Profile of Junior High School Science Textbooks: Fulfillment of the Higher-order Thinking Skills component

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Abstract. This study aims to analyze the fulfillment of HOTS components in elements such as learning indicators, materials, activities, and competency test questions in science textbooks for Class VII Semester 2. The research method uses mixed methods with an explanatory design starting from the collection and analysis of quantitative data followed by the collection and analysis of qualitative data that is built on the initial results of quantitative data. The material used to analyze HOTS fulfillment of "The Interaction of Living Things with the Environment" with Basic Competencies of 3.7 and 4.7. There are 27 identified components of HOTS fulfillment that are based on 8 learning indicators, 12 learning activities, and 7 competency test questions. With the results of HOTS fulfillment recapitulation the percentage of HOTS cognitive level at the analysis level (C4) 66.67%, the evaluation level (C5) 3.70%, and the creative level (C6) 11.11%. While the HOTS development matrix consists of 56 levels with high criteria of 30.36%, medium criteria of 41.07%, and low criteria of 28.57%. HOTS occurs when students are involved so that through a series of HOTS activities by determining learning sources in textbooks and appropriate learning arrangements, junior high school students can develop higher-order thinking habits.

1. Introduction

The educational paradigm that is reflected in the knowledge of the 21st Century Skill shows that knowledge alone is not enough. One of the provisions that must be given in preparing the future workforce is to teach students how to think [1], [2] and solve problems[3]–[5]. These thinking skills are the capital to be able to compete so that it is important to be developed by students [6]–[8]. High-order thinking skills play an important role in applying, connecting, or manipulating previous knowledge to solve new problems effectively [9].

Several research studies indicate that the assessment carried out at the school level requires the ability of students to be able to think at a higher level when faced with a problem or question which in turn can generate ideas for solving problems [10]–[12]. HOTS consists of problem-solving, decision making, critical thinking, and creative thinking [13]. In Bloom's revised taxonomy, HOTS is defined as the top three ability levels in the cognitive dimensions of analyzing (C4), evaluating (C5), creating (C6), and the dimensions of knowledge (factual, conceptual, procedural, and metacognitive) [5], [14]. Thomas, A., and Thorne stated that HOTS can be learned, can be taught to students, and can be improved students' skills and character [9], HOTS means the capacity to go beyond the information provided, adopt a
critical attitude, to evaluate, have metacognitive awareness and problem-solving capacity in complex thinking, solving complex and high-level problems to critical and creative levels [6], [15]. The demands of the Indonesian national education system are to state the importance of higher-order thinking skills as contained in the National Education System Law No. 20 of 2003 concerning the development of the potential of students to become critical, creative, and independent humans. This means that the Indonesian National Education System aims to provide a learning environment that enables the development of the potential of students to acquire knowledge and higher-order thinking attributes to become the core of classroom learning [15], [16].

In a variety of learning, the existence of textbooks has a vital role during the learning process [17]–[19]. To be able to choose a good textbook, we need a way of analyzing books that involve aspects that contain dimensions of factual, conceptual, procedural, and metacognitive knowledge. The importance of looking at and examining the existence and role of textbooks for long-term learning in science[20]–[22] and in developing cognitive abilities, a textbook analysis is needed to improve the quality of education in Indonesia in empowering higher-order thinking skills. The fulfillment of the HOTS indicator from Anderson and Krathwohl can be explained in the sub-indicators and descriptors for analyzing the integration of HOTS with integrated Science Learning Indicators which can increase HOTS [23], [24]. Based on the description above, it is necessary to analyze the fulfillment of the HOTS Indicator in the Junior High School Science Learning book to empower junior high school students' higher-order thinking skills in learning, then this study aims to analyze the fulfillment of HOTS components in elements such as learning indicators, materials, activities, and competency test questions in the Science textbook Class VII Semester 2. Basic Competence (BC) is determined based on the identification of the 2013 curriculum distribution at BC 3.7. and BC 4.7. The fulfillment of HOTS criteria can be a reference or as a consideration in determining learning settings in science learning modes, media, and resources.

2. Materials and Methods

The research method used is a mixed-method with a sequential explanatory design [25]. The application of a sequential explanation design starts from the collection and analysis of quantitative data followed by the collection and analysis of qualitative data which is built on the initial results of quantitative data [26] as follows:

- Quantitative data collection
- Quantitative data analysis
- Qualitative data collection
- Qualitative data analysis
- Overall Interpretation of Data

Figure 1. Sequential Explanatory Research Design [26] (Creswel, 2013)

Textbook analysis for HOTS achievements involves aspects that contain dimensions of factual, conceptual, procedural, and metacognitive knowledge. Aspects of the conceptual analysis of HOTS indicators are described based on the bloom taxonomy revised by Anderson, L., and Krathwohl, D (2001) [14] includes: 1) Analyzing (C4) consists of three indicators, namely: Distinguishing, Organizing, Attributing; 2) Evaluating (C5) consists of two indicators, namely: Checking, Criticizing, and 3) Creating (C6) consists of three indicators, namely: Formulating, Planning, Producing. In the analysis of the 2013 curriculum science textbook, the elements consist of basic competencies and indicators that will be the subject [27]. Then the next stage to take is

1. Creating a development matrix for HOTS fulfillment indicators to determine High, Medium, and Low criteria
2. Analyze HOTS compliance components through materials, learning activities, and competency tests
3. Make data interpretations based on the fulfillment results and analysis to conclude
3. Result
At this stage, the HOTS indicator matrix is developed against BC.3.7 and BC.4.7, through learning materials. The development of the fulfillment of each criterion can be seen in Table 1.

Table 1. The Higher Order Thinking Skill (HOTS) Indicator Development Matrix BC 3.7 and 4.7

| No | Learning Indicators | Learning materials | HOTS indicator | Fulfillment |
|----|---------------------|-------------------|----------------|-------------|
|    |                     |                   |                | H | M | L |
| 1  | 3.7.1. Explain the concept of the environment and its components | Environmental Concept | C4 2 | √ |
|    |                     | Understanding the concept of the environment, training awareness of the nature of oneself and one's existence in an environment through observing a macro environment that is engineered by students in an observation activity | C5 1 | √ |
|    |                     |                   |                | C6 2 | √ |
|    |                     |                   |                | 3 √ |
| 2  | 3.7.2. Conduct environmental observations and identify biotic and abiotic components | What do you find in an environment | C4 1 | √ |
|    |                     | Providing learning experiences in terms of knowing the environment. The environment that is introduced is the closest (school or home). Environment as a place to live for living things | C5 1 | √ |
|    |                     |                   |                | C6 2 | √ |
|    |                     |                   |                | 3 √ |
| 3  | 3.7.3. Describe the meaning of interaction | The interactions in the ecosystem form a pattern | C4 1 | √ |
|    |                     | Train students about the patterns that are formed during interactions and environmental components. Knowing the relationship between the organisms contained in the ecosystem | C5 1 | √ |
|    |                     |                   |                | C6 1 | √ |
|    |                     |                   |                | 2 √ |
| 4  | 3.7.4. Explain patterns of interaction | Interdependence forms | C4 1 | √ |
|    |                     | Train students to observe or observe the interdependence that occurs in living things in an ecosystem community | C5 1 | √ |
|    |                     |                   |                | C6 1 | √ |
|    |                     |                   |                | 2 √ |
| 5  | 3.7.5. Explain the concept of the interdependence of living things | Human interaction patterns affect the system | C4 1 | √ |
|    |                     | Review of learning experiences | C5 1 | √ |
|    |                     |                   |                | C6 1 | √ |
6 3.7.6. State the difference between food chain and food web, detritus food chain, and grazing food chain

| Project Tasks                                      | C4 | C5 | C6 |
|---------------------------------------------------|----|----|----|
| 1. Project Tasks                                  | √  | √  |    |
| 2. Difference between food chain and food web     | √  |    |    |
| 3. Difference between detritus food chain and grazing food chain |    | √  |    |

7 3.7.7. Have the skills to speak in front of the class through the presentation of exploration results

| Group work exercises and presentations            | C4 | C5 | C6 |
|---------------------------------------------------|----|----|----|
| 1. Group work exercises and presentations         | √  |    |    |
| 2. To speak in front of the class                 |    | √  |    |
| 3. Through the presentation of exploration results|    |    | √  |

Information:*)

HOTS fullness in the category
1) H = High (I ≥ 4)
2) M = Medium (I: 2-3)
3) L = Low (I: 0-1)

![Figure 2, HOTS Fulfillment Development Matrix](image)

Based on Table 1, the HOTS indicator development matrix through the distribution of compliance criteria at BC.3.7 and 4.7 Science learning textbooks for Class VII Semester 2 on the integration of HOTS fulfillment criteria indicators can be seen in Figure 2 HOTS indicator development matrix at 30.36% high criteria, at the criteria were 41.07% while the low criteria were 28.57%. The HOTS element fulfillment criteria were analyzed based on the BC 3.7 and 4.7 development matrices which included learning materials in determining these criteria. The findings show that several concepts, theories, have not influenced students' higher-order thinking. According to Adisendjaja if we look at facts in the field, Indonesian students are very good at memorizing but less skilled in applying their knowledge[28]. This may be related to the tendency to use memorization as a vehicle for mastering science, but not being able to build one's knowledge or build thinking skills.

The following stage is an evaluation of BC.3.7 and BC. 4.7. The HOTS fulfillment component with the assessed elements such as learning indicators, learning activities, and fulfillment competency tests are assessed through the dimensions of knowledge and descriptor codes, the level of HOTS fulfillment can be seen in Table 2.
Table 2, Data Analysis of HOTS Component Fulfillment

| No | The elements being assessed                                                                 | Knowledge Dimensions | Descriptor Code | Information               |
|----|--------------------------------------------------------------------------------------------|----------------------|----------------|--------------------------|
|    | **LEARNING INDICATORS**                                                                      |                      |                |                          |
| 1. | 3.7.1. Explain the concept of the environment and its components                             | Conceptual           | C4.2           |                          |
| 2. | 3.7.2. Conduct environmental observations and identify biotic and abiotic components         | Conceptual           | C4.2           |                          |
| 3. | 3.7.3. Explain the meaning of interaction                                                    | Conceptual           | C4.1           |                          |
| 4. | 3.7.4 Describe patterns of interaction                                                        | Conceptual           | C4.1           |                          |
| 5. | 3.7.5. Explain the concept of the interdependence of living things                           | Conceptual           | C4.2           |                          |
| 6. | 3.7.6. State the difference between food chain and food web, de tritus food chain and grazing food chain | Factual              | N              |                          |
| 7. | 3.7.7. Have the skills to speak in front of the class through the presentation of exploration results | Procedural           | C6.1           |                          |
| 8. | 4.7. Presenting the results of observations on the interaction of living things with the environment | Procedural           | C6.1           |                          |
|    | **LEARNING ACTIVITIES**                                                                      |                      |                |                          |
| 9. | Let's Learn: Understanding the Environment                                                   | Factual              | N              | Page 29                  |
| 10.| Let's Do It: Activity 2.1. Study the Environment                                             | Procedural           | C4.3           | Page 30                  |
| 11.| Let's Learn: Environmental Components                                                        | Factual              | N              | Page 32                  |
| 12.| Let's Do It: Activity 2.2. Observing Ecosystems                                              | Conceptual           | C4.1           | Page 32                  |
| 13.| Let's Learn: Know and explain patterns of interaction in ecosystems                          | Factual              | N              | Page 33                  |
| 14.| Come on Think: Have you ever seen a leaf with a hole? What causes the leaf to become hollow? | Metacognition         | C5.1           | Page 33                  |
| 15.| Let's Do It: Activity 2.3. Understanding the Interdependence of Living Things                | Conceptual           | C4.2           | Page 36                  |
| 16.| Let's practice:                                                                            | Conceptual           | C4.1           | Page 37                  |
| No | The elements being assessed | Knowledge Dimensions | Descriptor Code | Information |
|----|-----------------------------|----------------------|----------------|-------------|
| 17. | Exploration Activities: Exploration of the ecosystem around the school | Conceptual | C4.2 | Page 39 |
| 18. | Let's Do It: Activity 2.4. Knowing the form of interdependence | Conceptual | C4.2 | Page 39 |
| 19. | Come on Think: | Metakognisi | C4.1 | Page 41 |

**COMPETENCE TEST**

| 21. | Problem Number 1: If farmers eradicate insects, what will happen to the rice and frog populations? Tell! | Conceptual | C4.1 | Page 44 |
| 22. | Problem Number 2: What might affect the balance of the rice field ecosystem? Try to identify the 5 abiotic components that are present | Factual | N | Page 45 |
| 23. | Problem Number 3: What will happen if the producers in the paddy fields are exhausted due to a natural disaster, for example, a flood? | Conceptual | C4.2 | Page 45 |
| 24. | Problem Number 4: Why (rice, insects, frogs, snakes, and eagles) can live in the same place, namely the rice field ecosystem? Explain your answer based on picture 2.13 | Conceptual | C4.2 | Page 45 |
| No | The elements being assessed                                                                 | Knowledge Dimensions | Descriptor Code | Information |
|----|----------------------------------------------------------------------------------------------|----------------------|-----------------|-------------|
| 25.| Problem Number 5: If there are no snakes in the rice field ecosystem, try to answer the things that will happen below 1. What will happen to the frog population in the rice field ecosystem? 2. What will happen to the eagle population in the rice field ecosystem? 3. What is the impact on agricultural activities carried out by farmers on the rice field ecosystem? | Conceptual           | C4.2            | Page 45     |
| 26.| Problem Number 6: Residential residents located on the east side of the river often experience irritation problems on their eyes, while residents on the west side do not. Why does it happen? Tell | Conceptual           | C4.2            | Page 45     |
| 27.| Can the figures (a) and (b) above represent the interdependence of organisms? Tell            | Conceptual           | C4.1            | Page 46     |
The identified components of HOTS fulfillment are based on learning indicators, learning activities, and competency test questions. With the results of HOTS fulfillment recapitulation can be seen in Figure 3 the percentage of HOTS cognitive level at the analysis level (C4) 66.67%, the evaluation level (C5) 3.70%, and the creative level (C6) 11.11%. In the research findings, textbooks have not been able to foster higher-order thinking skills in problem-solving such as at the evaluation (C5) and creation (C6) levels, this must be supported by a learning model and curriculum balance that can foster HOTS. In line with the research of Hayat and Yusuf which states that science textbooks for secondary education in Indonesia are still not able to meet expectations resulting in low-quality student learning because textbooks emphasize terms and vocabulary so that students just remember all the information and use that information to answer the test, then think of it as science [29]. HOTS is measured using tasks, including analyzing, evaluating, and creating conceptual and procedural knowledge, or metacognition through the selection of appropriate textbooks. It is hoped that an increase in understanding of science can ultimately improve student learning outcomes. Textbooks as a source of student learning need to be supported by learning designs that can foster student HOTS. Student textbooks are one of the dominant learning materials or learning resources if the learning model is conventional. For textbooks to empower students’ HOTS and assist in the development of a science and technology literate society, it is necessary to prepare balanced learning and curriculum that emphasizes knowledge, history of science, and concern for technology and social issues [30].

The evaluation and creation levels require creative ideas that cannot be generated in the usual way. The development of modules or textbooks must be able to stimulate students to understand facts, classify, draw conclusions, relate them to other facts and concepts, make generalizations, and apply them by finding new solutions to new problems [31], [32]. HOTS places more emphasis on thinking skills that combine critical thinking and creative thinking. Giving assignments or assessing students' abilities with instruments for higher-order thinking that have been adapted to the intellectual, thought processes, and realities of life that exist can motivate students. This is because students are no longer busy thinking about abstract things about what they are learning but are busy with new things by existing realities [3]. Through textbooks, students will get a variety of information about the knowledge discussed in learning [33] meaning that familiarizing students with HOTS activities is important to help them prepare to solve new problems, adjust to new situations, and make decisions about a particular problem [34]. Reinforced research about something rational following the facts builds a new paradigm that is more creative and can create a concept into something or something new [14]. Thinking and skillfully solving every problem is a means to solve educational problems. The teacher will develop learning resources by the situation and conditions of the students to achieve the specified learning completeness. Textbooks are included in the main learning components that affect learning outcomes [35], [36]. Not just following the material in textbooks, but there are modifications to learning in the 21st century to answer global challenges. Preparing the millennial generation through HOTS is very much needed to overcome the problems and challenges of modernization [37].
importance of textbooks in the learning process, various studies were conducted. Several studies in various countries have been able to develop innovative textbooks, such as in Turkey [20], [38] to Indonesia [39]–[41].

4. Conclusion
Based on the research, the material used to analyze HOTS discoverers on the interaction of living things with the environment with basic competencies is 3.7 and 4.7. HOTS fulfillment components are identified by HOTS fulfillment recapitulation. The percentage of HOTS cognitive level at the analysis level (C4) was 66.67%, the evaluation level (C5) was 3.70%, and the creative level (C6) was 11.11%. While the HOTS development matrix consists of 56 levels with high criteria of 30.36%, medium criteria of 41.07%, and low criteria of 28.57%. HOTS is difficult to identify in a short time because of its indirect nature but can be identified through a series of activities that are correlated with HOTS such as in the analysis of SMP IPA textbooks that show textual evidence, which can then be arranged in learning that can empower students' HOTS and assist in the development a science and technology literate society by providing a balanced learning model and curriculum, new ideas are conceptualized and along with changing student and community needs stimulate students to understand facts, classify, draw, relate them to facts and other concepts, make generalizations, and apply them by finding solutions to new problems of habit as higher-order thinking through the cognitive dimension when observing, analyzing, and creating continuously through science learning books.

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