Problems Analysis in High School Biology Textbooks Based on Cognitive Domain of Bloom Taxonomy

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Abstract: The purpose of this study is to understand the consistency of questions in class X biology textbooks based on the types of Lower order thinking skills (LOTS) and Higher order thinking skills (HOTS). This descriptive study analyzed questions in high school biology textbook with publishers Erlangga and Prawira Intan. The results showed that the distribution of the LOTS cognitive domain for Erlangga i.e remembering (C1) of 3.75%, understanding (C2) of 95.4%, applying (C3) of 0.75%. Meanwhile, the appearance of the HOTS cognitive domain for Erlangga i.e analyzing (C4) of 70%, evaluating (C5) of 20%, and creating (C6) of 10%. In other publisher Prawira Intan, the LOTS category for C1 of 65.7%, C2 of 31.8%, C3 of 2.41%. The most HOTS cognitive domain in the book publisher Prawira Intan are C4 which is 66.6%, C5 of 20% , and C6 of 13.3%.

Keywords: problem analysis, Biology textbooks, cognitive domain, Bloom taxonomy.

Abstrak: Tujuan penelitian ini ialah memahami konsistensi soal pada buku teks biologi kelas X berdasarkan tipe Lower order thinking skill (LOTS) dan Higher order thinking skill (HOTS). Penelitian ini menggunakan jenis penelitian deskriptif kualitatif. Analisis soal dalam penelitian ini menggunakan buku teks biologi kelas X SMA/MA penerbit Erlangga dan Prawira Intan. Hasil penelitian menyatakan terdapat bahwa sebaran persentase kemunculan kategori ranah kognitif LOTS buku biologi kelas X penerbit Erlangga yaitu soal level C2 yaitu sebesar 95,4%, C1 sebesar 3,75%, C3 sebesar 0,75%. Kemunculan kategori HOTS dalam buku biologi kelas X penerbit Erlangga nilai sebesar C4 sebesar 70%, C5 sebesar 20%, C6 sebesar 10%. Pada buku penerbit Prawira Intan kategori LOTS dengan level C1 yaitu sebesar 65,7%, C2 sebesar 31,8%, C3 sebesar 2,41%. Sedangkan kategori ranah kognitif HOTS terbanyak dalam buku penerbit Prawira Intan yaitu level C4 sebesar 66,6%, C5 sebesar 20%, dan C6 sebesar 13,3%.

Kata kunci: analisis masalah, buku teks Biologi, domain kognitif, taksonomi Bloom.

▪ **INTRODUCTION**

Good teaching materials are needed to achieve learning objectives as effectively as possible because these teaching materials play an important role in the learning process as a medium for transmitting information. Good teaching materials facilitate learning that goes beyond a focus on scientific information.

Textbooks contain teaching materials about a particular field of science that contain learning materials and practice questions used by educators and students. Textbooks are usually the main component in teaching and learning activities because they are a reference for learning resources used in schools. Therefore, schools must consider the textbooks used to support learning outcomes. There are also questions in the textbook that must match the basic skills. A good question is a question that is in accordance with the purpose of the test and in accordance with the material being tested, the type of school and grade level, the type of questions and material being tested, the development of the students to be assessed. , and the competence of the questions with

the basic competence indicators of the test. Masduki, et al. (2013) confirmed that although BSNP has conducted a book feasibility study, there are still many shortcomings in the textbooks used in schools. One of them is the percentage of questions that students can use in the textbook. Therefore, it is very important to assess whether the questions in the subject textbooks have been able to advance students' understanding of various topics. cognitive capacity.

In the learning environment, the interaction between students, teachers, and learning resources is a learning process. In addition, learning is the support provided by teachers to students so that they can acquire knowledge and skills, develop morals and character, and form attitudes and beliefs. Because learning is an activity that has the goal of teaching students, learning is referred to as a system. Of course, teaching and learning activities have parts that are intact. A series of activities including many elements that interact with each other to form the learning process. When the teacher uses these elements in the activity process to achieve the intended goals.

Textbooks are materials that have been compiled by the authors in connection with relevant educational programs. Reading materials are characterized as books that must be used in schools and contain educational components to further develop character and character, the ability to understand science and innovation, and weaknesses according to the Regulation of the Minister of National Education Number 11 of 2005. experts or experts in their fields, as well as equipped with appropriate and compatible teaching facilities. The suitability of the contents of the textbook that affects students' understanding. In getting appropriate textbooks, teachers must be selective in choosing good or appropriate books to use (Febriyani, 2020).

Bloom's taxonomy principle is very useful for teachers in making questions and assessing students' abilities. Curriculum development, testing, and educational goals are all based on Bloom's taxonomy. Under Bloom's scientific categorization, learning targets are separated into two classes: lower-demand thinking skills (LOTS) and higher-demand thinking skills (HOTS). Higher demand thinking skills contain mental levels C1 and C2, namely understanding, applying, and remembering individually. The lower demand thinking ability test (LOTS) incorporates questions at this level (HOTS). combines mental levels C4 and C5, which are associated with investigation (examine), judgment (judgment), and development (C6) (make). (AA, J. 2016).

Low order thinking skills (LOTS) are the basic skills that must be acquired before students can achieve higher order thinking skills (HOTS). In the lower order thinking skills (LOTS), the most important thing is that the material can be remembered and understood. Remembering, Understanding, and Applying belong to lower order thinking skills (LOTS). Low-order thinking skills (LOTS) are not sufficient for teaching and learning processes. There must be high-level thinking skills (HOTS) in a teaching-learning atmosphere (Ahmad, 2018).

Before being modified, Bloom's taxonomy of cognitive domains includes six concepts. These six interpretations are derived from the descriptions of Degeng and Turmiji. The cognitive domain includes six classifications, including knowledge, which emphasizes remembering by exposing or identifying something that has been learned and stored in memory. Knowing and having the option to review words, definitions, realities, ideas, designs, arrangements, processes, central standards, and other data falls within this area. Comprehension, which emphasizes putting knowledge into an

understandable structure, is also included. Students must be able to understand the information presented in population pyramid drawings, tables, or population growth diagrams, as examples of this classification. Applications (applications) with learning objectives that use abstractions in specific and concrete circumstances Pressure to find solutions. At this level, a student is able to apply concepts, rules, formulas, methods, theories, etc. in an educational setting. Analysis (analysis) is the process of grouping information into more specific parts so that it can be understood its role, its relationship to the larger part, and the organizational structure of the whole part. Students must be able to break down the information given to them into smaller parts and evaluate the information to determine patterns or correlations. Synthesis is the combining of components to create a new and fresh whole. This is the learning result of synthetic classification. At the synthesis level, students will be able to describe the structure or pattern of a scenario and identify the facts or knowledge needed to achieve the desired outcome. The results of the evaluation (evaluation) are conclusions about the value of something for a particular purpose. In this lesson, students learn how to evaluate solutions, concepts, approaches, and other items using appropriate standards or criteria to ascertain their value in terms of efficacy or benefit.

A test is a tool or process that is used in a certain way and according to established guidelines to determine or measure something. Depends on the instructions given, such as wrong answers, doing assignments or taking orders, answering verbally, etc. The test, according to Sudjono, is an instrument of measurement and evaluation. On the other hand, according to Sudjana, tests are questions intended to elicit written, oral, or practical responses. From the above understanding, it is clear that the test referred to in the field of education is a method that can be used in the context of measurement and assessment. It can be a task or a series of tasks in the form of questions or orders that must be completed, so that values can be generated that describe a person's behavior or achievements and can be used to create a person's profile. In accordance with the organization of inquiry, there are two types of learning outcomes tests that are widely used by educators to survey student learning outcomes in schools: objective tests and exposition tests. Tests that are planned so that the results can be analyzed impartially are known as "objective tests." and consistent no matter who judges it. While essay or description tests ask candidates to respond to one or more questions with their own thoughts.

Previously, research related to problem analysis in books has been widely studied by other researchers such as (Suwarno, et al, 2022) who state that there is a need for development of learning models that improve decision-making strategies, and it is necessary to explore the decision-making process of pre-service and in-service mathematics teachers. -service in developing HOT problems. Research conducted by (Torres, et al, 2020) which states that in assessing activities using HOTS and LOTS. Further research conducted by (Qasrawi, et al, 2020) conducted research related to the analysis of Unlock English Reading, Writing, and Critical Thinking Skills Textbooks and found that most of the cognitive goals in the second edition belonged to both LOTS (Understanding) and HOTS (Analysis and Synthesis).) while the focus of the first edition is mainly on Understanding and Analysis. Crowe (2008) states that the application of BBT helps teachers to adjust teaching for the better and can improve students' mastery of the material. further research conducted by (Juhanda, et al, 2018)

which found that the realm of scientific scientific literacy of knowledge contained in class X BSE books was not evenly balanced so that the distribution of questions needed to be rearranged. The latest research is research conducted by (Abdelrahman, 2018) which states that there is a need for improvements to the questions in the textbook to cover the six levels of the new version of Bloom's Taxonomy and to train teachers and curriculum designers to use and write questions following the new version of the Taxonomy. Bloom.

From the explanation above, the writer conducts research related to the analysis of Problems in Class X Biology Textbooks Based on Bloom's Taxonomy at SMAN Se Padang Lawas Regency. The purpose of this review is to decide whether biology textbook questions are appropriate for secondary school students in terms of the types of Low-Level Thinking Skills (LOTS) and Higher-Order Thinking Skills (HOTS), as well as the answers of science educators to the questions the.

▪ **METHOD**

The research used is descriptive qualitative research and When the research lasted for six months from March to July 2022, it was carried out at State Senior High Schools throughout the Padang Lawas Regency. In obtaining the data the author uses data collection techniques in the form of observation, interviews and documentation. Informants in this study were teachers in the field of biology at the SMA/MA Sekabupaten Padang Lawas with interview grids using Teacher Ability, LOTS and HOTS type questions and the rules of writing questions. The instrument used in this study is a document analysis sheet marked with a check list and using several indicators contained in the cognitive realm of bloom taxonomy in the Lowder Order Thinking Skill (LOTS) and higher order thinking skills (HOTS) categories. For the data analysis technique, the writer uses 3 methods, namely data reduction, data presentation, and conclusion drawing/verification. The validity of the data that is triangulation. By comparing data from many sources, triangulation of data sources is used to evaluate the reliability of the data.

▪ **RESULT AND DISSCUSSION**

On the basis of the research that has been completed, the results of a series of studies that have been made have resulted in the emergence of the types of LOTS and HOTS questions in each category. Sample questions in biology textbooks (Intan Prawira publisher) are presented in Figure 1. Moreover, the number and percentage of occurrences of the LOTS and HOTS categories in all test questions contained in the text class X biology, calculated and displayed in the Table 1.

Figures 1. Prawira intan book questions

Table 1. The occurrence of the number of cognitive domains lower order thinking skill (LOTS) and higher order thinking skills (HOTS) in Erlangga

LOTS Category	Occurence	Total	Percentage %
Remembering (C1)	5	5	3.75%
Understanding (C2)	127	127	95.4%
Applying (C3)	1	1	0.75%
HOTS Category	**Occurence**	**Total**	**Percentage %**
Analyzing (C4)	28	28	70%
Evaluating (C5)	8	8	20%
Creating (C6)	4	4	10%

From analysis in Table 1, the percentage of occurrences of the lower order thinking skill (LOTS) cognitive domain category in the class X biology book, Erlangga publisher, is in the understanding category (C2), which is 95.4%. The second highest occurrence was in the remembering category (C1) with a percentage of 3.75%. The third highest occurrence is the category of applying (C3) with a percentage of 0.75%. Meanwhile, the highest percentage of occurrences in the category of higher order thinking skill (HOTS) in the Biology book class X publisher Erlangga is in the analyzing category (C4), which is 70%. The second highest occurrence was in the

evaluating category (C5) with a percentage of 20%. The third highest occurrence is in the category of creating (C6) with a percentage of 10%.

Table 2. The emergence of the number of cognitive domains about lower order thinking skill (LOTS) and higher order thinking skill (HOTS) in Prawira Intan

LOTS Category	Occurence	Total	Percentage %
Remembering	136	136	56.7%
(C1)	66	66	31.8%
Understanding	5	5	2.41%
(C2)			
Applying (C3)			
HOTS category	**Occurence**	**Total**	**Percentage %**
Analyzing (C4)	10	10	66.6%
Evaluating (C5)	3	3	20%
Creating (C6)	2	2	13.3%

Findings in Table 2. From the analysis display, the highest percentage of occurrences in the lower order thinking skill (LOTS) cognitive domain category in the biology book class X publisher Prawira Intan is in the remembering category (C1) that is equal to 65.7%. The second highest occurrence was in the understanding category (C2) with a percentage of 31.8%. The third highest occurrence is the category of applying (C3) with a percentage of 2.41%.cognitive domain higher order thinking skill in the class X biology book, Prawira Intan publisher, was in the analyzing category (C4), which was 66.6%. The second highest occurrence was in the evaluating category (C5) with a percentage of 20%. The third highest occurrence was in the category of creating (C6) with a percentage of 13.3%.

The class X biology textbook published by Erlangga contains 133 questions for 40 questions for the classification of high-demand thinking skills and 40 questions for the area of low-level reasoning ability (LOTS) (HOTS), according to the analysis of cognitive questions. These questions have been modified by the researcher and approved by the validator to be included in that category. Biology course X published by Prawira Intan in the lower order thinking skill (LOTS) category found 207 questions and the higher order thinking skills as many as 15 questions. The LOTS questions are classified into 3 operational verbs, explicitly regarding review (C1), awareness (C2), and application (C3). assess (C5), make (C4), and break down (C4) are three action words that can be applied (C6)—used to categorize HOTS questions (C6). The questions that have been adjusted and validated in the class X biology textbook published by Erlangga type Remember are lower demand thinking skills (LOTS) in this sentence (C1) found as many as 5 questions with a percentage of 3.75% Furthermore, for the questions that have been adjusted and validated with the understanding category (C2) found as many as 127 questions with a percentage of 95.4% and for questions that have been adjusted and validated with the applying category (C3) consists of 1 question with a percentage of 0.75%. And the higher order thinking skill (HOTS) type with the analyzing category (C4) was found as many as 28 questions with a percentage of 70%. adjusted and validated with the category of creating (C6) consisting of 4 questions with

a percentage of 10%. While the questions that have been adjusted and validated in the class X biology textbook published by Prawira Intan type lower order thinking skills (LOTS) with the category of remembering (C1) were found as many as 136 questions with a percentage of 65.7%. understanding (C2) found as many as 66 questions with a percentage of 31.8% and for questions that have been adjusted and validated with the category of applying (C3) consists of 5 questions with a percentage of 2.41%. Furthermore, the high-demand thinking ability examination class (HOTS) (C4) found 10 questions with a percentage of 66.6%. Furthermore, for questions that have been adjusted and validated with the evaluation category (C5), there were 3 questions with a percentage of 20% and for questions that has been adjusted and validated with the category of creating (C6) consisting of 2 questions with a percentage of 13.3%.

Similar to the research conducted by Asadin (2021) that the overall BSE (books A to book H) analyzed gave rise to 4 cognitive processes, namely the process of remembering, understanding, applying, and analyzing. Based on this research, it shows that the questions on the biology competency test in books A to H contain 42.93% of cognitive processes Remembering (C1), 41.24% understanding (C2), 9.03% application (C3), 6.77% analyzing (C4) and 0% each for evaluating (C5) and creating (C6. In addition, research conducted by Amarulloh (2014) found that biology SNMPTN questions based on the cognitive domain of Bloom's taxonomy were dominant in developing questions with the C2 category (understanding). 62.22%, C1 (remembering) 24.45%, and C3. Based on the results obtained from the number and percentage of questions that have been calculated, it is known that the cognitive questions in the class X Biology textbook contain some cognitive questions.the

Research findings, class X biology texts are used by high school seniors in the district of Padang Lawas, yes ng consists of 2 two SMAN in learning has included questions of higher order thinking skills in each chapter of the competency test contained in the Biology textbook. The analyzed questions have been stated according to each category indicator contained in memorizing, understanding, and applying at lower and higher levels (analyzing, evaluating, and creating). This is in line with the National Education Standards Agency (BSNP) guidelines which state that textbook questions must accurately reflect the subject matter in each chapter, vary in complexity to assist in the development of basic skills, and include questions. - Practice questions that can train and demand low-level and high-level thinking from students.

Agreeing on the findings of the meeting with state high schools, the class X science instructor in the district of Padang Lawas, stated that the scientific mastery possessed by the teacher related to the types of LOTS and HOTS questions was unquestionable. This can be seen from his explanation which says that LOTS and HOTS are learning that includes students so that they are able to produce critical thinking and skills and are evaluated based on the questions that are selected for assessment in learning in order to produce maximum learning outcomes and achievements for students. . He correctly stated that the explanation was because he had attended a basic training related to the 2013 curriculum and the implementation of learning that supported student skills. Where the training also discussed the application of LOTS and HOTS category questions to achieve student learning outcomes. Therefore, the knowledge possessed by the teacher about the types of HOTS questions is very good, so that it contains the teacher's understanding with the validation results from the cognitive

analysis sheet on the Biology textbook for class X based on the LOTS and HOTS types that have been synchronized and deserve to be described. According to Widodo (2006), the lack of teacher questions that require higher-order thinking shows that learning in schools has not trained students to develop higher-order thinking and reasoning. According to Arikunto (2012), the teacher's habit of making questions will be remembered by students that teacher A or B are accustomed to using easy, medium or difficult questions. This can cause students not to want to learn when they know the teacher often makes easy questions or vice versa students will study hard when they know the teacher often makes difficult questions.

Based on the teacher's response, he stated that the cognitive questions in the Biology textbook for class X had followed the guidelines for writing questions that were effective, accurate, and the questions that were part of it followed the indications and competencies contained in the curriculum. Because some of the questions in the Biology textbook for class X are both questions that require the teacher to add that the book of questions is intentionally filled as a medium and a means to assist students in improving their reasoning abilities in the space for high demand thinking capacity (LOTS) and low demand thinking capacity (LOTS).). This supports the case of Suci et al. that reading materials used in schools by students are still used as often as possible in developing experiences and are used as media that can prepare LOTS and HOTS because through textbooks containing LOTS and HOTS. can cultivate students who are dynamic, imaginative, fundamental thinking, and practice one of the 21st century skills that must be possessed by students, especially low-level reasoning abilities and high-demand thinking skills.

- **CONCLUSION**

Based on the results of data analysis and discussion of research results that have been obtained in the field, the researchers concluded that the analysis of cognitive problems in biology textbooks for class X based on Bloom's taxonomy at SMAN throughout the district of Padang Lawas has been declared valid and agreed by the validator. The teacher's response also stated that the cognitive questions in the Biology textbook for class X were in accordance with the rules of writing good and correct questions and the questions included were in accordance with the indicators and competencies contained in the curriculum.

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