

# The Analysis of Higher Order Thinking Skills (HOTS) in the Test Questions Constructed by English Teachers

Siti Musliha\*, Dadang Sudana, Yanty Wirza

Universitas Pendidikan Indonesia, Bandung, Indonesia

\*Corresponding author. Email: [sitimusliha@upi.edu](mailto:sitimusliha@upi.edu)

## ABSTRACT

The curriculum 2013 encourages the students' Higher Order Thinking Skills (HOTS). In this case, the teachers should try to meet the demands to achieve the curriculum 2013 goals. One of the effective ways to help the students to attain these thinking skills is teachers' questions. The teachers' questions, to some extent, can stimulate the students' thinking process. The purpose of this study was to analyze HOTS in the test questions constructed by the English teachers. This study used a qualitative content analysis design. The data resources of this study were the test questions designed by two different junior high school teachers. The data were collected from the question items in the teacher-made tests and were analyzed following revised Bloom's taxonomy framework. The results of this study show that the test questions made by the teachers require more HOTS-type questions because the tests are mainly LOTS-type questions. The majority of the test questions cover understanding questions (50%), followed by remembering (42.5%), analysing (3.75%), evaluating (2.5%), and creating (1.25%). Unfortunately, no test item is classified as applying question. Based on the results, it shows that the test questions made by the teacher lack HOTS-type questions.

**Keywords:** Bloom's taxonomy framework, Higher Order Thinking skills (HOTS), teacher-made test questions.

## 1. INTRODUCTION

The recent Indonesian educational program, curriculum 2013, encourages the students' Higher Order Thinking Skills (HOTS). HOTS are the three highest thinking levels of cognitive skills involving analyzing, evaluating, and creating (FitzPatrick & Schulz, 2015). These thinking skills become more extensive in the education field because it intends to develop the quality of teaching and learning (Driana & Ernawati, 2019). Besides, it aims to support the students to be more critical, creative, and productive in responding to a problem (Nguyễn & Nguyễn, 2017). So, the students are not only familiar with low-level tasks but also higher-level problems. Therefore, to achieve that objective, the teacher should emphasize these skills in their teaching and learning.

Some researchers assert that one of the alternative ways to support the students in attaining those levels of thinking is through the teacher's questions (Martinez, 1999; Lee, 2015). The teachers' questions, to some extent, can stimulate the students' thinking process (Crowe, 2010). Some education practitioners agreed that incorporating students with HOT questions can develop

their thinking process (Tyas, Nurkamto, & Marmanto, 2020; Qasrawi & BeniAbdelrahman, 2020). They can be more creative and productive in solving the problems as they need to think more than a simple memory to acquire the answer. Question items that require the students to respond using Lower Order Thinking Skills (LOTS), such as remembering and recalling memorized information, do not represent their comprehensive understanding of the content (Berg, 2004). However, it does not mean that those types of questions should be dodged by the students. The simple questions are indispensable since they are a prerequisite for acquiring other levels of thinking (Anderson & Krathwohl, 2001). Nonetheless, to help the students enhance their thinking process, the teacher's questions should emphasize HOTS.

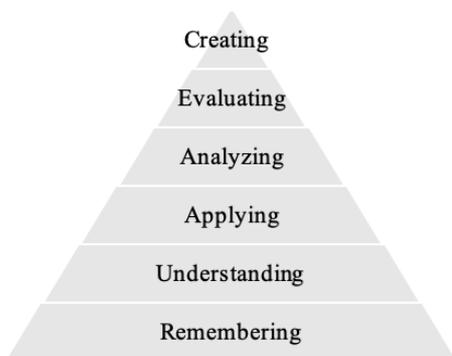
Some studies investigating HOTS in the question items have been conducted, such as analyzing lower and higher-order thinking skills in the textbooks (Frehat & Smadi, 2014; Roohani, Taheri, & Poorzangeneh, 2013, Damanik & Zainil, 2019; Febriana, Usman, & Muslem, 2019; Fakhira & Iskandar, 2020) and evaluating HOTS in the national examinations (Ahmad, 2016; Putra & Abdullah, 2019; Narwianta, Bharati, & Rukmini, 2019;

Ilham, Jabu, & Korompot, 2020). The mentioned researches have investigated the HOTS question items produced by the book authors and government. However, the study examines HOTS in the test questions constructed by the teachers is still infrequent (Akbariah, 2018; Wisrance & Semium, 2020). Thus, this study aimed to analyze the test questions made by the English teachers. It intended to know the degree to which the teachers' test questions present HOTS. This study employed the revised Bloom's Taxonomy as a framework to classify the test questions.

**2. LITERATURE REVIEW**

The definition of lower and higher order thinking skills in this study is derived from the revised Bloom's taxonomy (Anderson & Krathwohl, 2001; Brookhart, 2010), which is also utilized as a framework to analyze the data of the test questions constructed by the teachers. This taxonomy has two aspects: cognitive process and knowledge dimension (Anderson & Krathwohl, 2001; Brookhart, 2010). As seen in Figure 1, The cognitive process has six categories of thinking: remembering, understanding, applying, analyzing, evaluating, and creating. The first three thinking levels (remembering, understanding, and apply) are categorized as LOTs, and the last three (analyzing, evaluating, and creating) are classified as HOTS. Besides, the knowledge dimension includes four categories of knowledge: factual, conceptual, procedural, and metacognitive knowledge. However, this study mainly focuses on the cognitive process.

Remembering is a recall of information (Brookhart, 2010). The questions dealing with this level of thinking frequently evoke the students' memorized information. However, this type of thinking level is fundamental knowledge to the other levels of thinking. The sub-categories of this cognition are recognizing and recalling (Anderson & Krathwohl, 2001). Typically, the recognizing question requires the students to identify or locate the knowledge in long-term memory relating to the given instructions. Then, the recalling type of question requires simple retrieval of information. The examples



**Figure 1** Revised Bloom's taxonomy.

of remembering questions are: what is the title of the text...? Who writes the letter...? Which is true or false...?

Understanding is the ability to understand knowledge (Anderson & Krathwohl, 2001). This thinking level tends to focus on the questions that require the students to explain and exemplify the ideas of the information (Liu, 2009). The sub-categories of this cognitive process are interpreting, exemplifying, classifying, summarizing, inferring, comparing, and explaining (Anderson & Krathwohl, 2001). The question that needs the students to represent one form of representation to another type (e.g., picture to word or word to picture) is defined as interpreting. Then when the students are required to find some specific example of a particular topic is categorized as exemplifying. Next, classifying questions direct the students to subsume that something applies to a group. A question pointing the students to abstract a general theme of a particular topic is grouped as summarizing sub-category. However, when the question leads the students to conclude from the presented information is determined as inferring. Then, comparing sub-category enquires the students to match two ideas or objects. The last sub-category, explaining, demands the students to construct a general concept or idea. The examples of understanding questions are: what is the main idea of the passage...? Could you explain how to use...? What do you think...?

Applying is the capability to practice the knowledge in different ways (Anderson & Krathwohl, 2001). The questions of this level allow the students to demonstrate their understanding of the knowledge in the given situation (Virranmäki, Valta-Hulkkonen, & Pellikka, 2020). The sub-categories of this cognition are executing and implementing (Anderson & Krathwohl, 2001). The questions of executing category require the students to apply the procedure that has been learned to the new given problem that is familiar with the current lesson. Meanwhile, implementing questions challenge the student to use the method to the unacquainted task. The Examples of applying questions are: can you develop a set of instructions...? Can you group by characteristics such as...?

Analyzing refers to the ability to investigate information from different resources (Anderson & Krathwohl, 2001). Analysis questions expect the students to determine, distinguish, or examine which information is appropriate for the answer (Virranmäki et al., 2020). The sub-categories of this cognitive process are differentiating, organizing, and attributing (Anderson & Krathwohl, 2001). Differentiating refers to the questions that involve the students selecting or distinguishing the relevant or irrelevant part of the information. Besides, organizing questions order the students to find or integrate how the components match with the arrangement. Attributing questions ask the students to

discover the main idea, value, or intention of the information. The examples of analyzing questions are: can you distinguish between A and B...? What was the theme of the passage...? What is the main point of the message...?

Evaluating is the capability to check or critique information based on the criteria such as quality, efficiency, and consistency (Anderson & Krathwohl, 2001; Brookhart, 2010). The sub-categories of this thinking process are checking and critiquing (Anderson & Krathwohl, 2001). Checking tasks can involve the students to provide a solution to a problem (Anderson & Krathwohl, 2001; Crowe, 2010). Then, critiquing questions require the students to give their judgment to the product or information. The examples of evaluating questions are: can you provide possible solutions to the problem faced by the writer...? How many ways can you...?

Creating refers to students' ability to reorganize or produce prior knowledge into a new product (Brookhart, 2010). Creating questions require students to generate different solutions or create a strategy to solve the problems (Brookhart, 2010). The sub-categories of this thinking process are generating, planning, and organizing. Those subs relate to each other and direct the students into a creative process (Anderson & Krathwohl, 2001). In generating, students are faced with the questions that require them to provide some plausible solutions to the problem (Anderson & Krathwohl, 2001). Then, in the planning phase, the students are required to develop the solutions to the problem and draw them into an action plan (Anderson & Krathwohl, 2001). The last, in the producing session, the students construct the solutions to the problem given (Anderson & Krathwohl, 2001). The examples of creating questions are: can you write an alternative solution to the problem...? What changes would you make to solve...? What would happen if...?

**3. METHOD**

This study employed a qualitative content analysis. It was used to analyze and categorize the test questions constructed by the teacher based on the cognition levels in the revised Bloom's taxonomy as seen in Table 1 (Anderson & Krathwohl, 2001; Brookhart, 2010). Besides, it aimed to know the presentation of lower and higher order thinking in the teacher-made tests. Furthermore, it intended to provide how the thinking levels are presented in the teacher-made tests. There are two aspects of revised Bloom's taxonomy: cognitive domain and knowledge domain. However, this study focuses on the analysis of the cognitive domain in the test questions constructed by two English teachers from different junior high schools in East Java.

**Table 1.** Coding scheme based on revised Bloom's taxonomy

Cognitive Domain	Sub-categories
Remembering	Recognizing
	Recalling
Understanding	Interpreting
	Exemplifying
	Classifying
	Summarizing
	Inferring
	Comparing
	Explaining
Applying	Executing
	Implementing
Analyzing	Differentiating
	Organizing
	Attributing
Evaluating	Checking
	Critiquing
Creating	Generating
	Planning
	Producing

The data of this study were two written tests made by the teachers in the academic year 2020/2021. The two tests were used as the final examination in the second-semester academic year 2020/2021. This study focuses on the questions that tested reading skills. There are 80 questions collected from the two tests, each test consisting of 40 multiple-choice questions. Fortunately, all the questions cover reading skills. So, the researcher analyzed all the questions in the tests.

In analyzing the data, this study employed the analysis procedure proposed by Creswell (2002). First, the researchers read the test question to get initial understanding of the data. Then, the researchers coded (see table 1.1) and classified the test questions in accordance with the revised Bloom's taxonomy framework. Afterwards, the researchers did numerical computation to get the percentage of Lower and higher-order thinking skills in the test questions. Finally, the researchers presented and interpreted the data findings.

**4. FINDINGS AND DISCUSSION**

The results of document analysis by using revised Bloom's taxonomy framework adapted from Anderson and Krathwohl (2001), and Brookhart (2010) show that the test questions constructed by the teachers are mainly LOTs-type questions (92.5%). The rest (7.5%) belongs to HOTs-type questions. Table 2 shows the percentage of LOTs and HOTs questions.

**Table 2.** Distribution of the test questions constructed by the teachers based on revised Bloom’s taxonomy framework

Cognitive Domain	Number of questions	Percentage	Total
<i>Lower Order Thinking skills (LOTs)</i>			
Remembering	34/80	42.5%	92.5%
Understanding	40/80	50 %	
Applying	0/80	0%	
<i>Higher Order Thinking skills (HOTs)</i>			
Analyzing	3/80	3.75%	7.5%
Evaluating	2/80	2.5%	
Creating	1/80	1.25 %	

Based on Table 2, the LOTs-type questions reach 92.5% or 74 test items from overall data (80 items). They consist of 34 items (42%) of *remembering* and 40 items (50%) of *understanding*. Unfortunately, there has no item measuring the category of *applying*. Furthermore, the extent of HOTs-type questions grasps 7.5% or six questions which consist of three items (3.75%) of *analyzing*, two items (2.5 %) of *evaluating*, one item of *creating* (1.25%).

**4.1. Lower-order Thinking Skills in the Test Questions**

As presented in Table 2, LOTs questions have the largest percentage. This result supports the previous studies analyzing the cognitive levels of teacher-made English tests (Akbariah, 2018; Wisrance & Semium, 2020). In this study, the majority of the test questions constructed by the teachers are classified in the category of *understanding* and *remembering*, which requires the students to respond to the questions by recognizing or recalling information. These categories of thinking processes are categorized as the simplest level of thinking. However, these are all the essential parts of the cognitive process before attaining a high level of thinking (Virranmäki et al., 2020). Here are some examples of *remembering* questions excerpted from the teacher-made tests.

Excerpt 1

... passage...  
 Salma is ... years old.  
 a. 1  
 b. 2\*  
 c. 3  
 d. 4

The question presented in Excerpt 1 is the category of *remembering* question. This sample of questions has directed the students to respond to the dialogue by choosing the best answer from the choices presented. However, this type of question does not require the student to think deeply about the information because they can directly recognize the response from the conversation presented in the questions. The students can merely choose the answer D (good night) since they need

to respond to the mother’s statement (good night) in the dialogue. In this case, the students employ their memorized information; when someone says good night, we need to say good night in the response. Another question measured *remembering* is presented in Excerpt 2.

Excerpt 2

Daughter : It’s 8.30 o’clock. It’s time to go to bed.  
 Mother : Good night, dear.  
 Daughter : ... mom.  
 a. Good morning  
 b. Good afternoon  
 c. Good evening  
 d. Good night\*

This type of question has a similar thinking process to the previous example (Excerpt 1). The task does not require the students to explore their understanding of the passage to acquire the answer. Since the passage has clearly stated how old Salma is: “*she is only two years old*”, the students can easily recognize the response from the sentence. Consequently, this item is classified as a low level of thinking which is *remembering*. Furthermore, the students do not need to analyze the content and give their reason to find the answer.

From the two samples above, it can be seen that the questions are directed to the students to respond by using the basic elements of the thinking process. Referring to Anderson and Krathwohl (2001), there are two subcategories of *remembering* that the students solve from the two sample questions mentioned earlier. The first sub-category is *recalling*. Excerpt 1 requires the students to retrieve their knowledge about giving responses. The second sub-category is *recognizing*. It is reflected in excerpt 2, in which the students can easily recognize the answer from the sentence stated in the paragraph.

Furthermore, the two tasks have reflected a good way of presenting multiple-choice questions. According to Liu (2009), the stem of the multiple-choice questions should present a definite question, and the choices should be arranged in apparent logical order. As seen from excerpts 1 and 2, the teachers have constructed the stems and the choices properly. The questions are clearly stated in simple language so that the students can easily understand the intention of the task. Besides, the choices have been logically ordered. For example, in excerpt 2, the choices are arranged based on the order of number (i.e. a.1, b. 2, c. 3, d.4). This kind of arrangement intends to prevent the students from speculating on the best answer based on the order of the given choices (Liu, 2009).

The second category of cognitive process is *understanding*. This category of thinking process takes the largest percentage (50%) among others. There are 40 items out of 80 questions that measured *understanding* skills. This cognition is the

widest cognitive process because it has many sub-categories: *interpreting*, *exemplifying*, *classifying*, *summarizing*, *inferring*, *comparing*, and *explaining* (Anderson & Krathwohl, 2001). All the sub-categories are essential elements in the teaching and learning (Virranmäki et al., 2020). Following excerpts are examples of *understanding* questions derived from the teacher-made tests.

The first sub-category of *understanding* that is found in the test questions made by the teacher is *interpreting*. The *interpreting* question generally requires the students to transform the information from one particular form to another type of representation (Anderson & Krathwohl, 2001), such as transforming words to words, pictures to words, numbers to words, etc. The following excerpt is an example of the *interpreting* question.

Excerpt 3

- [picture of a crowing rooster]  
The correct greeting based on the picture is...?  
a. Good morning\*  
b. Good afternoon  
c. Good evening  
d. Good night

The sample of the question presented in Excerpt 3 is classified as interpreting category because it requires the students to interpret the meaning of the picture. Then, they need to transform the picture into words. In this process, the students employ their prior knowledge to understand the purpose of the instruction given.

The second sub-category is *exemplifying*. The test item that is required the students to give or select example(s) from a particular concept or principle is classified as *exemplifying* (Anderson & Krathwohl, 2001). Here is an example of an example taken from the teacher-made test.

Excerpt 4

- ...passage...  
Which of the following types is not common in the kitchen?  
a. grater                      c. refrigerator  
b. ruler\*                        d. jug

The instruction of Excerpt 4 requires the student to locate a thing that does not fit the group (kitchen). The served choices include three options that belong to the kitchen and one option that does not go with it. To get the best answer to that question, the students should select which of those four choices does not fit with kitchen stuff. This typical process is categorized as *exemplifying* because the students do not merely answer the question by recognizing or recalling the information stored. They use their knowledge to select a specific example of the information given. Anderson and Krathwohl (2001) stated that exemplifying occurs when the students are asked to produce a particular instance of a general concept.

*Classifying* is the third sub-category of the understanding level of thinking. This category corresponds to *exemplifying*. Exemplifying requires the students to point out a specific example or instance from the general idea while *classifying* directs the students to discover the general concept from a specific instance (Anderson & Krathwohl, 2001). Excerpt 5 is an example of the classifying question.

Excerpt 5

- My favorite .... are red and blue.  
a. food  
b. book  
c. color\*  
d. subject

The sample of the understanding question above is categorized as *classifying* because the task implicitly requires the students to put things into a group. We know that there is no explicit instruction asking the students to group something into a category. However, to get the answer, the students still need to understand and classify that the words (red and blue) belong to a group (color).

The third sub-category of understanding found in the teacher-made test is *inferring*. In learning a language, the ability to infer grammatical rules is considered *inferring* (Anderson & Krathwohl, 2001). The example of *inferring* questions are presented in excerpt 6.

Excerpt 6

- I have two friends. (38) ..... names are Jhon and Brian. (39) ..... are my roommates. They are kind and generous. I love (40) ..... very much.  
38. a. they    b. their\*    c. them    d. theirs  
39. a. they\*    b. their    c. them    d. theirs  
40. a. they    b. their    c. them\*    d. theirs

The questions included in excerpt six are classified as the *inferring* category. As shown in the choices of the problems, the students are required to infer which of those options is suitable to complete the sentence. This case relates to the students' knowledge about pronouns. To get the answer, the students need to formulate when to use 'they', 'their', 'them', and 'theirs'. So that, in solving these problems, the students do not solely rely on their prior knowledge, they need to differentiate the usage of those pronouns.

## 4.2. Higher-order Thinking Skills in the Test Questions

As presented in table 4.1, HOTS-type questions grasp 7.5% or six items out of 80 questions grouped into a higher level of thinking with the following distribution: three questions of *analyzing*, two questions of *evaluating*, and one question of *creating*. Furthermore, all the analyzing questions belong to the attributing sub-category. It can be said that the test questions constructed by the teacher have a small number of HOT questions.

The first level of higher-order thinking skills is *analyzing*. Among the three levels (analyzing, evaluating, and creating), this thinking skill has more questions. However, the questions do not vary. All the questions belong to the attributing sub-category. Excerpt 7 is the sample of analyzing questions retrieved from the teacher-made tests categorized as attributing.

Excerpt 7

.... passage....

What is the writer's purpose to write the text?

- a. to inform about the lake condition\*
- b. to tell how to sell in the lake
- c. to describe how to buy ticket in the lake
- d. to let the vendors leave their waste everywhere

The sample of the question presented in Excerpt 7 reflects an analyzing skill because it demands more complex cognition to get the correct answer. In this case, the students need to go beyond the basic observation, such as recognizing, recalling memory, and understanding to choose the best answer among four choices. The question above requires the students to find out the writer's intention in writing the text. Since the writer does not explain his aim explicitly, the students should determine all parts of the passage and then take the main point of those to get the answer correctly. Based on Anderson and Krathwohl (2001), this typical question belongs to attributing.

The second category of higher-order thinking is *evaluating*. Evaluating can occur when the students are involved in the questions asking them to give their opinion or make a judgment about something in the information presented. There are two questions in the teacher-made tests that belong to this cognition. Here is an example of evaluating questions taken from the teacher-made tests.

Excerpt 8

.... passage....

What is the characteristic of Merida?

- a. brave\*
- b. weak
- c. shy
- d. liar

Excerpt 8 is the sample of evaluating questions. The question is considered as evaluating category because it asks the students to give their opinion about someone in the passage. Based on the question, the students should indicate Merida's character. To know her characteristics, the students do not merely answer based on their personal preferences. They need to answer based on the action done by Merida in the passage. Besides, the students should understand the criteria of those characteristics mentioned in the choices (i.e., brave, weak, shy, and liar). So, the students should combine their understanding of character traits and the action done by the character (Merida) in the passage to conclude that Merida is brave. In this case, the question encourages the students to pose their prior knowledge into deeper processing of the information.

The last level of higher-order thinking skills is *creating*. There is only one question classified as this cognition in the teacher-made tests. Creating questions directs the students to generate plausible solutions to the problem given, plan a way to complete the goal, or produce original work (Brookhart, 2010). Excerpt 9 is the creating question found in the teacher-made test.

Excerpt 9

.... passage....

What would happen if the vendors keep leaving their waste in the lake?

- a. it will make the lake clean
- b. it will cause bad smell around the lake and invite the cockroaches and insects\*
- c. it will make people happy to visit the lake
- d. it will make the lake more beautiful

The question presented in excerpt 9 is the question categorized as creating. It is considered as creating cognition because it directs the students to give their hypothesis of a problem. When the students are required to generate assumptions of a problem, it means that they are involved in the activity of creating cognition (Anderson & Krathwohl, 2001). In this question (excerpt 9), the problem is about the vendors that keep leaving their waste in the lake. Then, the instruction of the question directs the students to give their prediction toward the effect of the action done by the vendors who keep leaving their waste in the lake. Since the answer to the problem is not explicitly mentioned in the passage, the students need to predict based on their logical reasoning.

Seen from the stem of the question, it has provided the information of the action done by the vendors, namely '*keep leaving their waste in the lake.*' From this information, the students can predict and then choose the best response among the choices toward the problems. However, the students do not merely come to the best answer by using that information. They still need to conceive the effect of the action done by the vendors. It can affect positively or negatively. Because the vendors have done negative things, the students must perceive that the effect will be awful toward the lake. Therefore, the students can eliminate the positive options of the choices. Thus, the students can get the best answer to the problem.

The result of the document analysis of the test questions constructed by the teachers using revised Bloom's taxonomy framework shows that the teacher-made tests mainly demonstrate lower levels of cognitive cognitions. However, higher-order thinking is limited. Remembering and understanding levels are more noticeable in the test questions. There are only a few questions that belong to analyzing, evaluating, and creating cognitions. Among eighty questions, only six of them are categorized as higher-order thinking skills. It means the tests require more test items fostering higher levels of thinking. It intends to give more opportunities

to the students to answer more complex questions. Nguyễn and Nguyễn (2017) state that the students who are frequently trained to solve more complex tasks often demonstrate positive impacts on their learning improvement. Learning a language, for instance, can expand the students' language skills as they use it to extract information, generate ideas, and make interpretations (Gil-Glazer, Walter, & Eilam, 2019).

In this research, having more LOTs than HOTs questions, presumably, can be a result of the use of multiple-choice questions. As mentioned in point 3 (Method), all the teacher-made tests for the final examination are in the form of multiple-choice questions. Some literature (Martinez, 1999; Magno, 2003) view that multiple-choice questions frequently assess lower-order thinking. It is probably arduous for multiple-choice questions to evaluate higher levels of thinking, such as analyzing, evaluating, and creating (Gareis & Grant, 2015). Multiple-choice questions do not, for instance, encourage productive, innovative, or creative thinking (Martinez, 1999) as the creation of the students' thinking is limited to the choices served (Gareis & Grant, 2015). However, it does not mean that multiple-choice questions cannot measure higher-order thinking skills. Multiple-choice questions can tap higher levels of thinking through some techniques: such as using the combination of test formats (e.g., combining multiple-choice with constructed responses), providing a factual statement and ask the students to analyze, and providing data and ask the students to develop a hypothesis (Liu, 2009).

## 5. CONCLUSION

Based on the results of the data analysis of the test questions constructed by the teachers, there are the points concluded. The first, the teacher-made tests mainly cover LOTs-type questions. So that, if the teacher wants to achieve the curriculum goals regarding the encouragement of students' higher-order thinking skills, the teacher should give more emphasis on HOT skills in their test questions. Second, there is a need to discuss how many percent of HOTs questions should be presented in the tests. We cannot neglect that LOT skills are essential elements for attaining higher-order thinking skills. So, it is necessary to discuss and consider the ideal portion of LOTs and HOTs questions in the tests. Third, the two tests made by the teachers for the final examination are in the form of multiple-choice questions. We suggest that the teacher can combine the multiple-choice question with other formats, such as combining multiple-choice with a constructed response.

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