



ANALYSIS OF HIGH SCHOOL STUDENTS' LITERACY USING THE PISA FRAMEWORK

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ABSTRACT

The aim of this research is to describe the literacy profiles, including science literacy, mathematical literacy, and reading literacy, among 9th-grade junior high school students and 10th-grade high school students. This study utilizes a descriptive method involving 104 respondents, with data collected through literacy tests based on PISA questions. The results of the research indicate that the average score for overall student literacy achievement is 56.2%. The average score for science literacy is 46.4%, for mathematical literacy is 40.6%, and for reading literacy is 67.9%. The students' science and mathematical literacy abilities are categorized as moderate, while their reading literacy ability is categorized as high. Based on the data obtained, students' overall literacy achievement in science, mathematics, and language is still within the moderate category. The low literacy abilities are caused by students' difficulty in interpreting graphs and tables in science literacy, as well as students' struggles with formulation skills in mathematical literacy. In reading literacy, students lack the ability to read and explore reading materials. Another factor is that students are not accustomed to working on literacy test questions, and evaluation tools have not led to literacy development.

Keywords: *students' literacy, science literacy, mathematical literacy, reading literacy, PISA framework*

1. INTRODUCTION

Scientific literacy has become a widely used term as an important characteristic that every citizen should possess in modern society (Hidayah et al., 2019). In the 21st century, an essential aim of education is to equip students to confront various facets of global existence (Nuryanti et al., 2023). Given the substantial challenges encountered by society, alterations are necessary in the educational framework to furnish students with the requisite components of 21st-century skills (Pratiwi et al., 2019). One of the skills needed is literacy. Literacy is not merely about reading and writing, but involves thinking skills that make individuals literate in learning, including in science education (Armas et al., 2019). Scientific literacy entails comprehending scientific principles and methodologies, and employing scientific knowledge to address challenges (Kartika et al., 2017). According to the Program for International Student Assessment (PISA), scientific literacy is the ability to apply scientific knowledge, identify questions, and determine conclusions based on scientific evidence to understand and make decisions regarding nature and its changes due to human activities. PISA monitors the system outcomes from the perspective of student achievement in each participating country, encompassing three literacies: reading literacy, mathematical literacy, and scientific literacy. PISA assessments are conducted every three years. Each cycle focuses on one of these three major domains of study, though two other domains are also included in the assessment. The focal subject was science in 2006 and 2015, mathematics in 2003, 2012, and 2022 and reading in 2000, 2009 and 2018. The fact that the reading skills are chosen as the focal subject means that PISA 2018 results focus on reading skills rather than mathematics and science literacy. The general aim of PISA is to assess the extent to which students have acquired the appropriate skills in reading, mathematics, and science to make significant contributions to their societies (Khoirudin et al., 2017).

Understanding scientific concepts is crucial for students to comprehend various aspects of the environment, contemporary society, technology, health, and economics (Nuryanti et al., 2023). The ability of students to engage in mathematical literacy is equally important as it requires them to be proficient in formulating, applying, and interpreting various mathematical contexts in life (Nisa & Faradiba, 2023). In order to be successful in science and mathematics, students must first read and understand the text and symbols well, and interpret what they read. Therefore, reading literacy also important for students. Reading literacy involves comprehending,



assessing, utilizing, and interacting with written material to engage with society, accomplish personal objectives, and cultivate knowledge and capabilities (Koyuncu & Firat, 2020). Reading literacy refers to the capacity to comprehend and utilize written language forms essential in society or esteemed by individuals. Proficiency in literacy equips students to confront real-life challenges more effectively and prepares them comprehensively for the demands of 21st-century education (Hassanzadeh & Nikkhoo, 2016). However, in reality, currently students' literacy abilities are still low.

The Organization for Economic Cooperation and Development (OECD) through PISA in 2022 the results of the PISA study of the literacy abilities of Indonesian students from 2000 to 2022 are presented in Table 1. The average achievement scores across various aspects of student literacy still fall within the score range of 359 – 403.

Table 1. Literacy Score of Indonesia from 2000 - 2022

Mean performance	Mathematics	Reading	Science
PISA 2000		371	
PISA 2003	360	382	
PISA 2006	391	393	393
PISA 2009	371	402	383
PISA 2012	375	396	382
PISA 2015	386	397	403
PISA 2018	379	371	396
PISA 2022	366	359	383

Table 1 indicates that the average literacy score of Indonesian students between 2000 and 2022 remains lower than the average score of countries participating in PISA. This suggests that Indonesian students have not yet mastered scientific concepts and processes, nor have they been able to apply their acquired knowledge effectively in their daily lives (Pratiwi et al., 2019). Students also lack in formulating, applying, and interpreting various mathematical contexts in life. There is also a deficiency in students' achievement in reading comprehension. This is also supported by research Ardianto and Rubini (2016) regarding the results of research on students' scientific literacy, students' scientific literacy scores are quite low, an average of 30% overall. The average achievement of student science literacy as a whole was 28.31% in the study (Hidayah et al., 2019). Research by Nuryanti et al. (2023) also found that the average scientific literacy score was 31.58%, falling into the low category.

There are several factors influencing the low level of students' scientific literacy according to Hidayah. These factors include: firstly, the low scientific literacy skills of students may stem from the conventional nature of science learning habits which neglect the importance of reading and writing scientific texts as essential competencies for students. Secondly, students' ability to interpret graphs/tables presented in questions is limited. Students are accustomed to merely filling in tables provided by teachers, thus their ability to interpret graphs/tables is also restricted. Thirdly, students are not accustomed to working on scientific literacy test questions. Fourthly, students do not grasp the basic concepts taught by teachers (Hidayah et al., 2019). The inadequate scientific literacy skills of Indonesian students stem from various factors including the curriculum and educational system, teachers' selection of teaching models and methods, as well as the availability of learning facilities and teaching materials (Anisa et al., 2021; Nuryanti et al., 2023). The low contribution of science education to the success of citizens is due to the detachment of science education from social contexts, emphasis solely on content mastery, and the use of inappropriate assessments, thus preparing citizens only to acquire knowledge. In education, students should understand the relevance of science education to everyday life and community living (Mawardini et al., 2015).



The findings suggest that overall, the literacy levels of Indonesian students are still low, and there are many factors influencing this. Therefore, efforts to improve science education in schools are necessary. Improvement efforts in the quality of education at schools should be supported by accurate information on the extent of students' literacy achievements. Several previous studies have examined students' literacy achievements. Research conducted by Hidayah et al. (2019) on 9th grade junior high school students found that the average achievement of student science literacy as a whole was 28.31%. Nuryanti et al. (2023), in her study, also found that the average scientific literacy score was 31.58% in the low category among 8th grade junior high school students. The mathematical literacy skills of junior high school students investigated by Khoirudin et al. (2017) revealed that students are still in the level 1 category, indicating low mathematical abilities. Mathematical literacy was also examined by Nisa and Faradiba (2023), whose research findings indicated that students with low-level problem-solving abilities could not meet the indicators of mathematical literacy, while students with moderate-level problem-solving abilities did not fully complete the indicators of mathematical literacy.

From previous research, scientific literacy achievement has been more extensively studied, as has mathematical literacy. However, there is still very little discussion regarding reading literacy. Nevertheless, in order to be successful in science and mathematics, the reader must first read and understand the text and symbols well and interpret what they read. Therefore, reading literacy is equally important for students. Hence, this research will address students' literacy in all three aspects: scientific literacy, mathematic literacy, and reading literacy.

2. METHODS

The research method used in this study was descriptive research. Descriptive research aims to provide a systematic, factual, and accurate portrayal of the characteristics of a population or a specific area. Descriptive research does not involve manipulation or alteration of independent variables but rather describes a condition as it is (Creswell, 2012). The population in this study is high school students in Sumedang Regency. The total sample consisted of 104 students, comprising 71 9th grade junior high school students and 33 10th grade high school students.

The instrument used is a literacy test instrument in the form of a multiple-choice test consisting of 24 items. The items are taken from the PISA tests from the years 2015, 2018, and 2022. The data obtained in this research are the results of the literacy test. Data analysis of literacy skills is carried out using the following scoring steps.

The science literacy questions used to measure students' science literacy are multiple-choice questions. The scoring system was carried out with scoring rules giving a score of 1 if the answer is correct and a score of 0 if the answer is incorrect

To determine the value, data obtained from test results that have been scored were then converted into grades. Convert scores to grades using the formula:

$$\text{value} = \frac{\text{score of students}}{\text{Score maximal}} \times 100$$

The value of science literacy achievement obtained was then interpreted based on the criteria presented in Table 2.

Table 2. Science Literacy Achivement Criteria

Range of Values	Criterion
67 - 100	High
33 - 66	Moderate
< 33	Low

(Nuryanti et al., 2023)



3. RESULTS & DISCUSSION

The data analysis shows literacy scores in science literacy based on PISA 2015, reading literacy based on PISA 2018, and mathematical literacy based on PISA 2022 among high school students. The three literacy aspects, the highest score is in reading literacy followed by science literacy, and the lowest score is in mathematical literacy. The average literacy achievement can be seen in Figure 1.

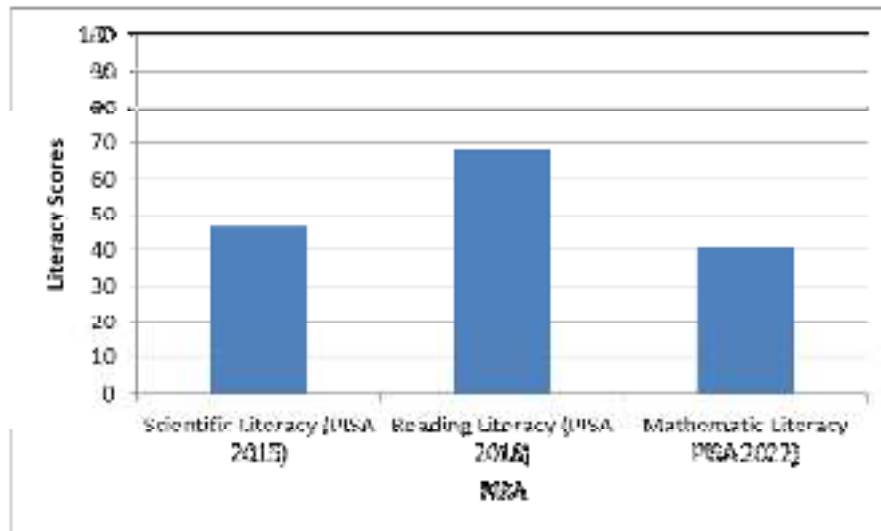


Figure 1. The Achievement of Literacy Scores Among High School Students.

Based on Figure 1, reading literacy obtains a score of 67.9, science literacy is 46.4, and mathematical literacy is 40.6. In terms of literacy achievement criteria, reading literacy falls into the high category, while science and mathematics literacy fall into the medium category. The result of this research different with previous research, research by Nuryanti et al. (2023) found that the average of scientific literacy score was 31.58% in the low category among 8th grade junior high school students. The data distribution in the literacy test results can be seen in Table 3.

Table 3. Students Literacy Test Result

Range of Literacy Scores	Number of Students (%)	Average (%)
67 - 100	26.0	56.2 (moderate)
33 - 66	69.2	
< 33	4.8	

The result of data analysis in Table 3 show that the description of the literacy profile in high school students (9th and 10th grades) can be categorized into the low group at 4.8%, the medium category at 69.2% and the high category at 26.0%. Based on the literacy scores achieved, students are in moderate category with an average score of 56.2%. Based on literacy score that have been obtained, it can be seen that there is still a need to increase to high category. Additionally, regarding the specific aspect of science literacy, it can be observed in Table 4.

Table 4. Students Science Literacy Test Result

Range of Literacy Scores	Number of Students (%)	Average (%)
67 - 100	12.5	46.4



Range of Literacy Scores	Number of Students (%)	Average (%)
33 - 66	72.1	(moderate)
< 33	15.4	

According to the data analysis presented in Table 4, the science literacy profile description of high school students (9th and 10th grades) can be classified as follows: 15.4% into the low category, 72.1% into the medium category, and 12.5% into the high category. Based on the science literacy scores achieved, students are in moderate category with an average score of 46.4%. Although the results fall into the medium category, in this science literacy aspect most students lack competence in interpreting data and evidence scientifically, even at the medium or low levels. Many students struggle to interpret data presented in the form of graphs and tables. This deficiency aligns with Hidayah et al. (2019) that students' ability to interpret graphs/tables presented in questions is limited. Also the inadequate proficiency in scientific literacy among students arises from their incapacity to address scientific literacy queries, which involve comprehending and analyzing the questions (Nuryanti et al., 2023). Considering the science literacy scores obtained, it is evident that there is a necessity to enhance them to reach the high category. Furthermore, specific aspects of reading literacy can be seen in Table 5.

Table 5. Students Reading Literacy Test Result

Range of Literacy Scores	Number of Students (%)	Average (%)
67 - 100	70.2	67.9 (high)
33 - 66	24.0	
< 33	5.8	

The result presented in Table 5 show that the description of the reading literacy profile in high school students (9th and 10th grades) can be categorized into the low group at 5.8%, the medium category at 24.0% and the high category at 70.2%. Based on the literacy scores achieved, students are in high category with an average score of 67.9%. In reading literacy, 70.2% of students fall within the score range of 67 - 100. The high category is also attributed to the majority of questions and students' answer being at level 1. This is consistent with the reading literacy ability of Indonesian students, which is only at level 1, while other OECD countries place the reading literacy level at level 3 (Shara et al., 2021). According to Shara et al. (2021) proficiency in reading literacy is fundamental and serves as a prerequisite for mastering other literacy skills. It demands students to exhibit strong concentration, enabling them not only to read fluently but also comprehend the information and meaning conveyed within the text. The low reading literacy can be caused by students' ability to explore when reading textbooks, reading interdisciplinary, and the ability to read in class are quite lacking (Husna et al., 2016). Therefore, reading literacy among students must be continually improved. Additionally, specific aspects of mathematical literacy can be seen in Table 6.

Table 6. Students' Mathematic Literacy Test Result

Range of Literacy Scores	Number of Students (%)	Average (%)
67 - 100	14.4	40.6 (moderate)
33 - 66	32.7	
< 33	52.9	



The result of data analysis in Table 6 show that the description of the mathematic literacy profile in high school students (9th and 10th grades) can be categorized into the low group at 52.9%, the medium category at 32.7% and the high category at 14.4%. Based on the mathematic literacy scores achieved, students are in moderate with an average score of 40.6 %. Although falling into the medium category, the distribution of students obtaining scores below 33 is quite substantial, reaching 52.9%. In this aspect of mathematical literacy, most students still struggle to reach level 2, facing difficulty when confronted with questions requiring formulation skills. Similar to the previous research, that the mathematical literacy skills of junior high school students investigated by Khoirudin et al. (2017) revealed that students are still in the level 1 category. Also according to Kastberg et al. (2015) for mathematical literacy, 69% of students can reach levels 1-4 and only 1% can reach the highest level 5. Based on mathematics literacy score that have been obtained, it can be seen that there is still a need to increase to high category.

4. CONCLUSION

Based on the results of the students' literacy, it can be concluded that the average score for overall student literacy achievement is 56.2% that indicate moderate category. The average score for science literacy is 46.4%, for mathematical literacy is 40.6%, and for reading literacy is 67.9%. The students' science and mathematical literacy abilities are categorized as moderate, while their reading literacy ability is categorized as high. Although categorized as moderate, there are still students from each literacy aspect who fall into the low category, with scores below 33, especially in mathematical literacy. Low literacy abilities are caused by students' difficulty in interpreting graphs and tables in science literacy, as well as students' struggles with formulation skills in mathematical literacy. In reading literacy, students lack the ability to read and explore reading materials. Another factor is that students are not accustomed to working on literacy test questions, and evaluation tools have not led to literacy development. The advice the author offers for further research is for other researchers to develop literacy instruments so that students become accustomed to literacy questions. Additionally, it is necessary to develop teaching materials that help students understand and apply science easily in everyday life.

5. ACKNOWLEDGMENTS

The researcher expresses gratitude to the respondents who willingly took part in this study.

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