



Analysis of Mid-semester Assessment in Cultivating Critical Thinking of Elementary School Students

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Abstract. Critical thinking skills can provide the right direction for thinking, working and assisting students in determining the proper steps in solving problems. The elementary school level plays a vital role in developing these thinking skills. A student's ability to think critically can be measured by providing an indicator of High Order Thinking Skills (HOTS). Mid-semester Assessment (PTS) is a series of assessment components that elementary school students must pass after the middle of the semester. This study aimed to analyzed the content of HOTS-based questions at PTS of Science subject regarding indicators of critical thinking skills. This study used a qualitative with a content analysis method. The content studied is about PTS of Science subject semester 1 of fifth grade. The data analysis used includes data reduction, data presentation, and conclusion. In this study, some findings described the realm of cognition for the category of questions based on HOTS oriented from C4 to C6. Indicators of critical thinking skills analyzed include interpretation, analysis, evaluation, inference, and explanation. The results of this study can be used as input for teachers in developing HOTS-based questions in improving students' critical thinking skills. This study is an essential finding in preparing PTS of Science subject questions that can foster students' critical thinking skills.

Keywords: Critical thinking skills · Higher-order thinking skills · Mid-semester assessment · Primary school

1 Introduction

The elementary school level plays a vital role in training students' thinking skills, one of which is the ability to think critically. Critical thinking ability is the ability individuals possess to open their minds and find out about a symptom or problem carefully and avoid making mistakes [1]. Furthermore, Woolfolk (2016) explained that critical thinking is the ability to reason in determining goals and responses to a situation based on evidence or supporting data that ends at the conclusion stage [2]. This opinion explains that critical thinking skills lead students to be able to draw the correct conclusions based on objective evidence or reasons.

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Students' critical thinking skills can give the right direction to think and work and help determine relationships with others with something more appropriate. Measure a student's ability to think critically, and it can be done by providing an indicator of HOTS. Students' critical thinking ability in science content is still relatively low, as seen from a scientific survey on PISA (Programme For International Student Assessment). Indonesia is 62 out of 70 countries [3]. This is in line with several surveys in Indonesia showing that HOTS in several regions are currently still deficient [4].

The survey results indicated that students' critical thinking skills in science subject matter must be improved. Through the habit of critical thinking, students will be more detailed in understanding the information received [5]. The 21st-century science learning concept contains 4Cs, namely Communication, Collaboration, Critical Thinking-Problem Solving, and Creativity-Innovation). In Bloom's taxonomy which has been revised by Krathwohl and Anderson, these students' abilities are categorized as HOTS, namely C-5 (evaluating), and C-6 (creating) [6]. Students' critical thinking skills will be seen when students can solve HOTS questions [7].

Science (IPA) is a subject matter for students to learn about the universe through observation and procedures to get conclusions. Samatowa (2016) stated that Science is the backbone of the development of technology and fundamental knowledge, so the content of science lessons can foster critical thinking skills in students [8]. Today there are still many students who experience misconceptions in understanding Science material. This of course can build a wrong perception in students in understanding material in Science. The concept is the ability to accept in understanding a generalized knowledge that exists in a person [9]. Based on these problems, it is necessary to increase the HOTS-based questions contained in Bloom's taxonomy which has been revised by Anderson & Krathwohl (2001), including analyzing (C4), evaluating (C5) and creating (C6) [10]. HOTS questions need to be given in the content of Science lessons for students' critical thinking skills. Teachers need to include HOTS questions in the science learning process [11].

The 2013 curriculum has a holistic educational process that includes cognitive, affective and psychomotor assessments [12, 13]. The 2013 curriculum is designed according to the competency needs of the 21st century [14]. Questions that foster students' critical thinking must be included in the daily, mid-semester, and end-semester assessments. A test question must be able to measure the learning achievement carried out by students [15]. The questions or tests carried out must be able to measure the ability of each student [16]. Mid-Semester Assessment (PTS) is carried out by teachers who have gone through a span of 8–9 weeks of learning [17]. The implementation of PTS is usually in the form of a written test consisting of objective questions, essays and short answers depending on the variation [18]. It is necessary to analyze the Science PTS of fifth grade questions in fostering students' critical thinking.

Yuniar et al. (2015) analyzed of HOTS on test objectives in Social Science Subjects [19]. In other studies, Yuliandini et al. (2019) developed of test questions based on HOTS in Elementary Schools and found that the skills of HOTS questions were still deficient [20]. Kholiq et al. (2019) analyzed of assessment oriented for fifth grade students and found that HOTS questions were still very rarely [21]. Pratiwi et al. (2020) found that it challenging to work on HOTS-based questions because in the learning process teachers

rarely gave HOTS-based questions so students were not accustomed to solving questions with critical thinking [22].

Then the study by Puspitasari & Saputri (2021) found that the application of HOTS questions can measure students' critical thinking skills [23]. Wijjiasih et al (2022) analyzed of critical mathematical thinking in terms of self-confidence, the results showed that each student has a different level of confidence and necessary thinking skills [24]. Then the study conducted by Lestari et al. (2020) found that the study of HOTS questions on each assessment instrument already existed but was not maximized [25].

Based on the explanation, it can be concluded that the importance of HOTS questions in a series of learning efforts is in growing students' critical thinking skills. At this time, there are still a few questions oriented to HOTS questions with cognition levels of C4, C5, and C6 in growing students' critical thinking skills. Many are still found in several assessment instruments that use LOTS (Low Order Thinking Skills) and MOTS (Middle Order Thinking Skills), especially in science subjects. The difference between this study and previous studies is that in the previous study no study examined HOTS-based PTS questions in terms of critical thinking ability indicators, so in this study, researchers analyzed the content of HOTS-based PTS questions in Science in terms of critical thinking ability indicators.

2 Method

2.1 Type and Design

This study used a qualitative approach with a content analysis method. The content was studied to find out the meaning contained in an instrument. As the analysis investigated in this study is the PTS of science of fifth grade question instrument. The analytical method is appropriate for analyzing a reading text with an explicit meaning [26]. Content analysis is an approach step that chooses the object of study itself. Therefore, in detail, the authors analyzed the contents of the HOTS-based questions in the PTS of science of fifth grade questions to grow students' critical thinking skills.

2.2 Data and Data Source

The data source in this study was the fifth grade PTS test instrument at Sambongrejo 2 Public Elementary School (S2PES), Tunjungan District, Blora Regency, Indonesia with the object of study being science questions. This study was conducted in a non-interactive manner so that researchers could do it anytime and anywhere without being adrift of time which made it easier for researchers to complete the analysis in this study.

2.3 Data Collection Techniques

The data collection technique used in this study was documentation. The documentation carried out in this study was in the form of collecting questions for PTS of science. The survey of documentation itself is an analytical technique in a document. The data obtained were used as data and studies. Therefore, the authors used this technique because it is in accordance with how to analyze the PTS of science questions.

2.4 Data Validity

The validity of the data in this study used the credibility test (internal validity) and dependability (reliability). The credibility test of the data or the trustworthiness of the study data is carried out utilizing a credibility test to increase persistence and discussion with colleagues. Meanwhile, improvements to strengthen reliability are by using category dependability tests. So, dependability testing (reliability) is carried out by conducting an audit (check) of the entire review process [27]. The audit is carried out with the help of expert judgment who examine the review process comprehensively.

2.5 Data Analysis

The analysis used in this study was interactive analysis by Miles and Huberman, has three paths: data reduction, data presentation and conclusion drawing [27]. The steps were carried out in the following way: This was done by the authors to organize the data. The data were taken from the PTS of science of fifth grade test instrument, which was focused on the cognitive domain in items based on HOTS questions. After the authors has reduced the data, the next step was to present the data in tables, brief descriptions, flowcharts or the like to make it easier for the authors to described the results of the analysis. The last step taken was to draw conclusions by wrote down the results of the data analysis that has been done.

3 Result and Discussion

In this study some findings describe the realm of cognition. HOTS-based questions are guided by the 2013 curriculum oriented to the cognitive domain. The cognitive domain as in Bloom's Taxonomy which has been revised by Anderson & Krathwohl (2001) consists of the ability to remember (C1), understand (C2), apply (C3), analyze (C4), evaluate (C5) and create (C6) [6]. The Ministry of Education and Culture (2017) divides it into 3 categories: the LOTS question category oriented to the C1 and C2 categories. Middle-order thinking skills are introduced to C3 and the variety of questions based on HOTS are taught to C4 to C6. Indicators of critical thinking skills analyzed include interpretation, analysis, evaluation, inference and explanation [28]. The aspects of each hand described by [29] have, performance, which is detecting an image or part that is presented (C4). The indicator aspect of the analysis is to analyze something in the questions raised (C4). The evaluation aspect is making conclusions or providing solutions about a matter in the questions presented (C5). The inference aspect is detecting something in the questions raised (C4). The defining element is making or providing solutions, and suggestions on the problems presented (C6).

3.1 The Form of PTS IPA Questions

Based on data analysis, the PTS of science of fifth grade questions at S2PES itself consist of themes 1, 2 and theme 3. Each piece has multiple-choice questions, short descriptions, and essay questions. Each of each article already includes the appropriate

KD (basic competences). This is evident in all the items contained in each theme. In theme 1 there is KD 3.1, theme 2 is KD 3.2 and in theme 3 there is KD 3.3. The description of the HOTS-based question analysis in each article is as follows;

3.2 HOTS-Based Question Analysis Theme 1

Analysis of HOTS-based questions obtained on the question instrument in theme 1 with KD 3.1. There are 10 question instruments in the form of 5-item multiple choice questions, 3 short descriptions and 2-item essays. For multiple-choice HOTS-based questions, there is number 4 with a cognitive level of C4 (analyzing), including interpretation critical thinking indicators; in this item, students are asked to pay attention to pictures of bone abnormalities. Students are asked to detect the type of bone abnormality. In the short description questions, all of them have used HOTS-based questions with a cognitive level of C4 (analyzing) on questions number 1 and 2 including aspects of critical thinking indicators, interpretation and analysis. In the question presented pictures of animal vertebrae and human hand bones, students were asked to detect the type of bone and analyze the designated bone. Meanwhile, number 3 is a HOTS-based question with a cognitive level of C5 (evaluating) including aspects of critical thinking evaluation indicators. In this question, students are asked to conclude the relationship between bones and joints. In the essay questions, there are no HOTS-based questions.

3.3 HOTS-Based Question Analysis Theme 2

Analysis HOTS questions obtained on the instrument questions on theme 2 with KD 3.2. Instrument questions total 12 questions. The question instrument in the form of multiple choice has 6 items, a brief description of 4 items and an essay of 2 items. For multiple-choice HOTS-based questions, there is 1 item at number 6 with a cognitive level of C6 (creating) which is included in the explanation critical thinking indicator. This question asks students to provide opinions or solutions on maintaining respiratory health. A brief description contains HOTS-based questions in numbers 2 and 4 with a cognitive level of C4 (analyzing) including indicators of critical thinking ability, analysis and inference. In question number 2, students are asked to investigate gas exchange in the human respiratory system. In question number 4, students are asked to detect a type of disease in the human respiratory system. As for the essay questions, there are HOTS-based questions on item number 1 with a cognitive level of C4 (analyzing) including the aspect of interpreting critical thinking ability indicators. In this item, a picture of the human respiratory organ is presented, and students are asked to detect the names of the organs in the human respiratory system.

3.4 HOTS-Based Question Analysis Theme 3

Analysis of HOTS-based questions obtained on the question instrument in theme 3 with KD 3.3. Instrument questions total 7 questions. Instrument questions in the form of multiple choice have 4 items, a brief description of 2 items, and 1 item essay. For multiple-choice HOTS-based questions, there are numbers 1 and 2 with a cognitive

level of C4 (analyzing), including interpreting critical thinking indicators. In this item, a picture of the digestive system in animals is presented, and students are asked to detect the function of the parts in the image. Question number 2 with a cognitive level of C4 (analyzing) is included in critical thinking analysis indicators. In this item, students are asked to investigate the function of enzymes in the human digestive system. While the brief description is found in number 1 with a cognitive level of C4 (analyzing) including the aspect of the indicator of critical thinking interpretation. In this item, students are asked to detect the function of the image of the digestive system in animals. In the essay questions, there are no questions in the HOTS category.

The findings of the analysis show that in the PTS of science of fifth grade questions at S2PES, several HOTS-based questions already match the indicators of critical thinking skills. HOTS-based PTS of science questions are necessary because they can support science process skills and the ability to solve problems and provide the right reasons for solving them [30]. Familiarizing students with HOTS-based science questions will be able to improve student's critical thinking skills [31].

The findings shows that the HOTS-based questions are still few compared to the total number of questions. The study of HOTS-based questions on themes 1, 2 and 3 has met the criteria for critical thinking indicators consisting of interpretation, analysis, evaluation, inference and explanation [28]. The whole theme has already applied HOTS-based questions to science PTS questions in developing critical thinking skills.

In understanding fact knowledge, students must be able to remember fact knowledge. In applying fact knowledge, students must have an understanding memory of fact knowledge. In analyzing fact knowledge, students must be able to recognize, understand and apply fact knowledge. In evaluating fact knowledge, students must be able to remember, understand, use and analyze fact knowledge. In creating fact knowledge, students must be able to recognize, understand, apply, analyze and evaluate fact knowledge.

HOTS-based questions at PTS of science of fifth grade in growing students' critical thinking skills in terms of KD are appropriate. This of course can stimulate students to think critically in solving problems related to the issues of everyday life. This follows the Ministry of Education and Culture (2018), which states that questions are said to be reasonable criteria if the questions involve problems of daily life that make students think critically [17]. The HOTS-based science PTS questions in theme 1 already include indicators of critical thinking skills, including interpretation, analysis and evaluation. The HOTS-based questions in theme 2 cover aspects of critical thinking ability indicators, including an explanation, analysis, inference, and interpretation.

Overall, aspects of critical thinking indicators are already present in each theme. Multiple-choice questions in each piece have implemented HOTS-based questions that include elements of critical thinking ability indicators. Short description questions in all articles have implemented HOTS-based questions which include aspects of critical thinking ability indicators. There are no HOTS-based questions for essay questions on theme 1 and 3, so there are no HOTS-based questions on the essay questions, which means they cannot fulfill the critical thinking ability indicator aspect. Most of the HOTS-based questions analyzed at the cognitive level are at the C4 (analyzing) status. This level already includes parts of critical thinking ability indicators, including interpretation, inference and analysis. One HOTS-based question is at the C5 cognitive level (evaluating)

which is classified as an indicator of the evaluation of critical thinking skills. There is one HOTS-based question at the C6 mental level (creating) including the explanatory crucial thinking hand.

Based on the explanation above, HOTS-based questions in PTS already exist but are still few found. This finding is in line with previous research that PTS questions are still dominated by LOTS and MOTS questions [19, 21, 25]. To support the development of critical thinking skills, students need to be familiarized with HOTS-based questions by paying attention to the indicators of students' necessary thinking skills [29, 31]. Thus, preparing HOTS-based questions in the future needs to increase equity in implementing aspects of critical thinking ability indicators.

4 Conclusion

Based on the results of the analysis, it can be concluded that the HOTS-based questions at PTS of science of fifth grade S2PES have included aspects of critical thinking indicators. However, the questions are still low and are dominated by questions in the LOTS and MOTS categories. The cognitive level for HOTS-based questions is still overwhelmed at the C4 level (analyzing) while the mental group at C5 (evaluating) and C6 (creating) are still low.

The results of previous relevant studies related to the analysis of HOTS-based questions in science content were only limited to categorizing the cognitive level of LOTS, MOTS, and HOTS students. This study is an essential finding in preparing PTS IPA questions that can foster students' critical thinking skills. The results of this study are very important for teachers in improving the quality of education in schools.

This study has several limitations, namely, the study only in terms of critical thinking skills. This study's weaknesses are shortcomings in finding references and document materials that are limited to the PTS of science of fifth grade questions only. In future studies, other evaluation questions can also be studied with other cognitive domains, such as problem-solving, conceptual reasoning, concept understanding, creative thinking, and so on.

The results of this study can be used as input for teachers in developing HOTS-based questions to grow students' critical thinking skills and can awaken and improve the quality of teachers in presenting practice questions for science learning assessments in fostering necessary thinking skills. The suggestions that the researchers contributed from the results of this study, among others, for teachers and prospective teachers are expected to get used to making HOTS-based questions in fostering critical thinking because after the researchers conducted this study, the researchers found that making HOTS-based questions was not difficult, it just required creativity in making them. The government is expected to socialize the development of HOTS-based questions in developing critical thinking skills for the advancement of the quality of education in Indonesia.

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