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ANALYSIS OF 7TH GRADE SCIENCE TEXTBOOKS ON THE MATERIALS "ECOSYSTEMS AND THEIR CONSERVATION" AND "SOLAR SYSTEM" FROM A SCIENTIFIC LITERACY PERSPECTIVE

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ABSTRACT

This study investigates how scientific literacy components are embedded in seventh-grade science textbooks based on PISA indicators. This study employed a qualitative descriptive design with content analysis techniques. The study analyzed three textbooks published by the Ministry of Education and Culture (2021), Erlangga (2023), and Yrama Widya (2024), selected through purposive sampling. Data collection focused on the chapters "Ecosystems and Their Conservation" and "Solar System," which were examined using instruments measuring four aspects of literacy: context, competence, knowledge, and attitudes. The analysis showed that all textbooks addressed these aspects with varying degrees of integration. Yrama Widya's textbook achieved the highest level of inclusion (81–100%, in the excellent category), while the books from the Ministry and Erlangga were in the adequate range (41–61%). Across textbooks, competencies were most prominent (33%, 41%, 37%), context was moderately integrated (34.5%, 38.8%, 29.4%), knowledge was unevenly distributed (9.1%, 10.2%, 21.6%), and attitudes were least emphasized (21.8%, 10.2%, 11.8%). Overall, scientific competencies dominated, while aspects of epistemic knowledge remained absent. These findings highlight the need for more contextual and exploratory textbooks that can strengthen students' scientific reasoning in the 21st century.
Keywords: content analysis; science literacy; science textbooks

INTRODUCTION

In today's era, scientific literacy is a fundamental aspect of education because it plays a role in shaping students who are able to think critically, creatively, and innovatively in accordance with the demands of 21st-century skills (Sibarani *et al*., 2019). Scientific literacy refers to the ability to understand scientific concepts and facts, relate them to technology and social life, and then use them to solve problems in real-world contexts (Pratiwi *et al*., 2019). The urgency of strengthening scientific literacy is evident in the results of the 2022 PISA (Philosophy of International Student Assessment): Indonesia's average score of 359 in reading and 383 in science, still below the average for OECD countries. This situation underscores the need for learning that places greater emphasis on understanding, reasoning, and applying science in everyday life (Solihin *et al*., 2024; Elim *et al*., 2024).

Scientific literacy encompasses not only conceptual understanding but also the competency to explain phenomena scientifically, evaluate and design scientific investigations, and interpret data and evidence logically (Nofiana & Julianto, 2018). This definition aligns with the PISA framework, which emphasizes students' ability to use scientific knowledge to address real-world problems. Scientific literacy also contributes to supporting 21st-

century skills, particularly C4 domains such as problem-solving, critical thinking, communication, and collaboration (Selamat, 2021). Therefore, the relationship between scientific literacy and 21st-century skills is crucial for preparing students to face the complexities of modern life (Pertiwi *et al*., 2024).

Strengthening scientific literacy in schools is influenced by the learning process and teaching materials used. Textbooks are influential learning media because they serve as the primary reference in teaching and learning activities (Tolingguhu *et al*., 2024). Textbooks are printed teaching materials that contain structured and logical material to support the achievement of learning objectives (Daryanto, 2011: 49). However, Adisendjaja and Romlah (2007) stated that teachers and students tend to rarely reanalyze the information in textbooks, so the contents are often accepted at face value. This situation can lead to learning that is more oriented towards memorization, rather than fostering reasoning and scientific work.

Teaching materials play a crucial role in improving scientific literacy skills, and textbooks should help students understand concepts, practice critical thinking, and relate knowledge to everyday phenomena (Zakiyah *et al*., 2017; Jayadi, 2022). However, textbooks often undergo changes to adapt to the curriculum, so their quality needs to be reviewed regularly to maintain alignment with learning objectives and adequately incorporate aspects of scientific literacy. Informative, conceptual, interactive, and exploratory learning strategies can support scientific literacy, and textbooks should facilitate this through real-world contexts, investigative activities, and data-based reasoning exercises (Luzyawati & Lissa, 2020; Mauliya Lorenza, 2025).

Ideally, textbooks help improve scientific thinking skills. However, many textbooks remain textual and do not promote conceptual understanding and application of science. Therefore, improvements are needed to achieve ideal scientific literacy in students (Hasibuan & Sani, 2021). This indicates a gap between science learning objectives and the content of the textbooks used. Therefore, textbook analysis is crucial to ensure that the material not only presents scientific facts but also fosters critical thinking and scientific skills in line with 21st-century demands (Wulandari & Cintamulya, 2022).

Previous research indicates that the integration of scientific literacy in textbooks is still limited. Safitri *et al*. (2022) found that scientific literacy aspects in sixth-grade elementary school thematic textbooks were still low. Kartikasari (2022) also demonstrated an imbalance in scientific literacy aspects in seventh-grade science textbooks, with the knowledge aspect dominating (62%), while the scientific inquiry and science-technology-society context dimensions accounted for only 9–14%. These findings reinforce the need for a more specific study of textbooks used in junior high schools/Islamic junior high schools.

Based on this urgency, this research focuses on the chapters "Ecosystems and Conservation" and "Solar System" because both are core materials in Phase D Science (Junior High School/Islamic Junior High School) in the Independent Curriculum and are relevant for linking science concepts to life phenomena, environmental issues, and scientific reasoning (Kemendikbudristek, 2022). According to Khairrunisa *et al*. (2025), the implementation of Ecosystem

and Conservation material yielded excellent results, with all learning activities achieving optimal results for the application of scientific literacy. Similarly, the implementation of the Solar System material in scientific literacy-based learning yielded excellent results (Cahyani & Sari, 2023). Given these characteristics, these two chapters have strong potential to train students' scientific literacy through conceptual understanding, use of evidence, and science-based decision-making in real-world contexts.

Furthermore, this analysis is even more relevant because textbooks remain the primary learning reference; several studies report that approximately 90% of science teachers use textbooks as a reference in their teaching (Fakhri & Herlanti, 2025). Therefore, a more ideal and scientific literacy-oriented textbook is needed to serve as a more effective learning guide for students and improve the quality of science learning. Based on this description, researchers conducted a study entitled "Analysis of Grade 7 Science Textbooks on the Materials 'Ecosystems and Their Conservation' and 'Solar System' from the Aspect of Scientific Literacy."

METHOD

Research Design

This study utilised a qualitative descriptive approach with content analysis to examine the extent to which Grade VII science textbooks support the development of science literacy, as defined by PISA. The research design can be seen in Figure 1.

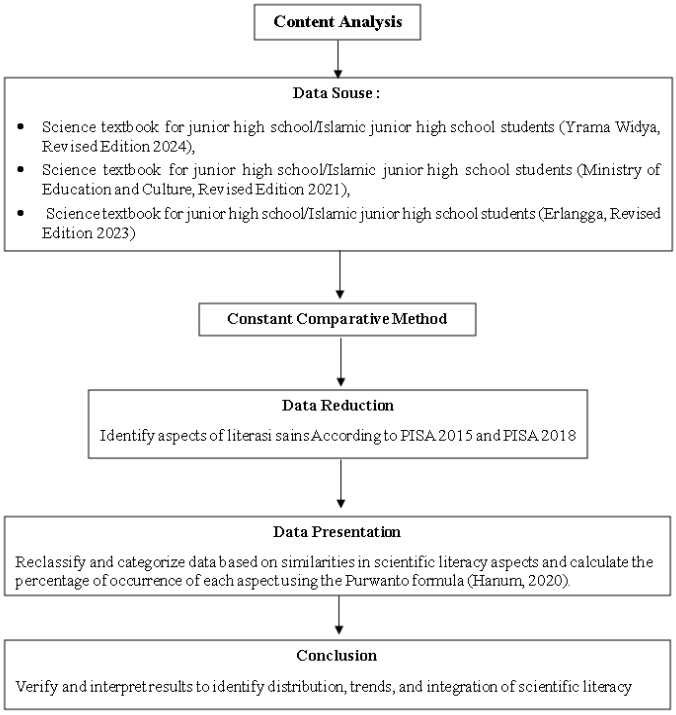


Figure 1. Research Design. *Source: Researchers (2026)*

Data Source

The research sources consisted of three science textbooks for seventh-grade junior high school students: Science Textbooks for Grade VII Junior High School/Islamic Junior High School published by Yrama Widya (Revised Edition 2024), the Ministry of Education

and Culture (Revised Edition 2021), and Erlangga (Revised Edition 2023). The third book was chosen because it represents learning resources commonly used in schools: the Ministry of Education and Culture's book as a national reference, Erlangga's book which is often found in schools, and Yrama Widya as a private publisher.

Data Collection Techniques

Data collection techniques were carried out through observation and documentation methods. Observation was conducted by examining the contents of textbooks, while documentation took the form of data collection from seventh-grade science textbooks. The selection of books was based on their level of use in SMP/MTs, then chapters from the odd semester and pages were taken systematically. The instrument in the form of a table of PISA 2015 & PISA 2018 scientific literacy indicators was used to analyze the contents of the book (OECD, 2016, 2019).

Table 1. Indicator Science Literacy

		Science Literacy Aspects	Kode
Context	**Context - Personal**	Health maintenance, accidents, nutrition	KP1
		Personal use of natural resources (e.g. fuel)	KP2
		Environmentally friendly actions, waste and rubbish management	KP3
		Lifestyle and associated risks	KP4
		Scientific aspects of hobbies, technology, music, and sports	KP5
	Context - Local	Disease control, food selection, and health communities	KL1
		Population maintenance, quality of life, safety, food distribution, and energy supply	KL2
		Population distribution, waste disposal and environmental impact	KL3
		Rapid and gradual natural disasters (earthquakes, erosion, etc.)	KL4
		New discoveries: genetic modification, health and transportation technology	KL5
	Context - Global	Epidemics and the spread of infectious diseases	KG1
		Renewable and non-renewable natural resources, population growth, species utilisation	KG2
		Biodiversity, sustainable ecology, pollution, biomass/soil	KG3
		Climate change and the impact of modern communication	KG4
		Species extinction, space exploration, structure of the universe	KG5
Competence	**Competence - Explaining Phenomena Scientifically**	Recalling and applying scientific knowledge	KF1
		Identifying, using and generating models/representations	KF2
		Making predictions and sound reasoning	KF3
		Generating hypotheses that explain phenomena	KF4
		Explaining the application of science in society	KF5
	Competency - Evaluating and Designing Scientific Investigations	Identifying scientific questions	KE1
		Proposing methods of scientific exploration	KE2
		Evaluating exploration and assessing the objectivity of data	KE3
	Competency - Interpreting Data and Evidence Scientifically	Converting data between representations	KD1
		Analysing data and drawing conclusions	KD2
		Identifying assumptions, evidence and reasoning in texts	KD3
		Distinguishing between scientific and non-scientific arguments	KD4
		Supporting arguments with scientific sources	KD5
Knowledge		The relevance of facts in everyday life	PK1

	Knowledge Content	-	Basic scientific concepts, principles, and theories	PK2
	Knowledge Procedural	-	Identification of experimental variables (dependent, independent, control)	PP1
			Measurement (quantitative, qualitative, scale, instruments)	PP2
			Repetition, averages, replicability, error control	PP3
	Knowledge Epistemic	-	Scientific claims supported by data and reasoning	PE1
			The function and design of empirical investigations	PE2
			The influence of measurement errors	PE3
			Collaboration, criticism, and peer review	PE4
			The relationship between scientific knowledge and social and technological issues	PE5
Attitude	**Attitude**		Stimulating students' curiosity	SA1
			Increasing interest in science	SA2
			Encouraging concern for the environment	SA3

Analysis Technique

Data was collected through documents on the contents of textbooks in chapters discussing "Ecosystems and Their Preservation and the Solar System" with page selection using non-probability sampling techniques with systematic sampling where every 5 pages of the book were taken. The systematic sampling technique allows for the selection of every nth unit from the population, even though the starting point is not random, this procedure becomes a form of non-probability systematic sampling (Neuendorf, 2017).

The data analysis in this study used the constant comparison method, an interactive data analysis technique developed by Miles, Huberman, & Saldaña (2014). Data analysis was conducted continuously and interactively until data saturation was reached, when no new relevant data was found. The data analysis steps used are in table 2.

Table 2. Data Analysis

Data Analysis Stage	Activity Description
Data reduction	Data reduction was carried out by identifying the presence of Scientific Literacy aspects in the three analyzed books. Each relevant quote was then coded according to the Scientific Literacy aspects.
Data Presentation	The reduced data was then reorganized to align with the classification of scientific literacy aspects, then categorized based on similarities in scientific literacy aspects. This process was accompanied by calculating the percentage of occurrence of each aspect using Purwanto's formula in Hanum (2020): Percentage of Scientific Literacy Aspects = (Number of Aspects / Total Aspects) × 100%
Drawing Conclusions	The final stage involved verifying and interpreting the analysis results to obtain an overview of the distribution of scientific literacy, trends, and the level of integration of scientific literacy in the analyzed science textbooks.

The validity of the analysed data was tested using a reliability test, namely an agreement test between two experts (inter-rater reliability, IIR). This study used Cohen's kappa coefficient, which can be calculated using the formula

$$K = \frac{P_a - P_c}{1 - P_C}$$

K = Cohen's Kappa Coefficient
Pa = Observed Proportion of Agreement
Pc = Proportion of Expected Agreement
1 = Constant

To determine the category of Cohen's Kappa coefficient values, the categorisation according to Landis and Koch (1977) can be used as follows.

Table 3. Landis and Koch Categorization

Value	Category
k<0.00	*Poor Agreement*
0.00 < k < 0.20	*Slight*
0.21 < k < 0.40	*Fair*
0.41 < k <0.60	*Moderate*
0.61 < k < 0.80	*Substanstial*
0.81 < k < 100	*Almost perfect agreemant*

(Vosoughi *et al*., 2024)

RESULTS AND DISCUSSION

The results reveal that the textbooks published by Yrama Widya (2024 edition), Ministry of Education and Culture (2021 edition) and Erlangga (2023 edition) universally incorporated into Science Literacy. Scientífic literacy occurs within the read chapters studied in grade 7, the Ecosystem and its Conservation, and the Solar Syslem chapter. The analysis was conducted using systematic sampling, whereby every 5 pages of the book were sampled. Overall, all aspects of science literacy were found, but when narrowed to the indicator of science literacy in the aspect of epistemic knowledge, it was not found in all books. The results of the analysis of the textbook content showed variations in the emergence of aspects of scientific literacy, which were grouped into four main dimensions context, competence, knowledge, and scientific attitude according to the indicators PISA 2015 dan PISA 2018 (OECD, 2016, 2019). Analysis between the two validators confirmed the scores obtained in table 4.

Table 4. Reliability Test Between Validators Per Book

Book	Coefficient of Agreement (KK)	Category
KEMENDIKBUD	0,79	Substanstial
ERLANGGA	0,66	Substanstial
YRAMA WIDYA	0,87	Almost perfect agreemant

The analysis showed that the three open-ended textbooks had high reliability, with Kappa values ranging from 0.66 to 0.87. The Kemdikbud textbook (Revised Edition 2021) received a Kappa of 0.79, categorizing it as Substantial Agreement, thanks to its systematic presentation, clear scientific concepts, experiments, reflective questions, and the connection of science to everyday life, which led to consistent agreement among the validators. The Erlangga textbook (Revised Edition 2023) received a Kappa of 0.66, also in Substantial Agreement, but slightly lower due to its narrative presentation and lack of explicit social context, leading to occasional disagreement among the validators. The Yrama Widya textbook (Revised Edition 2024) excelled with a Kappa of 0.87, categorizing it as Almost Perfect Agreement, due to its strong integration of sentences on science, technology, and society, clear text structure, and exploratory activities and scientific data that facilitated validation.

Based on the above review, the analysis of textbooks in context, the Erlangga textbook stands out in the global

context (KG5), while the Kemdikbud textbook emphasises competence in explaining phenomena scientifically (KF1). On the other hand, the Yrama Widya book shows strong dominance in competence because of its even distribution. However, the Yrama Widya book is most prominent in the global context (KG3), as seen in Table 5 below.

Table 5. Science Literacy Aspects in the Book

Science Literacy Aspects	KEMENDIKBUD	ERLANGGA	YRAMA WIDYA
KP1	-	4,08%	0,98%
KP2	1,82%	-	-
KP3	1,82%	4,08%	-
KP4	-	-	-
KP5	-	-	-
KL1	-	4,08%	-
KL2	-	-	4,90%
KL3	-	2,04%	1,96%
KL4	-	2,04%	-
KL5	-	-	-
KG1	-	-	-
KG2	1,82%	-	2,94%
KG3	3,64%	8,16%	13,73%
KG4	-	4,08%	0,98%
KG5	25,45%	10,20%	3,92%
KF1	1,82%	14,29%	12,75%
KF2	3,64%	8,16%	9,80%
KF3	-	-	1,96%
KF4	5,45%	2,04%	3,92%
KF5	3,64%	6,12%	0,98%
KE1	3,64%	-	2,94%
KE2	7,27%	2,04%	0,98%
KE3	1,82%	-	-
KD1	1,82%	-	-
KD2	3,64%	6,12%	1,96%
KD3	-	-	1,96%
KD4	-	2,04%	-
KD5	-	-	-
PK1	-	4,08%	3,92%
PK2	1,82%	6,12%	17,65%
PP1	1,82%	-	-
PP2	5,45%	-	-
PP3	1,82%	-	-
PE1	-	-	-
PE2	-	-	-
PE3	-	-	-
PE4	-	-	-
PE5	-	-	-
SA1	18,18%	8,16%	6,86%
SA2	3,64%	-	1,96%
SA3	-	2,04%	2,94%

1. Book KEMENDIKBUD

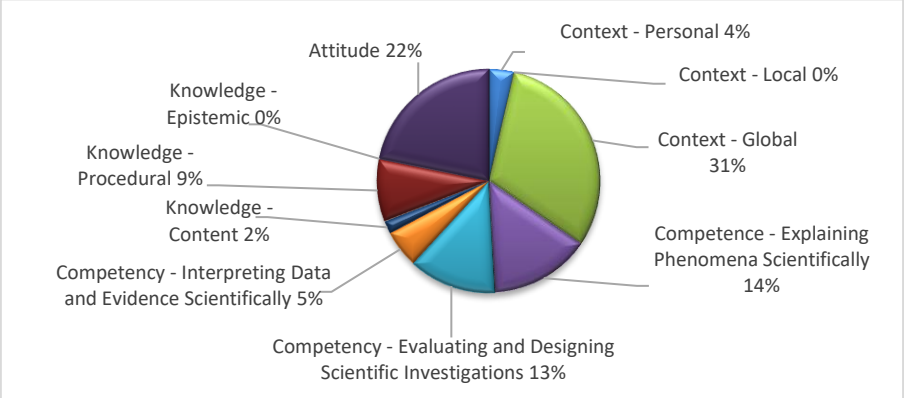


Figure 2. Science Literacy Aspects in the Book KEMENDIKBUD

From the results of the percentage of the appearance of the KEMENDIKBUD book in the table above, the context aspect category section is only found in the personal context (3.64%) with 2 statements and the global context (30.91) with the appearance of 17 statements. The competency aspect category explains phenomena scientifically (14.55%) with 8 statements, the competence to evaluate and design scientific investigations (12.73%) with the appearance of 7 statements, the competence to interpret data and evidence scientifically (5.45%) with the appearance of 3 statements. In the knowledge aspect category, there is only content knowledge (1.82%) with 1 statement, and procedural knowledge (9.09%) with 5 statements. Finally, in the attitude aspect category (21.82%) with 12 statements.

2. Book Erlangga

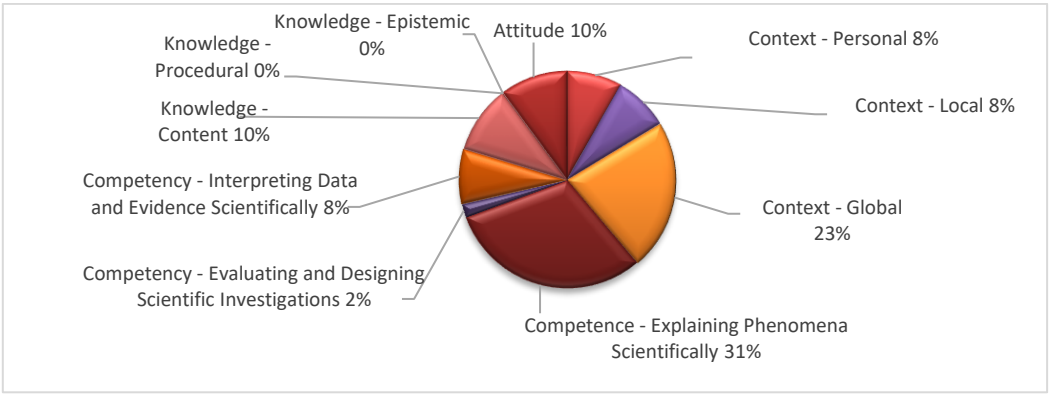


Figure 3. Science Literacy Aspects in the Book Erlangga

From the results of the percentage of the appearance of the Erlangga book in the table above, the context aspect category section is in the personal context (8.16%) with the appearance of 4 statements, the local context (8.16%) with the appearance of 4 statements, the global context (22.45) with the appearance of 11 statements. The competency aspect category explains phenomena scientifically (30.61%) with 15 statements, the competence to evaluate and design scientific investigations (2.04%) with the appearance of 1 statement, the competence to interpret data and evidence scientifically (8.16%) with the appearance of 4 statements. In the knowledge aspect category, there is only content knowledge (10.20%) with 5 statements. Finally, in the

attitude aspect category (10%) with 5 statements.

3. Book Yrama Widya

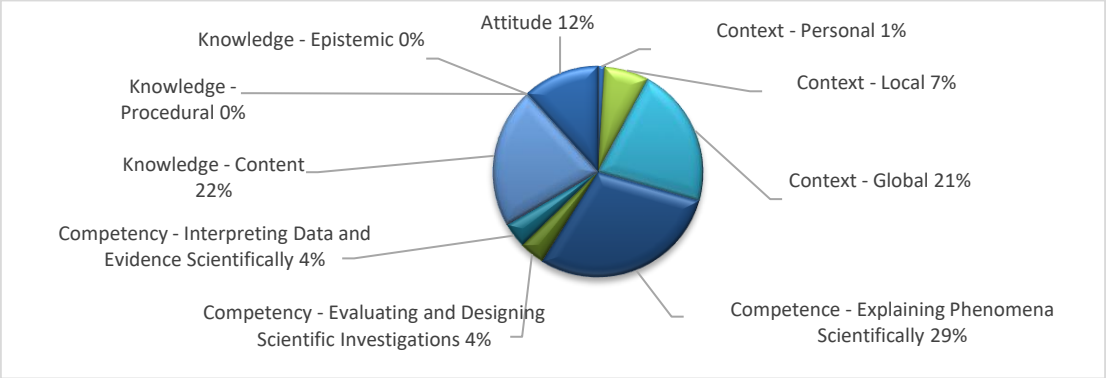


Figure 4. Science Literacy Aspects in the Book Yrama Widya

From the results of the percentage of the appearance of the Yrama Widya book in the table above, the context aspect category section is only found in the personal context (0.98%) with 1 statement, local context (6.86%) with 7 statements, global context (21.57) with the appearance of 22 statements. The competency aspect category explains phenomena scientifically (29.41%) with 30 statements, the competence to evaluate and design scientific investigations (3.92%) with the appearance of 4 statements, the competence to interpret data and evidence scientifically (3.92%) with the appearance of 4 statements. In the knowledge aspect category, there is only content knowledge (21.57%) with 22 statements. Finally, in the attitude aspect category (11.76%) with 12 statements.

Table 6. Overall aspectual sentence science literacy

Science Literacy Aspects	KEMENDIKBUD	ERLANGGA	YRAMA WIDYA
Context	19	19	30
Competence	18	20	38
Knowledge	5	5	22
Attitude	12	5	12

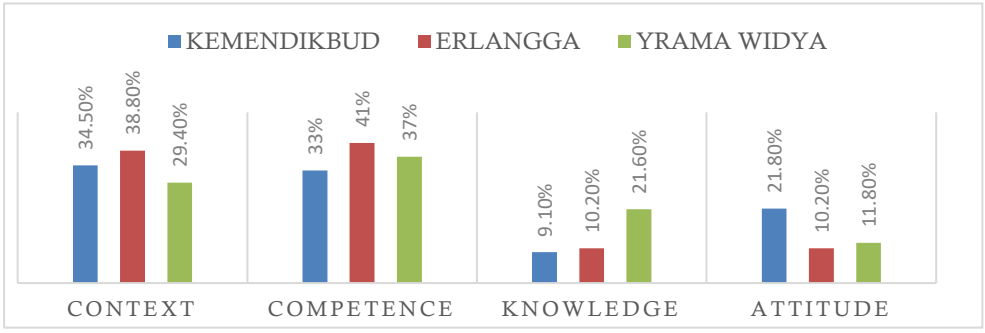


Figure 5. Bar Chart of Science Literacy Aspects in the Book

Based on the accumulated results for the scientific literacy aspect presented in Figure 3, calculations based on the percentage criteria can be seen in the context aspect of the books published by the Ministry of Education and Culture, Erlangga University, and Yrama Widya University. The scores were 34.5%, 38.8%, and 29.4%, respectively. However, the Ministry of Education and Culture books

still only partially incorporate local culture in their contextual aspects, indicating that the Ministry of Education and Culture books need to improve their local contextual aspects. According to Puspa Widya Lubis *et al* (2022), textbooks that fail to demonstrate local potential in the contextual section need to be revised to achieve meaningful contextualization. In line with this, learning that incorporates local culture can improve contextual understanding, environmental awareness, and scientific literacy (Permana Putra & Wahyuni, 2025).

In terms of competency, the books published by the Ministry of Education and Culture, Erlangga University, and Yrama Widya University achieved high scores, with scores of 33%, 41%, and 37%, respectively. These three books were considered nearly equal in terms of competency. This indicates that the competency level in each textbook has been standardized to support student learning. The scientific competencies required for scientific literacy reflect the view that science is a collection of social and epistemic practices that characterize all scientific fields and form the framework for all scientific activities (Roberto *et al*., 2023).

In terms of knowledge, books published by the Ministry of Education and Culture and Erlangga University demonstrated low scores with scores of 9.1% and 10.2%, respectively, while books published by Yrama Widya University demonstrated a more even knowledge distribution with a score of 21.6%. In this aspect, based on indicators, no epistemic knowledge was found on the pages examined in the three textbooks, and no procedural knowledge was found in the Erlangga and Yrama Widya books. According to Safitri *et al*, (2022) the scientific literacy aspect of the textbooks' knowledge content remains relatively low. However, knowledge is crucial for learning, so there is a need to improve the knowledge component in the Ministry of Education and Culture and Erlangga University books, particularly in the chapters examined.

In terms of attitude, the Ministry of Education and Culture's book received a score of 21.8%, which is considered good, while the Erlangga and Yrama Widya books received scores of 10.2% and 11.8%, respectively, which are considered low. Sentences about scientific aspects should be added so that the book can function as reading material that hones students' abilities. According to Apriani *et al* (2023), attitude is a fundamental competency needed in the 21st century. Furthermore, attitude indicators can shape students' character during the learning process.

The Aspects of Science Literacy

Science itself is an activity carried out by humans to seek knowledge directly related to scientific matters in the universe in a systematic manner through scientific methods to observe, identify, describe, and conduct investigations related to natural phenomena (Fang & Wei., 2010). Meanwhile, science literacy is an important part of education, so learning related to science education needs to include science literacy so that students can meet the needs of technology and scientific knowledge in the future (Nurfaidah, 2017).Science literacy is divided into four important aspects, namely context, competence, knowledge, and attitude (PISA 2015 Results, 2016; PISA 2018 Results, 2019).

The contextual aspect of science literacy plays an important role because it helps students relate scientific concepts to real-life phenomena. Environmental,

health, technology, and natural resource issues are relevant contexts for students to understand that science is not just theory, but part of life. This aspect may already be present in all books; one of the paragraphs in the Yrama Widya book reads as follows. *"Water plays a vital role in ecosystems. Not only aquatic organisms, but all living things in all habitats require water. Humans cannot survive if they lose as little as 12% of their body water. What about living things in the desert? They also need water. Water is used as sparingly as possible, and various adaptations are made to obtain and convert it."* The sentences in the paragraph reflect aspects of context. This is appropriate because context-based learning can also help increase interest and motivation to learn, as students can see the immediate benefits of what they are studying. Saraswati *et al*. (2021) found that critical thinking skills and environmental awareness are related to contextual understanding in science learning . The use of local context in learning activities and textbooks can help strengthen science literacy (National Academies of Sciences, Engineering, and Medicine, 2016).

Next, there is the competency aspect, which describes how student conduct science throug this scientific prosess. Within this competency aspect, there are ablitiws such as observaing, asking question, explaning phenomena scientifically, using evidence, and interpreting data to draw conclusion. Students will become more then mere users of information if this element is well developed. They will become individuals engaged in research and constructive criticism. This competency aspect is included in all books, one of which is in the Erlangga book stated as follows: *"The Sun's surface activity is decreasing drastically due to the solar minimum period. As a result, sunlight is experiencing a drastic decrease, indicated by the disappearance of sunspots."* Nugraha (2022) asserts that a scientific approach emphasizing the strengthening of competencies can significantly enhance scientific literacy skills. Therefore, the development of competency aspects assists students in understanding that science is a series of social and epistemic activities that shape the way humans think and act towards natural phenomena.

The knowledge aspect is crucial for scientific literacy in textbooks to be considered complete. This aspect encompasses three components: content knowledge, procedural knowledge, and epistemic knowledge. Epistemic knowledge plays a role in helping students understand how scientific knowledge is constructed, tested, and used, so that students not only know the "what" but also the "how" and "why" of a scientific concept. Without a strong knowledge foundation, students' ability to understand the context and carry out the scientific process will be limited. The knowledge aspect is found in all three textbooks, one of which is the Ministry of Education and Culture's textbook, which states: *"An ecosystem is an interaction between living things in an area and their environment that influence each other, for example a lake ecosystem consists of organisms and all the objects in it."* This statement provides a conceptual foundation for students before they relate the material to the context of life and undertake scientific activities. Similarly, Fakhriyah *et al*. (2017) stated that students' low knowledge can make it difficult for them to understand complex scientific concepts. By providing a strong knowledge component, students are better

able to solve real-world problems through rational and critical scientific thinking (Safitri *et al*., 2022). Therefore, knowledge components need to be presented adequately and proportionally in textbooks, as they serve as the primary foundation for teachers and students in the learning process.

However, mastery of knowledge alone is not enough; scientific literacy also needs to be strengthened through scientific attitudes, which are reflected in prompting questions, reflections, and calls to action in textbooks. Furthermore, attitudes are a crucial component in developing a principled scientific personality. Scientific attitudes encompass curiosity, honesty in discovering facts, openness to new ideas, and responsibility for the environment. Attitudes can be reflected through prompting questions and calls to reflection in textbooks. In Erlangga's textbook, for example, the *"What factors shape an ecosystem? What things can disrupt it? What preventative measures can be taken?"* encourage students to think critically, connect concepts to real-world situations, and formulate science-based actions. Questions like these help students develop positive attitudes toward science, increase learning motivation, encourage exploration, and foster participation in scientific problem-solving. According to Widyastika *et al*. (2022), strengthening scientific attitudes can shape the character of 21st-century students who are adaptive to developments in science and technology. Similarly, Arsyad & Safitriani (2025) found a significant correlation between scientific attitudes and students' scientific literacy skills. Thus, developing scientific attitudes not only strengthens learners' affective aspects but also contributes to improved scientific reasoning and social responsibility in the broader context of life.

Overall, context, competence, knowledge, and attitude are four complementary components of scientific literacy. However, this study's findings indicate that their distribution across the three textbooks is not entirely balanced. In the Ministry of Education and Culture's textbook, context (34.5%) was the most dominant aspect, while knowledge (9.1%) was the least dominant. In Erlangga's textbook, competence (41%) was the highest aspect, while knowledge and attitude (10.2% each) were the lowest. In Yrama Widya's textbook, competence (37%) was also the highest aspect, and attitude (11.8%) was the lowest. This difference in proportions indicates that students' opportunities to practice scientific literacy depending on the textbook used.

This unequal distribution impacts the quality of the learning process. The dominance of context (as in the Ministry of Education and Culture's textbook) makes the material more relatable to everyday life, but if knowledge is low, students risk lacking the conceptual foundation to accurately explain phenomena and develop strong scientific reasoning. Conversely, the dominance of competence (as in Erlangga and Yrama Widya) can encourage student engagement in the scientific process. However, when attitudes and/or knowledge are relatively low, learning can become more procedural and less likely to foster scientific character traits, such as curiosity, responsibility, and reflection on the impact of science. This means that differences in the distribution of context, competence, knowledge, and attitudes influence the learning process, particularly students' ability to connect concepts to real-life

situations, conduct evidence-based reasoning, and make responsible decisions.

Context makes science relevant and meaningful, competence engages students in the scientific process, knowledge forms the basis for scientific thinking, and attitudes foster scientific character in learning. If these four aspects are developed in a balanced manner in textbooks and classroom implementation, students will not only master scientific knowledge but also be able to think critically, act responsibly, and make decisions based on scientific principles in accordance with 21st-century demands. These findings emphasize the importance of aligning textbooks with national curriculum standards (Independent Curriculum), as well as the role of teachers in selecting, supplementing, or modifying materials so that each component of scientific literacy appears proportionally, for example by adding concept reinforcement when the knowledge aspect is low, enriching investigative activities when competencies are not yet dominant, or inserting reflective questions and real action activities when the attitude aspect is still limited.

CONCLUSION

Scientific literacy is a crucial skill every student needs to understand phenomena, make evidence-based decisions, and solve problems in everyday life, especially in the 21st century. The study results show that scientific literacy in seventh-grade junior high school (SMP/MTs) science textbooks is categorized as good to excellent based on expert validation. However, the distribution of scientific literacy components across the three textbooks is not consistent. In the KEMENDIKBUD textbook, the highest aspect is context (34.5%) and the lowest is knowledge (9.1%). In Erlangga's textbook, the highest aspect is competence (41%), and the lowest is knowledge and attitude (10.2% each). In Yrama Widya's textbook, the highest aspect is competence (37%) and the lowest is attitude (11.8%). This difference indicates that students' opportunities to practice context, scientific processes, conceptual reinforcement, and scientific attitude development can vary depending on the textbook used.

Therefore, the four aspects of scientific literacy (context, competency, knowledge, and attitude) need to be developed in a more balanced way so that science learning does not stop at memorizing concepts, but also trains students to think scientifically, fosters curiosity, and builds concern and responsibility for the environment. The practical implications of these findings are the need for recommendations for stakeholders: publishers can strengthen the knowledge aspect (especially epistemic knowledge) through deeper and evidence-based explanations of concepts; authors/developers of books can add investigative activities and reflective questions that foster scientific attitudes; and teachers can supplement the material through project assignments, data-based discussions, and real-life action activities when one aspect is still lacking. With this strengthening, textbooks are expected to become more effective learning resources in developing comprehensive scientific literacy that is relevant to the demands of 21st-century skills.

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