A Need Assessment of Integrated Science Teaching Material Based Higher Order Thinking Skills (HOTS)

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Abstract. Indonesia's ranking on the 2018 PISA results, Indonesia was ranked 70 out of 78 countries that participated in the OECD with an average score of 396. The purpose of this study was to analyze the need for the development of HOTS-based integrated science teaching materials for grade VI elementary schools. The research data were obtained through literature study, documentation, observation and interviews. The data analysis involved several steps, namely, data reduction, categorization, validity checkings, interpretation, and inferences. The things analyzed include: 1) Local conditions of the school, 2) Student books and teacher books, 3) Curriculum, and 4) Student characteristics. The results of this research showed that students only use books from the government. There are no HOTS based books yet. Based on the result, the development of HOTS based integrated science teaching materials in grade VI elementary schools is required.

1. Introduction

Today's education is faced with the challenges of a complex life and a changing environment, and a competitive world of work. Facing this global competition, educational institutions must be able to produce quality human resources so that they can play a role in various fields of life [1]. Students are expected to be able to master various skills. One of those skills is 21st century skills. 21st century skills are skills that require students to have higher thinking skills in order to remain competitive at the level of the new millennium [2]. The national education system requires strategic efforts that seek to increase the capacity and ability to practice to a higher level and quality to be able to face the challenges of the 21st century [3]. High-order thinking skills in science subject content are very important for students to master in relation to how students deal with problems in daily life both in the school environment, health, natural events and other problems related to science and technology. Socio-scientific problems are aimed at improving students' ability to make informed decisions about problems to be discussed through improving scientific reading reading [4]. Higher order thinking skills of students in Indonesia are good in primary and secondary schools are still in the low category. This is in accordance with the news published in Kompas.com (Tuesday, April 17 2018) that in the implementation of the National Examination (UN) for Senior High School (SMA) and Madrasah Aliyah (MA) levels which have been attended by around 1,812,565 students SMA and MA throughout Indonesia which was held in April 2018, caused problems that had gone viral on social media. Many complaints were conveyed by students and educators regarding the difficulty of UN questions, especially Mathematics questions. Minister of Education and Culture, Muhadjir Effendy on one occasion stated that the weight of UNBK questions, especially Mathematics
and Natural Sciences subjects was different from the usual assessment. The Ministry of Education has started to apply international standards, both for Mathematics and Natural Sciences problems, namely those that require higher-order thinking skills, or Higher Order Thinking Skills. High Order Thinking Skills (HOTS) are applied following the low ranking of the Program for International Student Assessment (PISA) compared to other countries. This is marked by Indonesia’s rating in the 2018 PISA results which was received by the Minister of Education and Culture Nadiem Makarim on December 3, 2019. News reported by kompas.com showed that Indonesia was ranked 70 out of 78 countries that participated in the OECD with an average score 396. So to catch up with the lags, one of the efforts made was to increase the standard of National Examination questions in accordance with the standards set by PISA. The low level of high-order thinking skills of students in science subjects was also found in the USBN results at SD Negeri Purwokerto 01, where 84% of the errors in answering science questions were in reasoning and problem solving.

Teaching materials have an important role in improving students’ High Order Thinking Skills (HOTS) [5]. Teachers should be able to develop teaching materials according to student needs. So far, most teachers have only used books from the government and from other publishers as guides. We know that teaching materials are an essential component in learning that determines the quality of education [6]. Analysis of the development of integrated science teaching materials based on Higher order thinking skills (HOTS) is needed as an effort to improve students’ High-Level Thinking Skills [7]. Integrated science teaching materials are important to be developed in order to improve student learning outcomes of HOTS science.

2. Research Method

This study used a qualitative research method regarding the teaching material needs of grade VI elementary schools. Data obtained from literature study, documentation, interviews and the results of observations conducted at SD Negeri Purwokerto 01 regarding teaching materials used for learning. The data obtained relates to the local conditions of the school, analysis of teacher and student books, analysis of curriculum, analysis of student characteristics, and analysis of the importance of HOTS. The data obtained is used as a reference for developing teaching materials based on higher order thinking skills on the theme of saving sentient beings in elementary schools. The data analysis involved several steps, namely, data reduction, categorization, validity checkings, interpretation, and inferences.

3. Results and Discussion

3.1. Analysis of Local Conditions of Schools

This stage begins with literature studies and field studies to determine the needs of teaching materials according to teachers and students, which include: a) teacher and student responses to the teaching materials used, b) teaching material needs according to teachers and students. The results of this analysis can be seen in Table 1.
| Teacher and student responses to the teaching materials used | Analysis of teaching material needs according to teachers and students |
|------------------------------------------------------------|------------------------------------------------------------------|
| 1. Feasibility Content (Study Material)                     | 1. Teaching Material Needs According to the Teacher               |
| a. Textbooks based on curriculum content, Graduate Competency Standards, Core Competencies and Basic Competencies are in accordance with the 2013 Curriculum. However, there is material that should be separated from the theme book but is still incorporated into the theme book, namely material for mathematics and sport. | a. The teaching materials used must be able to attract both in terms of material and in terms of appearance so that students are motivated to read and learn them. |
| b. the material is difficult for grade VI students to understand because there are too few sources of information to read | b. in accordance with the curriculum applied in schools, namely the 2013 curriculum |
| 2. Presentation of the Material                             | 2. Teaching Material Needs According to Students                  |
| a. The science material presented in the textbook is not in depth. | a. the material is complete, compact and easy to understand |
| b. The textbook is not equipped with difficult vocabulary (glossary) | b. has an attractive appearance, using many colors |
| c. Evaluation questions in the textbook are only in the form of descriptions, there are no multiple choice questions yet. | c. has an interesting picture / illustration |
| 3. Graphics                                                 | d. there are many observation activities with pictures to make it more contextual |
| a. The use of fonts and font sizes in textbooks is good, but the pictures used are not many | |
| b. The paper and spacing in the textbook used are good enough, but the layout (layout) and appearance design are not neat. | |

The following is a description of Table 1:

3.1.1. Teacher and Student Responses to the Teaching Materials Used

Teacher and student responses to the teaching materials used in the implementation of the 2013 curriculum, namely student thematic books published by the Ministry of Education and Culture. The aspects used to obtain information from teachers and students about responses to the teaching materials used include the following components: (1) the appropriateness of the content (subject
matter); (2) presentation of the material; and (3) graphics. The following are the responses of teachers and students about the teaching materials used based on these three components:

1) Content Eligibility (subject matter)
Based on the teacher's response to the assessment of teaching materials provided by the government, namely: textbooks based on curriculum content, Graduate Competency Standards, Core Competencies and Basic Competencies are in accordance with the 2013 Curriculum. The scope of specific material for each subject is formulated based on the level of competence and competence core to achieve minimum graduate competence at certain levels and types of education [8]. Learning materials are knowledge, attitudes and skills that must be mastered by students in order to achieve the specified competency standards [9]. However, in reality there is a discrepancy in the thematic books that have been used. The discrepancies included material that should have been separated from the theme book but still incorporated into the theme book, namely PJOK and Mathematics so that the theme of integration was obscured. In addition, according to students, the material contained in thematic books provided by the government was difficult for grade VI students to understand because there were too few sources of information that could be read.

2) Presentation of the Material
According to the teacher's opinion, the science material presented in the textbook is not in depth. There are words that are difficult for students to understand, but the textbook is not equipped with difficult vocabulary (glossary). Evaluation questions in the textbook are only in the form of descriptions, there are no multiple choice questions yet. Multiple choice questions need to be held to train students to understand various forms of evaluation questions.

3) Graphics
The analysis of teaching material needs by teachers and students shows that the use of fonts and font sizes in textbooks is good, but the size of the letters in the source of the pictures used is too small so it is difficult to read. The paper and spacing in the textbook used are good enough, but the layout (layout) and appearance design are not neat.

3.1.2. Analysis of Teaching Material Needs According to Teachers and Students
1) The Need for Teaching Materials According to the Teacher
Based on the identification of teaching material needs according to the teacher, information is obtained about the teaching materials desired by the teacher, namely the ideal teaching materials must meet the following criteria: (1) the teaching materials used must be able to attract both in terms of material and in terms of appearance so that students are motivated to read and study it; (2) in accordance with the curriculum applied in schools, namely the 2013 curriculum; (3) following the times and practical to use; (4) teaches a caring attitude towards the environment and literacy in science and technology; (5) provide a lot of observation activities through pictures for students, especially science material.

2) Needs of Teaching Materials According to Students
Based on the results of interviews with students, the desired teaching materials should: (1) the material is complete, concise and easy to understand; (2) has an attractive appearance, using many colors; (3) has an interesting picture / illustration; (4) there are many observation activities with pictures to make it more contextual. The meaning of learning will be obtained when learning is based on context. Johnson (2009: 46) argues that contextual education directs thinking to experiences / when ideas are experienced and used in their context to have meaning [10].

Based on the findings above, it can be concluded that the teaching materials used so far are considered less effective in achieving learning objectives, so it is necessary to have teaching materials specifically designed for certain thematic materials. With this assumption, the development of integrated science teaching materials based on Higher Order Thinking Skills is offered on the theme of saving sentient beings in grade VI elementary schools which have specifications that are expected to increase the achievement of students' higher order thinking skills in science.

3.1.3. Analysis of Student Books and Teacher Books
Based on the analysis that has been done, there are several deficiencies in the teacher's and student's books, so that their implementation is still not optimal. These deficiencies include: (1) the science
material presented in the student book is still at a minimum (2) the content of mathematics and sport lessons is still integrated in the theme book, which should have been independent and separated from the theme book (3) the science material which is contained in the sixth grade student book on the theme of saving sentient beings, the sub-theme of My Friends' Animals has not fully facilitated students to improve higher-order thinking skills. One of the findings about the existence of deficiencies in the teacher's and student's books can be seen in the theme of saving sentient beings, the Animal My Friend sub-theme. The results of the analysis are as follows: (1) in the competence mapping in the Animal Friends sub-theme in learning 1 with the Basic Competence comparing the method of reproduction of plants and animals, there is a discrepancy with the contents of the questions in the student book, namely in the student book the questions contained are writing down the benefits of animal breeding in ovipar and vivipar (2) the competence 4.1 teacher book presents works on plant breeding, but in the sub-theme of 2 my best friend's animal book, there is an order to present works on animal breeding (3) on competence mapping and indicators for sub-theme Animal My friends learning 2 have competence and indicators of mathematics lesson content even though the content of mathematics lessons is independent and is not included in the theme book (4) on competence mapping and the indicators in the Animal Friends sub-theme contain competence and indicators of subject matter in sport where the content of sport lessons is also independent and should not be incorporated into the book theme, (5) s Besides that, in the science lesson content to explain how animals are reproduced in student books there is no stimulus or description of the material that can help students to improve higher order thinking skills.

3.1.4. Curriculum Analysis
The 2013 curriculum or often known as K-13, is a curriculum that is still implemented by the government to replace the Education Unit Level Curriculum (KTSP) which has been in effect for approximately 6 years. The 2013 curriculum entered its trial period in 2013 by turning several schools into experimental schools. In 2014, the 2013 Curriculum has been implemented in Class I, II, IV, and V while for Class VII and VIII Middle Schools and Class X and XI Senior High Schools, the 2013 curriculum has three aspects of assessment, namely the knowledge aspect, the skill aspect, and the attitude aspect or behavior.

The curriculum applied at SD Negeri Purwokerto 01 is the 2013 curriculum. This curriculum is implemented simultaneously in Tayu District in the 2019/2020 Academic Year. Based on the results of discussions with the principal of SD Negeri Purwokerto 01, he strongly supports the implementation of the 2013 curriculum. Basically, if it is carefully understood and applied seriously, the 2013 curriculum has many advantages, including: (1) students are more required to be active, creative and innovative in solving every problem they face in school; (2) teachers are required to be more active and creative in designing thematic learning activities; (3) there is an assessment of all aspects (cognitive, affective and psychomotor). Determination of grades for students is not only obtained from the test scores but also obtained from the values of politeness, religion, practice, attitudes and others; (4) the emergence of character education and character education which are very much needed by students and the nation to give birth to a generation that has good character and character. The 2013 curriculum is not completely perfect. Schools that implement the 2013 curriculum are required to use thematic books provided by the government. The lack of the teacher's ability to compile thematic material also disrupts learning activities.

3.1.5. Analysis of Student Characteristics
The analysis of student characteristics begins with observations made by the teacher to find the fundamental problems encountered in schools related to students. The basic problem obtained is in the form of student characteristic data used as the basis for developing learning tools. The learning tools will be used later when applying the developed teaching materials. Based on the results of observations, the characteristics of students that are often found are lack of motivation in learning, lack of high-order thinking skills of students, and lack of self-confidence. Other problems that are often encountered include the lack of cooperation between students, students rarely read books
because the books they have are not interesting. Attractive teaching materials are needed to motivate students' interest in learning.

3.1.6. Analysis of the importance of HOTS

HOTS is the ability to think that applies processing in activities to remember, restate or refer to something. HOTS is more synonymous with the level of practice questions and exams. HOTS is closely related to the 2013 curriculum. The 2013 curriculum aims to produce creative, critical and innovative people. The results to be achieved from the 2013 Curriculum are students who have high-order thinking skills. Therefore, in the subject matter and the test there are several questions with the HOTS level. Therefore, to improve the learning outcomes of natural science, students must have good higher-order thinking skills.

According to the National Center for Competency Based Training (2007), teaching materials are a set of written and unwritten materials used by teachers or instructors to carry out the learning process in the classroom [11]. Robertus Adi SarjonoOwono (2017) states that teaching materials are all materials (both information, tools, and texts) that are arranged systematically, which displays a complete figure of competencies that students will master and use in the learning process with the aim of planning and reviewing implementation. learning [12].

Good teaching materials are designed according to instructional principles. Teachers can write their own teaching materials that they want to use in learning activities [13]. In addition, teachers can also use textbooks or other materials and information that are already on the market to be repackaged or arranged in such a way that they can become teaching materials. Teaching materials are usually provided with guidelines for students and teachers. Useful guidelines to make it easier for students and teachers to use teaching materials.

Descriptive data in this study obtained from the results of literature studies, documentation, observation and interviews show that integrated science teaching materials based on Higher order thinking skills (HOTS) are indeed very necessary as an effort to improve students' higher order thinking skills. The results of previous research on the development of integrated science teaching materials show that the development results of teaching materials are needed for teachers and students, and are effective in improving student learning outcomes because the teaching materials developed are in accordance with learning needs [14].

4. Conclusion

Based on the results of the research and discussion that has been obtained above, it can be concluded as follows: 1) the results of the analysis of the local conditions of the school show that the 2013 primary school science teaching materials published by the government are still not sufficient to support the science learning process, especially to support learning that requires skills high level thinking students. HOTS-based supporting teaching materials are needed which are packaged in an attractive appearance. 2) there are discrepancies in the books used by teachers and students. The mapping of KD in the Animal Friend sub-theme has a discrepancy with the contents of the questions in the student book, namely in the student book the questions contained are writing down the benefits of animal breeding in ovi-oviparous. In the KD 4.1 teacher book presents works on plant breeding, but in the sub-theme of 2 my friend's animal book there is an order to present works on animal breeding. In addition, there are basic competencies and indicators for the content of mathematics and physical education lessons, even though the content of mathematics and physical education is independent and not included in the theme book, besides that in science subject content to explain how animals are reproduced in student books there is no stimulus or description of material that can help students to improve higher order thinking skills. 3) the curriculum used is the 2013 curriculum, which requires students to be active, creative and innovative in solving problems. 4) the characteristics of students that are often found are lack of motivation in learning, lack of high-order thinking skills, lack of self-confidence and students rarely read books because the books they have are less attractive. 5) HOTS is closely related to the implementation of the 2013 curriculum which aims to produce creative, critical and innovative people. The results to be achieved from the 2013 Curriculum are students who have high-order thinking skills. Therefore, in the subject matter and the test there are several questions with
the HOTS level. To improve learning outcomes in natural science, students must have good higher-order thinking skills. One effort that can be done is to develop teaching materials in accordance with the results of the needs analysis. The teaching materials needed and developed in this study are Integrated Science teaching materials based on High Order Thinking Skills / HOTS which are designed for teachers and students as an effort to improve the higher order thinking skills of grade VI elementary school students.

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