This strategy involved taking existing questions, modifying them from procedural to analytical tasks, and adding requirements for argumentation, justification, and decision-making to promote higher-order thinking.

Based on interviews with both male and female math teachers, it can be concluded that teachers have strategies for developing HOTS questions. Several strategies employed by the participants are in line with findings reported in previous studies, the strategies carried out by TM3 are in line with the results of Rohim's research (2019) which states that strategies in compiling HOTS questions are (1) conducting an analysis of the basic competencies that will be made into HOTS questions, (2) compiling question grids, (3) using interesting problems in everyday life, (4) writing question items, and (5) making assessment guidelines and answer keys. In addition, the ATM (Observe-Imitate-Modify) strategy is also used by TM2 and TF3 in compiling HOTS questions, several studies show that the ATM strategy in learning can improve student learning outcomes (Fitriani et al., 2022; Nazarani, 2019).

Describe the difficulties you experienced when compiling HOTS questions!

Teachers naturally encounter several obstacles and difficulties in developing HOTS questions. This section will discuss the challenges encountered by participants in developing HOTS questions. TM1 stated that the obstacle they encountered was finding questions that were difficult or required lengthy calculations to modify. This aligns with the strategy used by TM1, namely ATM (Observe, Imitate, and Modify), which requires a starting point and then modifying it into a new question. TM2 stated that the difficulty in developing HOTS questions was due to the presence of similar KKO at different levels of thinking. TM3, in an interview, described the difficulties encountered when developing HOTS questions, particularly her concern that students would not be able to answer the questions.

The difficulties experienced by female respondents in developing HOTS questions, based on the interview results, are as follows. TF1 stated that she still has difficulty distinguishing between HOTS questions and LOTS questions, which affects her performance when developing HOTS questions. TF2 stated that the difficulty experienced when developing HOTS questions is connecting the subject matter to real-life problems. In other words, respondents often struggle to find contexts that are relevant, authentic, and appropriate to their students' developmental levels. Meanwhile, TF3 stated that the difficulty experienced in developing HOTS questions was limited access to valid and tested HOTS example questions. This resulted in participants modifying routine questions or previous exam questions without conducting an in-depth analysis of the cognitive level being measured.

Based on the interview results, several conclusions can be drawn regarding respondents'

difficulties in developing HOTS questions. First, teachers struggled to develop HOTS-based questions, aligning with Maulina et al. (2019), who stated that teachers need to train and hone their skills in developing HOTS-based evaluation questions to facilitate stimulus selection and allow for a variety of questions. Second, the difficulty in developing HOTS questions stemmed from students' varying abilities, which raised concerns among teachers that students would be unable to solve the questions. This aligns with the research findings of Kembong et al. (2023), who found that low student understanding made it difficult for teachers to align question indicators with the abilities they wanted to develop. Third, teachers struggled to find good and correct HOTS question references, aligning with the research findings of Sinta et al. (2022), who also stated that teachers were constrained by a lack of resources to use as reference material when developing questions.

CONCLUSION

The first finding of this study indicates that the percentage of HOTS questions appearing in teacher-developed daily assessments remains low. Empirical evidence from this study shows that the majority of questions constructed by the teachers who participated in this research were categorized as LOTS questions. This finding certainly requires serious follow-up, considering that the use of HOTS questions in learning significantly influences the development of critical and creative thinking skills in students, which are highly needed in the future. Various efforts are certainly needed to improve teachers' ability to develop HOTS questions. Efforts to improve this competency can be carried out in various ways, such as teacher involvement in Teacher Working Groups (KKG) at the elementary school level or Subject Teacher Conferences (MGMP), through supervision of test instruments or questions by the principal or supervisor.

The second finding in this study indicates that teachers' ability to understand the concept of HOTS is still low. This is evidenced by only one teacher (17%) who answered the definition correctly. Meanwhile, five teachers (83%) were unable to answer correctly. These results confirm previous research that found teachers' understanding of HOTS is still low. A positive finding in this study was the statement from all teachers that providing HOTS questions was crucial for students. The view that HOTS questions are important provides excellent starting point for encouraging a shift from procedural learning to more analytical, reflective, and contextual learning. Furthermore, this has the potential to build a school culture that emphasizes the quality of student thinking, not simply grades.

The final finding of this study concerns the difficulties teachers experienced in developing HOTS questions. One of the challenges teachers encountered was the difficulty in developing stimulus for HOTS questions. Through stimulus, students understand the context of the problem, preventing them from immediately guessing or memorizing formulas, but rather from first analyzing the information provided. Without clear stimulus, questions tend to only measure memory. Another difficulty lies in the varying abilities of students, which raises concerns among teachers that students will not be able to solve the questions. Teachers struggle to find good and correct HOTS question references, indicating a lack of resources available to teachers when developing HOTS questions.

RECOMMENDATION

Based on research findings showing that the percentage of HOTS questions prepared by teachers and teachers' understanding of the definition of HOTS is still very low, even though they believe in the importance of HOTS questions for students, efforts are needed to strengthen teacher competencies systematically and continuously. Teacher professional development programs need to focus not only on conceptual understanding of HOTS and its differences from LOTS, but also on practical skills in preparing HOTS questions, especially in designing contextual and meaningful stimuli. On the other hand, the limited references for good and correct HOTS questions indicate the need to provide structured learning resources, such as the development of HOTS question banks, guidance modules, and collaboration between KKG,

MGMP, schools, and universities. With policy support, continuous mentoring, and the availability of adequate references, it is hoped that teachers will be able to implement HOTS questions more optimally in the learning and assessment process.

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

DATA AVAILABILITY

The data that support the findings of this study are available from the corresponding author upon reasonable request. The data are not publicly available due to privacy considerations of research participants.

REFERENCES

Abakar, A. A. B. (2025). Effectiveness of HOTS Learning Concept With The Implementation of Independent Curriculum In Elementary School. *Journal of Education and Learning*, *1*(1), 19–28. https://journal.unesa.ac.id/index.php/EL/article/view/39351

Abosalem, Y. (2016). Assessment Techniques and Students' Higher-Order Thinking Skills. *International Journal of Secondary Education*, *4*(1), 1–11.

Aini, R., Karma, I. N., & Affandi, L. H. (2023). Kesulitan Guru dalam Menyusun Soal Evaluasi Berbasis Higher Order Thinking Skills dalam Pembelajaran Kurikulum 2013. *Jurnal Educatio*, *9*(4), 2062–2069.

Anderson, L. W., Krathwohl, D. R., Airasian, P. W., Cruikshank, K. A., Mayer, R. E., & Pintrich, P. R. (2001). *A Taxonomy for Learning, Teaching, and Assissing: A Revision of Bloom's Taxonomy of Educational Objectives.* Longman.

Andria, F. F. (2022). *Analisis Kemampuan Guru dalam Menyusun Soal Matematika Berbasis HOTS*. Universitas Pendidikan Indonesia.

Aprilia, I., Bayu, N., Widya, N., Bagus, R., & Lutfi, S. (2024). Implementasi Pembelajaran Berbasis HOTS dalam Meningkatkan Kemampuan Berpikir Kritis Siswa pada Mata Pelajaran Matematika Sekolah Dasar. *JPBB : Jurnal Pendidikan, Bahasa Dan Budaya*, *3*(1), 59–68.

As'ari, A. ., Ali, M., Basri, H., Kurniati, D., & Maharani, S. (2019). *Mengembangkan HOTS melalui Matematika* (1st ed.). Universitas Negeri Malang.

Darmadi, Safitri, A., Wardani, A. D., & Serly, W. A. (2022). Pengaruh Penerapan Soal Hots Sebagai Bagian Dari Kurikulum 2013 Terhadap Pemahaman Siswa Sekolah Dasar Pada Pembelajaran Matematika. *Research & Learning in Primary Education*, *4*(1), 29–34.

Efendi, R. (2015). Konsep Revisi Taksonomi Bloom dan Implementasinya pada Pelajaran Matematika. *Konsep Revisi Taksonomi Bloom Dan Implementasinya Pada Pelajaran*

Matematika, *2*(1), 72–78.
Fauziana, Fani, K., & Rahmiaty. (2021). Analisis Kemampuan Siswa Dalam Menyelesaikan Soal HOTS Pada Pelajaran IPA. *Genderang Asa: Journal of Primary Education*, *2*(2), 66–75.
Fitriani, Marwiah, & Iskandar. (2022). Pengaruh Strategi Amati Tiru Modifikasi (ATM) dengan Media Video terhadap Kemampuan Membaca Puisi Siswa Sekolah Menengah Pertama. *Konsepsi*, *11*(1), 1–8.
Gradini, E., Noviani, J., & Samsudin, S. S. (2025). Through the Teacher ' s Lens : Perspectives on Integrating Higher-Order Thinking Skills into Mathematics Instruction. *JTAM (Jurnal Teori Dan Aplikasi Matematika)*, *9*(2), 659–673.
Gunawan, F., Mardiyyanningsih, A. N., & Fajri, H. (2024). Analisis Higher-Order Thinking Skills (HOTS) Siswa SMA pada Materi Sel. *Journal on Education*, *6*(2), 13735–13747.
Hamdi, S., Kartowagiran, B., Istiyono, E., & Rahman, H. N. (2022). The ability of Junior High School mathematics teachers writing Higher Order Thinking Skills (HOTS) questions. *Jurnal Riset Pendidikan Matematika*, *9*(2), 115–123.
Ifadah, K., Pristiwiyanto, & Mustain. (2023). Analisis Kemampuan Guru Pendidikan Agama Islam dalam Menyusun Soal HOTS. *FATAWA: Jurnal Pendidikan Agama Islam*, *3*(2), 79–86.
Isrokatun, Sunaengsih, C., Maulana, Syahid, A. A., Karlina, D. A., & Rohaeti, P. (2023). Miskonsepsi Guru Sekolah Dasar Mengenai Pemahaman Pembelajaran Berbasis HOTS. *DWIJA CENDEKIA: Jurnal Riset Pedagogik*, *7*(3), 808–822.
Kembong, J., Irfan, M., & Hermuttaqien, B. P. F. (2023). Analisis Kesulitan Guru dalam Menyusun Soal Evaluasi Berbasis HOTS Pada Pembelajaran IPA Kelas Tinggi SD Inpres Japing Kecamatan Pattalassang Kabupaten Gowa. *Jurnal Kepengawasan, Supervisi Dan Manajerial*, *1*(3), 120–128.
Khotimah, R. P., Setyaningsih, N., Masduki, & Sutarni, S. (2021). Pelatihan Penyusunan Soal Matematika Berbasis Higher Order Thinking Skills (HOTS) bagi Guru-Guru SMP Muhammadiyah Klaten. *Jurnal Warta LPM*, *24*(4), 646–655.
Maulina, D. N., Slamet, S. Y., & Indriayu, M. (2019). Higher Order Thinking Skills (HOTS) Instrument in Social Studies Learning for Elementary School Students in Grobogan Regency. *SEWORD FRESSH*, 1–7.
Miles, M. B., & Huberman, A. M. (2014). *Analisis Data Kualitatif*. Universitas Indonesia Press.
Mutmainnah, I. W., Akib, I., & Saleh, S. F. (2025). Pengaruh Pemahaman Konsep dan Kemampuan Berpikir Kritis terhadap Kemampuan Penyelesaian Soal Matematika Berbasis Higher Order Thinking Skill pada Siswa Sekolah Dasar. *Pendas : Jurnal Ilmiah Pendidikan Dasar*, *10*(September), 256–263.
Naqiyah, E. Z. (2023). Analisis Higher Order Thinking Skills (HOTS) Pada Soal Penilaian Akhir Semester Mata Pelajaran IPA Kelas VII Di Kabupaten Serang. *Jurnal Pendidikan MIPA*, *13*(1), 67–72.
Nazarani. (2019). Meningkatkan Hasil Belajar Tematik Melalui Teknik ATM (Amati, Tiru dan Modifikasi) di Kelas VI SD Negeri 1 Sagu Sukamulya. *Jurnal Pendidikan Teknologi Informasi*, *4*(2), 21–26.
Novita, L., Windiyani, T., Sukmanasa, E., & Utari, R. L. (2023). Higher Order Thinking Skills in Evaluation of IV Grade Thematic Materials in Elementary Schools. *Jurnal Ilmiah Sekolah Dasar*, *7*(3), 498–507. https://doi.org/10.23887/jisd.v7i3.57003
OECD. (2023). PISA 2022 Result. *OECD Publishing*.
Pratiwi, L. F. (2022). Analisis Kemampuan Guru dalam Membuat Soal Tipe Hots (High Order Thinking Skills) Mata Pelajaran Matematika. *Humantech : Jurnal Ilmiah Multidisiplin Indonesia*, *1*(6), 20–28.
Putri, M. D. (2022). Analisis HOTS (High Order Thinking Skills) Penilaian Akhir Semester

Ganjil Madrasah Kelas III MI Nurul Huda 2 Kota Mojokerto. *MODELING: Jurnal Program Studi PGMI*, *9*(3), 558–563.

Ramadhani, A. S., Siregar, S. N., & Saragih, S. (2021). Pengembangan Soal HOTS Berkonteks Budaya Melayu Riau pada Materi Segiempat dan Segitiga Kelas VII SMP / MTs. *Juring (Journal for Research in Mathematics Learning)*, *4*(3), 277–292.

Rohim, D. C. (2019). Strategi Penyusunan Soal Berbasis HOTs pada Pembelajaran Matematika SD. *Jurnal Riset Dan Konseptual*, *4*(4), 436–446.

Saraswati, P. M. S., & Agustika, G. N. S. (2020). Kemampuan Berpikir Tingkat Tinggi Dalam Menyelesaikan Soal HOTS Mata Pelajaran Matematika. *Jurnal Ilmiah Sekolah Dasar*, *4*(2), 257–269.

Setiawan, B., Dores, O. J., Supendi, A., Natalia, N. D., Chris, & Langgi, R. (2023). Analisis Kemampuan Siswa dalam Menyelesaikan Soal HOTS Berbasis Budaya Dayak Desa. *J-PiMat*, *5*(1), 737–742.

Sinta, U. A., Roebyanto, G., & Nuraini, N. L. S. (2022). Analisis Kesulitan Guru dalam Menyusun Soal Evaluasi Berbasis Hots Pada Pembelajaran Matematika di SDN Torongrejo 2. *Jurnal Pembelajaran Bimbingan Dan Pengelolaan Pendidikan*, *2*(1), 45–53.

Stobaugh, R. (2013). *Assessing Critical Thinking In Middle and High Schools Meeting The Common Core*. Routledge.

Sulaiman, N., & Ayub, A. F. M. (2023). Teacher ' s perception towards teaching and learning practice based on HOTs in mathematics. *Contemporary Mathematics and Science Education*, *4*(1), 1–6.

Sundi, V. H., Astriani, L., Irawan, B., Sari, M. Y., & Kartika. (2021). Efektifitas Soal HOTS terhadap Pemahaman Konsep Matematis dan Disposisi Matematis ditinjau dari Kesiapan Belajar Siswa di Sekolah Dasar. *ELSE (Elementary School Education Journal)*, *5*(2), 137–146.

Wibowo, A., Bisri, M., Dewi, E. R., & Astuti, W. (2024). Miskonsepsi Mahasiswa Pendidikan Guru Madrasah Ibtidaiyah Tentang Higher Order Thinking Skill (HOTS). *Dirasah*, *7*(1), 361–371.

Yessi, Driana, E., & Ernawati. (2022). Tingkat Pemahaman dan Instrumen HOTS Buatan Guru IPA di SMP Tangerang Selatan Tahun Pelajaran 2019-2020. *Jurnal Penelitian Dan Penilaian Pendidikan (JPPP)*, *7654*(June), 15–28.

Zahra, A., & Solihati, N. (2023). Analisis HOTS (High Order Thinking Skills) pada Soal Penilaian Akhir Semester (PAS) pada Siswa Kelas Rendah SDN Jatimurni V Kota Bekasi. *Jurnal Ilmiah Universitas Batanghari Jambi*, *23*(3), 2662–2667.

Zamsir, Kodirun, Busnawir, Bey, A., & Arapu, L. (2022). Kompetensi Guru Matematika SMP dalam Membuat Soal Higher Order Thinking Skills. *Jurnal Pendidikan Matematika*, *13*(2), 147–155.

Zana, F. M., Sa'dijah, C., & Susiswo. (2024). The cognitive alignment of mathematics teachers' assessments and its curriculum. *International Journal of Evaluation and Research in Education (IJERE)*, *13*(3), 1561–1575. https://doi.org/10.11591/ijere.v13i3.26814