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Student's Science Literacy At SMA Negeri 1 Kambera

Ferdinand Ndawa Lu Remindima[1], Marleni Rosalia Ndapa Huda[2]
[1 2]Pendidikan Biologi, Fakultas Keguruan & Ilmu Pendidikan, Universitas Kristen Wira Wacana Sumba, Indonesia
E-mail: [1]ferdiremindima@unkriswina.ac.id *, [2]marlenihuda@unkriswina.ac.id
*Coresponding Author

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ABSTRACT
This study aims to measure the level of science literacy skills among students of SMA Negeri 1 Kambera. Science literacy is the ability to understand, use, and apply science knowledge to explain natural phenomena and make informed decisions based on concrete evidence. This ability is crucial to assist students in their science development. This study used a descriptive quantitative-quantitative *(mixed method)* method with data collection through literacy tests, interviews, and observations. A total of 70 students participated in the testing process, and interviews were conducted with three biology teachers. The results showed that the average science literacy skills of students were in the high category, namely 80.3%. The first indicator scored 78%, the second indicator scored 91%, and the third indicator scored 72%. Interviews with teachers revealed that although learning media such as PowerPoint and student worksheets were used, science literacy skills were not taught or assessed in detail. These findings highlight the importance of developing more innovative teaching methods and using technology, multimedia, and practical exercises to improve students' science literacy skills.

Keywords: *Science Literacy, Biology Learning, Assessment Of Science*

INTRODUCTION

Literacy is a person's ability to process and understand information while reading and writing, including science literacy (Remindima et al., 2025; Satriya et al., 2024). Science literacy is one of the essential competencies that students must possess to face the challenges of the 21st century (Ariani et al., 2025). Science literacy is not only defined as mastery of science concepts, but also an individual's ability to understand natural phenomena, interpret science data, think critically, and use science knowledge in decision-making related to everyday life (Siregar et al., 2020). In the context of secondary education, strengthening science literacy is crucial because it serves as a foundation for developing a science mindset, problem-solving skills, and student readiness to face developments in science and technology.

National and international studies show that the level of science literacy of Indonesian students is still relatively low. According to Sholikah & Pratiwi (2020), data from the Programme for International Student Assessment (PISA) over several periods shows that Indonesian students' science literacy achievements are below the average for OECD member countries. This condition indicates that science learning in schools has not fully developed students' science and applied thinking skills (Putri et al., 2025). This fact is a serious concern for the world of education, especially at the senior high school (SMA) level, which plays a crucial role in preparing students for higher education and social life.

A similar situation was also found at SMA Negeri 1 Kambera. Based on observations and interviews with biology teachers, it was found that most students still experience difficulties in linking science concepts to real-world phenomena, interpreting data or graphs, and explaining science problems logically and systematically. The science learning process tends to focus on mastering

material and solving routine problems using media such as the whiteboard, thus not fully encouraging students to develop comprehensive science literacy skills. These initial findings indicate a gap between the expected objectives of science learning and students' science literacy skills.

Based on the results of the needs analysis conducted at SMA Negeri 1 Kambera, the overall score of students was 50.3%, which means it is classified as moderate. The science literacy test consists of 40 questions divided into 30 multiple choice questions and 10 essay questions. The first indicator of science literacy is *"Understanding the methods of inquiry that lead to science knowledge"* with an average score of 63% of students answering the questions correctly so it can be concluded that students are quite capable of understanding the methods of investigating science phenomena. The second indicator is *"Organizing and analyzing"* has an average score of 45% of students answering correctly so it can be concluded that students are not yet able to organize and analyze a research problem. The third indicator is *"Interpreting quantitative and science data"* has an average score of 43% included in the sufficient category. Based on the results obtained from the three indicators of student science literacy at SMA Negeri 1 Kambera, it can be concluded that it is still classified as moderate and needs to be improved.

Students' science literacy is categorized as low or moderate, supported by a number of previous studies related to student science literacy at various levels of education and school contexts. According to Qadar et al., (2022), low student science literacy is due to a lack of interactive learning such as direct practice by teachers related to science in local contexts or its relationship to daily life. Based on this, it is necessary to recommend the implementation of innovative learning models, contextual approaches, or strengthening literacy-based assessments. However, most studies still focus on urban areas or schools with certain characteristics, while studies that specifically examine student science literacy at SMA Negeri 1 Kambera are still very limited. In addition, there are not many studies that link student science literacy outcomes to learning conditions and characteristics of the learning environment at the school.

The research gap lies in the lack of empirical data describing the level of science literacy of students at SMA Negeri 1 Kambera in a contextual and comprehensive manner. Previous research tends to be general in nature, thus not fully representing local school conditions, both in terms of learning processes, learning resources, and student characteristics. Therefore, research that specifically examines students' science literacy at SMA Negeri 1 Kambera is needed as a basis for formulating more targeted strategies for improving science learning.

This study both supports and expands on previous research findings by providing a more contextual empirical overview. It does not aim to refute these findings, but rather to strengthen evidence that science literacy remains a crucial issue, particularly in high schools within a specific local context. Therefore, the novelty of this study lies in its specific focus on SMA Negeri 1 Kambera and its use of preliminary study results as a basis for analyzing students' science literacy.

Theoretical Framework

Science literacy is a basic competency that students must possess to face the challenges of the 21st century, characterized by the rapid development of science and technology (Khery et al., 2022). Science literacy is not only understood as the ability to master science concepts and facts, but also includes the ability to understand natural phenomena, ask science questions, interpret data, and use science evidence in decision-making related to everyday life (Siddiqova, 2021). According to Cordon & Polong (2020), in the context of 21st-century skills, science literacy plays a vital role in developing critical thinking, problem-solving, and evidence-based decision-making skills, which are key competencies that high school students must possess.

Conceptually, science literacy consists of several interrelated dimensions: science content, science processes or competencies, and the context of science application (Fensham, 2009). The science content dimension relates to the understanding of science concepts, principles, and theories. The science process dimension encompasses the ability to identify science problems, explain phenomena scienceally, and use evidence and data to draw logical conclusions (Laugksch, 2000). Meanwhile, the science context dimension emphasizes students' ability to apply science knowledge to personal, social, and global situations (Kolsto, 2001). These three dimensions align with 21st-century

skills, particularly in fostering analytical thinking skills, information literacy, and the ability to relate knowledge to real-world problems.

Science learning at the high school level plays a strategic role in developing students' science literacy. Effective learning should not only focus on mastering material and solving routine problems, but also encourage students to actively construct knowledge through observation, experimentation, discussion, and contextual problem-solving (Aydin-Ceran, 2021). Such science learning can develop 21st-century skills, such as critical thinking, creativity, collaboration, and communication (Oktaviani & Faizah, 2024). By actively involving students in the learning process, they not only understand science concepts but also are able to apply them to various life situations.

Students' science literacy levels are influenced by various factors, both internal and external. Internal factors include students' learning interests, motivation, and initial abilities, while external factors include the learning strategies implemented by teachers, the availability of learning resources and media, and the school learning environmescient (Jufrida et al., 2019). These factors interact to shape students' learning experiences. Learning that lacks variety and remains teacher-centered tends to hinder the development of science literacy and 21st-century skills. Conversely, contextual and student-oriented learning can significantly improve critical thinking and problem-solving skills.

In the context of education policy, science literacy is closely linked to the Independent Curriculum, which emphasizes the development of student competencies and character (Akbar et al., 2023). Science literacy is a crucial component in realizing the Pancasila Student Profile, particularly in the critical and creative reasoning dimensions. According to Zakarina et al., (2024), the Independent Curriculum encourages contextual, project-based, and real-life science learning, enabling students to optimally develop 21st-century skills through science learning.

Various previous studies have shown that students' science literacy in Indonesia remains in the low to moderate category. These studies generally conclude that low science literacy is caused by learning that emphasizes memorization of concepts and provides little space for critical and applied thinking (Rohmah & Hidayati, 2021). However, most of the research is general in nature and has not specifically examined the state of science literacy in specific school contexts.

METHODS

This study used a descriptive quantitative-qualitative (mixed method) method. Data were collected through a science literacy ability test and interviews in October at SMA Negeri 1 Kambera. The study population consisted of all grade XI students of SMA Negeri 1 Kambera for the 2025/2026 academic year. The selection of grade 11 students as research subjects was based on the consideration that students at this level have more stable learning independence and analytical thinking skills compared to grade 10 students. In addition, the curriculum in grade 11 provides a very relevant coverage of material to measure science literacy indicators, namely the ability to explain phenomena scienceally and interpret data. The sample was selected using cluster sampling consisting of two classes selected from 7 classes to represent the sample or randomly selected (cluster) from the population. The instrument used in this study was adapted from Gormally et al., (2012), which includes 3 indicators of science literacy: understanding of investigation methods that lead to science knowledge, organizing and analyzing, and interpreting quantitative data and science information. This study employed mixed-data analysis techniques. Quantitative data obtained from the science literacy test were analyzed using descriptive statistics, finding means and percentages across categories. Qualitative data from interviews were analyzed through data reduction, data presentation, and conclusion drawing to deepen the test findings.

The instrument has been validated by experts and tested for reliability and obtained a score of 95 from experts and a reliability value of 0.87, which indicates that the instrument is valid and reliable. A total of 70 grade XI students from SMA Negeri 1 Kambera worked on the test questions. Interviews were conducted with 3 biology teachers at the school. Data obtained from the student literacy ability test and teacher interviews were then analyzed descriptively using percentages, classified as shown in the table below.

Tabel 1. Criteria for Science Literacy Assessment

No.	Interval (%)	Category
1	≥ 80%	Very High
2	70% -79%	High
3	60% -69%	Medium
4	50% -59%	Low
5	≤49%	Very Low

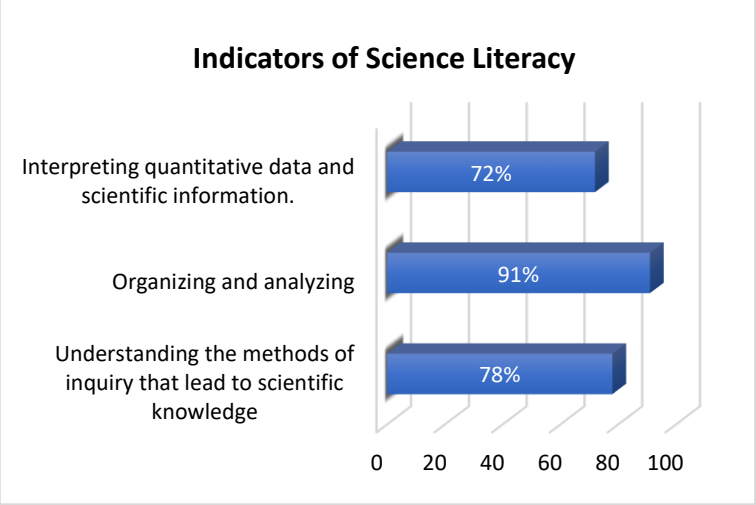
RESULTS AND DISCUSSION

The results of a science literacy test of 70 students at SMA Negeri 1 Kambera showed that their average science literacy ability was 80.3%, placing them in the Very High category. The research findings are presented in the following Table.

Table 2. Student Science Literacy Assesment Result at SMA Negeri 1 Kambera

No.	Indicators	Persentage(%)
1	Understanding the methods of inquiry that lead to science knowledge	78%
2	Organizing and analyzing	91%
3	Interpreting quantitative data and science information.	72%
	Average	80,3%

Based on Table 2, the percentage of students' science literacy test results for the three indicators above differed. The first indicator, *"Understanding the methods of inquiry that lead to science knowledge,"* had a score of 78%, which is considered high. The second indicator, *"Organizing and analyzing,"* had a score of 91%, which is considered very high. The third indicator, *"Organizing and analyzing,"* had a score of 72%, which is considered high.



Graph 1. Percentage of Science Literacy Assessment Result

The indicator *"Understanding investigative methods leading to science knowledge"* scored 78%, which is considered high but falls below the data organization ability. This score indicates that students understand the flow of science procedures, from problem analysis and hypothesis formulation to determining work procedures in the laboratory or field (Hariyanto & Hikmatul, 2024). In biology, students are able to understand how experiments are conducted in a specific manner, for example, in photosynthesis tests, leaves must be covered with tin foil. However, the difference in scores with the second indicator indicates that although they are adept at processing existing data, the ability to design independent investigations or understand the in-depth logic behind science methodology still requires guidance and direction. Students understand "how" to do it, but may still have some difficulty dealing with unexpected confounding variables in biological research. This is in line with research conducted by Arohman et al., (2016), which states that students' ability to understand the flow of science activities, from problem planning and hypothesis formulation to science work procedures, in science literacy

requires in-depth analysis of the problems faced by students, especially in the study of biology.

The *"Organizing and Analyzing"* indicator showed a highly significant score of 91%. This near-perfect score indicates that students at SMA Negeri 1 Kambera have excellent technical skills in managing raw information. In the Biology lessons that have been conducted, this is reflected in students' ability to classify observational data (for example, grouping types of flora in Sumba based on their morphological characteristics) and present it in systematic tables or graphs. This high score is likely influenced by teaching patterns that frequently train low- to mid-level cognitive aspects (LOTS to MOTS), and students are already accustomed to structured assignment procedures (Sutrisna, 2021). Students appear highly adept at distinguishing variables and identifying linear patterns from explicitly presented data. This aligns with research conducted by Osborne (2023), which states that in organizing and analyzing a problem, students are able to sort and group data and information realistically. This is influenced by each student's cognitive ability to read the data provided by the teacher.

The *"Interpreting quantitative data and science information"* indicator scored the lowest of the three, at 72%. While still in the high category, this figure indicates a gap in higher-order critical thinking (HOTS) skills. Interpreting isn't just about reading numbers; it involves drawing in-depth conclusions, predicting future trends, and linking numerical data to abstract biological concepts (Mardiani et al., 2024). Students may be proficient at creating graphs (91%), but when asked to explain the biological implications of the data presented, for example, linking a graph of declining fauna populations to changes in environmental carrying capacity, they tend to struggle. Although the scores obtained are in the high category, this interpretation is often caused by a lack of literacy combined with mathematical logic, resulting in students sometimes getting caught up in the numbers without understanding the science meaning behind them. According to research conducted by Qiao et al., (2024), STEM learning that involves students interpreting data logically enables them to understand the flow of the data presented. The results showed that students had considerable difficulty categorizing data when combined with the mathematical logic provided, thus requiring in-depth guidance for students in reading quantitative data and science information.

CONCLUSION

This study shows that the science literacy skills of students at SMA Negeri 1 Kambera are in the very high category with a percentage of 80.3%. Based on the results obtained on 3 indicators of science literacy, namely "Understanding investigative methods that lead to science knowledge", "Organizing and Analyzing" and "Interpreting quantitative data and science information" all indicators have scores in the high category meaning that students at SMA Negeri 1 Kambera have good literacy skills but in the 3rd indicator there is still a need for improvement so that students are better at interpreting quantitative data and viewing science information. Therefore, further efforts are needed to strengthen student-centered teaching methods, connect with real-life learning situations, and integrate technology to improve science literacy skills. Improving these skills is crucial in preparing students to face the challenges and rapid changes of the 21st century. This research serves as evaluation material for teachers at SMA Negeri 1 Kambera to focus more on science literacy.

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