# ANALYSIS OF SCIENCE LITERACY COMPONENTS IN TWELVE GRADE BIOLOGY TEXTBOOKS ON GROWTH AND DEVELOPMENT MATERIAL

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*Abstract*

*Science literacy is a form of scientific knowledge and skills possessed by a person to identify a question, obtain new knowledge, explain scientific phenomena. This study aims to analyze the content of biology textbooks in science literacy on growth and development material in grade twelve of SMA/MA. The research was conducted using a qualitative approach with the content analysis method. Analysis of science literacy components was carried out after obtaining book data. Data collection in the research on the analysis of science literacy components in biology textbooks of class eleventh grade of SMA / MA was carried out by means of surveys, observations and documentation. The percentage results between the comparison of 2 science literacy books, the first book with 18 points is at a percentage of 53% (very good category) while the second book with 16 points is at a percentage of 47% (good category). The two books do not have too much difference in content, it's just that it takes a good understanding to digest the contents of the purpose of each book in presenting the material.*

*Keywords: Biology Textbooks, Scientific Literacy, Qualitative*

## 1. INTRODUCTION

Books have an important role in the learning process and the development of knowledge. Science, information, and entertainment can be obtained from books, therefore, books are a mandatory component that must exist in educational institutions both formal and non-formal educational institutions. School textbooks have an important role in learning, so in the preparation of a textbook there must be several rules that must be met by a textbook writer. These rules have been discussed in detail by the National Education Standards Agency (BSNP), which is a body tasked with assessing the feasibility of using a textbook. The importance of books in the world of education has not been a serious concern of various parties who care about the world of education. A research conducted by Sri Redjeki (Jamaludin, 2009) shows that the books consumed by Indonesian students are 50 years behind the latest developments in modern science. Textbooks used in schools must have correct content, systematic presentation, good language use and readability, and functional graphics.

The issue of education is one of the concerns of the Indonesian government. This is outlined in the 4th goal of the 17 Sustainable Development Goals. The goal is to achieve

quality education. One of the policy directions to be implemented from 2020 to 2030 is to improve the quality of teaching and learning so that students acquire basic skills, critical thinking skills, have values and personal character to become productive citizens by implementing the curriculum by strengthening teaching that focuses on mathematics, literacy and science at all levels, and strengthening character education, ethics, religion, and citizenship (Ministry of National Planning and Development: 2019).

An understanding of science is required in the context of science literacy. Therefore, this science literacy cannot be separated from the role of students' reading literacy. However, after being evaluated, the average number of the National Alibaca Index in 2019 fell into the low literacy activity category (Solihin et al., 2019). This is one of the factors that affect the quality of science literacy in Indonesia. In addition, other factors that can affect the quality of Indonesia's science literacy can also be related to the ongoing education process such as the education system applied, the selection of models, approaches to learning methods and strategies, selection of learning resources, learning styles of students, learning infrastructure and other factors (Sandi, Setiawan, & Rusnayati, 2013). One of the factors that cause low levels of science literacy is the selection of learning resources. Learning resources are all sources such as messages, people, materials, tools, techniques, and settings that students utilize as a source for learning activities and can improve the quality of their learning (Jonassen, 2015). One of the learning resources for students is the use of textbooks. Textbooks are one of the learning media used and become a mandatory reference for use in primary and secondary education units or universities (Ginting, 2018). In developing countries, textbooks play an important role in the learning process, adjusting to the curriculum and learning instructions carried out (Chiappetta et al., 1991).

Science literacy is important to be used as a reference in the process of preparing books as learning resources in schools. However, textbooks that discuss in detail the components of science literacy are still rare. The percentage for the number of journals that contain discussions about science literacy based on learning resources in Indonesia in 2009-2017 is 5.15% (Ni'mah, 2019). Therefore, analyzing the condition of textbooks in circulation is considered very important, especially if the textbook is related to science literacy (Sandi, Setiawan, & Rusnayati, 2013).

Textbooks based on Permendiknas No. 2 Article 1 of 2008 are mandatory reference books for use in primary and secondary education units or tertiary institutions that contain learning materials in order to increase faith, piety, noble character, and personality, mastery of science and technology, increase sensitivity and aesthetic abilities, increase kinesthetic and health abilities prepared based on national education standards. In addition, the definition of a textbook is a book that is systematically arranged to support the teaching and learning activities of students at school which contains learning materials and practice questions (Rahmawati, 2015). According to the Center for Bookkeeping (2003), textbooks are one of the sources of knowledge for students in schools which is a means that greatly supports the process of teaching and learning activities. Some of these definitions lead the author to the definition of textbooks in this study. Textbooks are mandatory reference books used by students that contain materials and questions that support learning activities in schools that are prepared based on national education standards. national education standards.

Textbooks or textbooks or in English are often referred to as textbooks cannot be separated from their important role. The role can be felt directly by the learning actors, namely for students and educators. For students, textbooks play a role in facilitating

independent learning activities, while for students textbooks play a role in providing assistance for educators in presenting the material to be delivered (Suryaman, 2006). In addition, Sunarko (in Banowati, 2007) explained that the benefits of the existence of textbooks used in the school concerned include increasing attention and motivation to learn, providing variety in learning, providing a structure that facilitates the learning process, presenting the core of learning information, providing more concrete examples, stimulating analytical thinking, and providing a learning situation without pressure. From some of these explanations, it can be concluded that textbooks provide a very important role for the continuity of teaching and learning activities.

Biology textbooks as one of the science books must meet the assessment criteria in terms of content, presentation and linguistic feasibility (BSNP, 2014). Aspects of content feasibility are related to the depth and breadth of discussion of science material, accuracy of material related to concepts, facts, theories, laws and methods, currency, containing productivity insights, stimulating curiosity, developing life skills, sense of diversity, and contextual insights. The linguistic aspect relates to the writing style or text writing and the presentation and graphical aspects relate to presentation techniques related to the conciseness and systematic presentation of concepts and materials, supporting presentations in the form of illustrations, images, diagrams or correct science charts, and the presentation of learner-centered learning and can stimulate learner feedback and invite active learners in science learning (Ariningrum, 2013). Biology textbooks must also be designed according to the applicable curriculum and always developed in quality. This is because books designed in accordance with the applicable curriculum and developed with a new paradigm make the learning process in the right direction (Aqil, 2017). Science textbooks should be written by controlling the text they write and always presenting science as a dynamic science, science as an experiment rather than just a collection of facts and terms. And built by including material that triggers science process skills by doing science (learning science, learning about science, and doing science) which plays a role in decision making in the daily lives of students (Adisendjaja & Romlah, 2007).

Chiappetta, Fillman & Sethna (1991b) in A Quantitative Analysis of High School Chemistry Textbooks for Scientific Literacy Themes and Expository Learning Aids mentioned several categories to analyze science textbooks as follows:

1. Science as a body of knowledge 2.
   This category is used if the purpose of the text in the analyzed book is:
   a. Present facts, concepts, principles and laws.
   b. Presenting hypotheses, theories and models.
   c. Asking students to recall knowledge or information.
2. Science as a way of investigating
   This category is used if the purpose of the text in the analyzed book is:
   a. Requires students to answer questions through the use of materials.
   b. Requiring students to answer questions through the use of graphs, tables, etc.
   c. Requires students to make calculations.
   d. Requiring students to explain answers
   e. Involving students in experiments or thinking activities.
3. Science as a way of thinking.

Science is a human activity characterized by a thought process that occurs in the mind of anyone involved in it. The work of scientists related to reason, illustrates human curiosity and their desire to understand natural phenomena. Each scientist has attitudes, beliefs and values that motivate them to solve the problems they encounter in nature. Scientists are driven by immense curiosity, imagination, and thought in their investigations to understand and explain natural phenomena. Their work is manifested in creative activity where ideas and explanations about natural phenomena are constructed in the mind. This category is used if the purpose of the text in the analyzed book is:

    a. Describe how a scientist conducts an experiment.
    b. Show the historical development of an idea.
    c. Emphasizes the empirical nature and objectivity of science.
    d. Illustrates the use of assumptions.
    e. Shows how science proceeds by inductive and deductive reasoning.
    f. Provides cause and effect relationships.
    g. Discussing facts and evidence.
    h. Presenting scientific methods and problem solving.

4. Interaction of science, technology, and society.

This category is used if the purpose of the text in the analyzed book is:

    a. Describing the usefulness of science and technology for society
    b. Showing the negative effects of science and technology for society
    c. Discuss social problems related to science or technology, and
    d. List careers and jobs in science and technology.

Science literacy is a form of scientific knowledge and skills possessed by a person to identify a question, obtain new knowledge, explain scientific phenomena, and draw conclusions based on facts, understand the characteristics of science, awareness or literacy of science and technology in shaping the natural, intellectual and cultural environment and willingness to engage and care about science-related issues. literacy

Science literacy has principles. This principle will be used as a guideline for making science literacy-based YouTube content media. The basic principles of science literacy1 are as follows.

1. Contextual, meaning in accordance with local wisdom and the times;
2. Fulfills social, cultural and state needs;
3. In accordance with learning quality standards that are aligned with 21st century learning;
4. Holistic, meaning total and comprehensive (Ernawati, 2016) and integrated with various other literacies;
5. Collaborative, meaning cooperation skills (Djoko Apriono, 2013); and
6. Participatory, meaning taking part in an activity.

Science literacy has indicators. The indicators of science literacy can be seen in the following table The following table:

**Table 1. Science Literacy Indicators**

| No. | Science Literacy Indicators |
| --- | --- |
| 1. | Science Process: |
| | 1) Explaining Science Phenomena |
| | 2) Using Science Evidence |
| | 3) Identifying Scientific Questions |
| 2. | Science Content: Understanding Scientific Content |
| 3. | Scientific Context: Problem Solving |

In measuring science literacy, there are three indicators of science literacy. They are science content, science process, and science application context. The indicators of science literacy are as follows.

1. Science Literacy Content. In this dimension, learners need to grasp a number of key or essential concepts to be able to understand certain natural phenomena and changes that occur due to human activities.
2. Science Literacy Process. The process of science literacy requires learners to be able to use scientific knowledge and understanding, such as the ability to find, interpret and treat evidence.
3. Science Literacy Context. The context of science literacy emphasizes application in everyday life rather than in the classroom or laboratory. Science literacy in the context of science also involves issues related to events that occur in life such as the example of someone who cares about science around his life (Saka, 2019). From the scope of the three science literacy indicators, the one that is in accordance with the science literacy-based YouTube content media developed by the researcher is the science context indicator because in the development of this YouTube content video there are daily life applications such as Growth and Development.

## 2. RESEARCH METHOD

The research employed a qualitative approach utilizing the content analysis method. The selected textbooks for analysis were the twelfth-grade textbooks "Active and Creative Learning Biology" by Manickam Bala Subra Maniam Yusa and "Biology" by Nunung Nurhayati, Yati Unayah, Basuki Prayitno. The specific topic chosen for analysis was Growth and Development, given its direct relevance to human experiences in everyday life. The assessment of science literacy components commenced subsequent to the acquisition of book-related data. Data collection for this study, which focused on analyzing science literacy components in eleventh-grade biology textbooks, encompassed surveys, observations, and documentation as the primary research methodologies.

## 3. RESULT AND DISCUSSION

### 3.1. Results

From the results of the analysis of SMA / MA biology textbooks conducted to determine the level of science literacy in Biology textbook class XII SMA. This textbook was chosen in accordance with the modern curriculum 13 and this book is very widely used by public schools because of the completeness of the material that can be used as a reference for learning that provides maximum learning outcomes. Science literacy has indicators. The indicators of science literacy can be seen in the following table:

**Table 2. Analysis of Book 1**

| No. | Science Literacy Indicators | Score | | | |
|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 |
| 1. | Science Process:<br>1) Explaining Science Phenomena | | | | √ |
| | 2) Using Science Evidence | | | | √ |
| | 3) Identifying Scientific Questions | | | √ | |
| 2. | Science Content:<br>Understanding Scientific Content | | | | √ |
| 3. | Scientific Context:<br>Problem Solving | | | √ | |

**Description:**

1 = not enough with weight (1- 2.0)

2 = sufficient with weight (2.1 - 3.0)

3 = good with weight (3.1 - 4.0)

4 = very good with weights (4.1 - 5.0)

This instrument is measured using the formula:

$$\text{Literacy Category} \quad \frac{\sum \text{Indicators by category}}{\sum \text{indicators Total Category}} \quad \text{X Number of Assesment Aspects}$$

With the following calculation:

$\frac{18}{20}$X 5 = 4.5 (the book is categorized as a "very good" book in the teaching and learning process on 20 science literacy).

**Table 3. Analysis of Book 2**

| No. | Science Literacy Indicators | Score | | | |
|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 |
| 1. | Science Process:<br>1) Explaining Science Phenomena | | | | √ |
| | 2) Using Science Evidence | | | | √ |
| | 3) Identifying Scientific Questions | | | √ | |
| 2. | Science Content:<br>Understanding Scientific Content | | | √ | |
| 3. | Scientific Context:<br>Problem Solving | | √ | | |

**Description:**
1 = not enough with weight (1- 2.0)
 2 = sufficient with weight (2.1 - 3.0)
3 = good with weight (3.1 - 4.0)
4 = very good with weights (4.1 - 5.0)
This instrument is measured using the formula:

$$\text{Literacy Category} \quad \frac{\sum \text{Indicators by category}}{\sum \text{indicators Total Category}} \quad X \text{ Number of Assesment Aspects}$$

With the following calculation:
$\frac{16}{20}$ X 5 = 4.0 (the book is categorized as a "good" book in the teaching and learning
process on literacy science literacy).
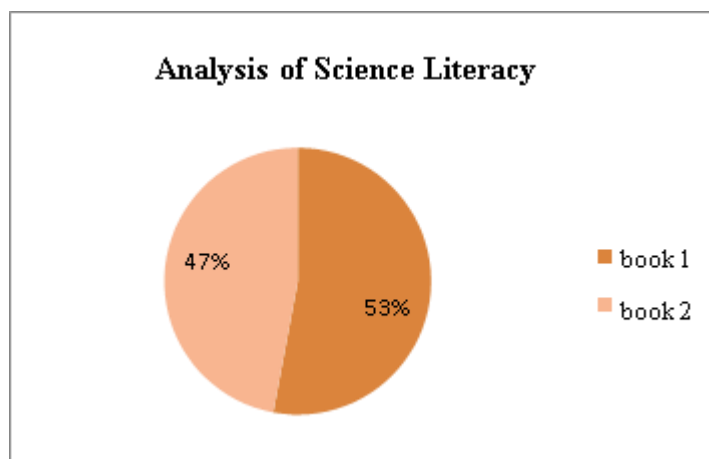


**Figure 1. Comparison of analysis in each book**

**3.2. Discussion**
In the results of research that has been carried out in science literacy, it can be explained that the two biology books for class XII SMA / MA that researchers review from science literacy indicators have a good level of book category. Both in terms of explaining science scientifically and its contribution in studying lessons to be more enjoyable by students and students.

The book reviewed from growth and development material in class XII SMA / MA is very often used by teachers and is most widely used in public and private SMA / MA schools. By applying the K-13 curriculum, students and students are required to be more active than teachers to better understand biological material, so that the learning process can run according to their interests and learning outcomes can be achieved optimally.

Judging from the first book whose content is superior to the second book. Then the first book can be a very good and relevant reference from the second book. Which is where the first book has skills in the Science process that explain about science phenomena with (4 points) very good, as for the source of the scientific book with (4

points) very good, as well as the identification of scientific questions has (3 points). identification of scientific questions has (3 points) good. As for this book which is assessed from its science content in understanding the phenomena of growth and development material, it has (4 points) which is very good, and the existence of problem-solving assessments in solving cases of growth and development material with (3 points) which is good. So, if you add up all the points on each indicator according to the formula described the total points are 4.5 which is where this biology book is a "very good" category book. Because it has met the requirements of science literacy that can be applied to the learning process by teaching staff such as teachers and can be used as an additional reference as teaching material for any researcher who wants to carry out research on the theme of "education".

The second book has content that is no less good than the first book, but the first book is still superior to the second. Which is where this second book in terms of its science process indicators by explaining scientific phenomena is very good at explaining it in growth and development material with (4 points) very good. The scientific evidence submitted in the book is also very much referenced so that it can get (4 points) which is very good, but the identification of scientific questions is not so emphasized in growth and development material but the assessment can be given with (3 points) which is good. In the context of science, namely in scientific phenomena, it is categorized (3 points), which is good by presenting the discourse of growth and development in summary and this book in solving problems gets (2 points) because this book has not found many clues or signs in exploring the material so it needs references such as additional teacher explanations and online media such as the internet. So, if adding up all the points on each indicator according to the formula described the total points are 4.0 which is where this biology book is a "good" category book with a total of 3 points overall. So that this book is also said to be able to be the science literacy of students because this book has been very used by many public and private schools and it can be said that teachers must also be more active in teaching students to be able to better understand Biology lessons so that lessons can run with fun and get maximum results.

In the percentage that has been described in the results of the discussion, it can be seen that the first book has 53% with a "very good" category in the class XII Biology book used by teachers in teaching at SMA / MA and the second book is no less good with a percentage of 47% with a "good" category, this book is also widely used by teachers as teaching material to add value to the learning outcomes of students to the maximum.

## 4. CONCLUSION

From the results of the two books that can be used as science literacy, we know that these two books are very capable of providing a good presentation for growth and development material in Biology Subjects of 12th grade high school. Including in public and private schools. Both of which both have good quality education according to the teachings in their schools. The percentage results between the comparison of 2 Science literacy books, the first book with 18 points found with a percentage of 53% (Very good category) while the second book with 16 points found with a percentage of 47% (Good category). The two books do not have a very far difference in content, it only takes a good understanding to digest the contents of each book's purpose in presenting the material.

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