Mapping of High School Physics Science Literacy using Instruments Contained with Local Wisdom and Pancasila Student Profile: A Study in Banjarbaru City

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Abstract. Science literacy is an essential competency for students in the twenty-first century; however, the science literacy profile of high school students in Banjarbaru City has not been specifically investigated. Therefore, this study aimed to examine the science literacy profile of high school students in Banjarbaru City using a local wisdom-based instrument integrated with the Pancasila Student Profile. This study employed a quantitative survey design and analyzed student responses using the Rasch model through the Winstep application. Purposive sampling was used to select three senior high schools representing three sub-districts of Banjarbaru City, namely North Banjarbaru, Liang Anggang, and Landasan Ulin. A total of 99 students participated in the study. The results revealed that the overall science literacy level of students was categorized as moderate, with most students falling within the moderate ability category. Analysis based on science literacy competencies showed that students with higher ability levels demonstrated stronger achievement across the competencies of explaining scientific phenomena, interpreting scientific data and evidence, and evaluating and designing scientific investigations. However, interpreting scientific data and evidence was identified as the most challenging competency across ability levels. These findings indicate that although students have developed foundational science literacy skills, further efforts are needed to strengthen higher-order competencies, particularly evidence-based reasoning and scientific data interpretation. The results may provide useful information for improving science learning and assessment practices in secondary education.

Keywords: science literacy; Banjarbaru City; Rasch model; local wisdom; Pancasila Student Profile.

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1 Introduction

Science, mathematical, and language literacy are essential competencies for individuals to participate effectively in the knowledge-based society of the Fourth Industrial Revolution [1, 2]. The rapid advancement of science and technology in the twenty-first century has increased the demand for these competencies in various aspects of life [3] . Consequently, individuals are required to develop a range of twenty-first-century skills, particularly science literacy, to adapt to the challenges and opportunities of modern society [4].

Science literacy refers to an individual's ability to engage with science-related issues and ideas as a reflective citizen capable of participating in informed discussions about science and technology[5]. This ability includes explaining scientific phenomena, evaluating and designing scientific investigations, and interpreting scientific data and evidence. In addition, science literacy involves applying scientific concepts in everyday situations and using scientific evidence to explain and understand natural phenomena [6–8]. Therefore, science literacy encompasses not only scientific knowledge but also the ability to use that knowledge in scientific reasoning and decision-making [3, 9–11].

Science literacy has become an essential competency for students in preparing for life in an increasingly globalized world, where environmental, health, economic, and other societal challenges require informed decision-making [12–17] . Individuals with adequate science literacy possess the knowledge, understanding, skills, and values needed to interpret scientific information and apply it in various contexts [18, 19]. Furthermore, students with strong science literacy skills are more likely to develop awareness of personal, social, and environmental issues and to make responsible decisions based on scientific evidence [20–23]. Therefore, fostering a culture of science literacy has become an important educational goal, particularly in preparing students with the competencies required for the twenty-first century.

Science literacy is an important focus of education around the world, including Indonesia [24–27]. It is widely recognized as an indicator of educational quality and students' readiness to face the challenges of modern society [21, 28, 29]. Achieving quality education requires not only effective teaching and learning processes but also appropriate assessment practices [30–32]. Therefore, science literacy needs to be measured systematically to provide evidence that can support educational evaluation, decision-making, and policy development. Information obtained from science literacy assessments can be used to identify students' strengths and weaknesses and to improve the quality of education in the twenty-first century.

Science literacy in Indonesia has been assessed through the Programme for International Student Assessment (PISA). The results of PISA from 2000 to 2022 consistently indicate that Indonesian students perform below the average science literacy level of OECD countries [5, 33]. These findings suggest that improving students' science literacy remains a major challenge for the Indonesian education

system. However, PISA provides information at the national level and offers limited insight into variations in science literacy across different regions of Indonesia. Given the country's large geographical area and diverse educational contexts, regional assessments are needed to provide a more detailed understanding of students' science literacy profiles [34, 35]. Such information is important for developing educational programs and interventions that are responsive to local needs and conditions.

Banjarbaru City, one of the major educational centers in South Kalimantan, has received limited attention in studies of students' science literacy. Previous research conducted in this area reported relatively low levels of science literacy; however, the sample size used was not sufficiently representative to describe the overall science literacy profile of high school students in Banjarbaru City. Therefore, further investigation using a larger and more representative sample is needed to obtain a more comprehensive understanding of students' science literacy levels.

This study employed a science literacy instrument integrated with local wisdom and the Pancasila Student Profile. The Pancasila Student Profile emphasizes the development of competencies that enable students to connect learning experiences with real-life situations [36, 37]. Similarly, the integration of local wisdom provides contextual learning situations that are familiar to students and supports their understanding of scientific concepts in everyday life. These characteristics are consistent with the PISA framework, which highlights the importance of contextual factors in the assessment of science literacy. Therefore, this study aims to examine the science literacy profile of high school students in Banjarbaru City using an instrument based on local wisdom and the Pancasila Student Profile.

2 Method

This study employed a quantitative survey design. Purposive sampling was used in this study to gather data from a preselected sample of the population. The population of this study consisted of high school students in Banjarbaru City. Based on data obtained from the Ministry of Education database (Dapodik), it is known that the number of high school students in Banjarbaru City is 5,205, spread across 14 schools.

Purposive sampling was used to select the research sample. Three schools were chosen to represent three different sub-districts of Banjarbaru City, namely North Banjarbaru, Liang Anggang, and Landasan Ulin. To determine the minimum required sample size, the Slovin formula was applied. The resulting sample size was considered sufficient to represent the target population and support the objectives of the study.

$$n = \frac{N}{1 + N(e)^2}$$

Based on the Slovin formula, the minimum required sample size was determined to be 99 students. The study ultimately involved 99 students who met the sampling criteria.

Data were collected using a written science literacy test developed based on local wisdom and the Pancasila Student Profile. The instrument focused on the topic of particle dynamics in physics, as this topic is closely related to students' everyday experiences and provides opportunities to assess the application of scientific concepts in real-life contexts. The instrument was developed using the PISA science literacy framework, which emphasizes three core competencies: explaining scientific phenomena, evaluating and designing scientific investigations, and interpreting scientific data and evidence. The blueprint of the instrument based on these competencies is presented in Table 1.

Table 1. Outline of the instrument [36]

Total Question	Science Literacy Competencies
6	Explaining phenomena scientifically
6	Interpreting data and evidence scientifically
4	Evaluating and designing scientific research

Students' science literacy was measured using an instrument consisting of 16 two-tier multiple-choice items. Each item required students to select an answer and provide a supporting reason. Responses were scored according to the rubric presented in Table 2.

Table 2. Score Guidelines [36]

Multiple Choice Answer	Reason Quality	Score
Correct	Scientifically accurate	3
Correct	Partially accurate	2
Correct	Incorrect	1
Incorrect	Incorrect	0

Scientifically accurate = The explanation is scientifically correct and complete.
Partially accurate = The explanation is generally correct but incomplete or lacks precision.

Incorrect = The explanation is scientifically incorrect or unsupported.
The maximum possible score was 48, and students' scores were converted into percentages using the following formula:

$$Grades = \frac{Total\ Score}{48} \times 100\%$$

The scoring results were recorded in Microsoft Excel and saved in a formatted text (space-delimited) file prior to analysis. The data were then analyzed using the Winsteps software based on the Rasch measurement model. Students' science literacy levels were determined using person-measure analysis. The criteria used to classify students' ability levels are presented in Table 3.

Table 3. Students Ability Criteria

Logit Value of Student Ability	Ability Criteria
$X \geq (M + 1{,}5\ Sdi)$	Very High
$(M + 0{,}5\ Sdi) < X < (M + 1{,}5\ Sdi)$	High
$(M - 0{,}5\ Sdi) < X < (M + 0{,}5\ Sdi)$	Moderate
$(M - 1{,}5\ Sdi) < X < (M - 0{,}5\ Sdi)$	Low
$X \leq (M - 1{,}5\ Sdi)$	Very Low

In addition to person-measure analysis, science literacy skills were further examined using Wright maps (variable maps). A Wright map simultaneously displays the distribution of student ability and item difficulty on the same logit scale. Items located at the upper part of the map represent more difficult questions, whereas items at the lower part represent easier questions. Similarly, students with higher ability levels are positioned at the upper part of the map, while those with lower ability levels are positioned at the lower part. This feature provides a comprehensive representation of the relationship between student ability and item difficulty.

3 Results and Discussion

3.1 Overall Science Literacy Profile of High School Students in Banjarbaru City

This study aimed to examine the science literacy profile of high school students in Banjarbaru City. Three senior high schools representing different sub-districts of Banjarbaru City participated in the study. A total of 99 students were involved as research participants, which met the minimum sample size determined using the Slovin formula.

Table 4. *Summary Statistic*

SUMMARY OF 99 MEASURED Person

	TOTAL SCORE	COUNT	MODEL MEASURE	MODEL S.E.	INFIT MNSQ	INFIT ZSTD	OUTFIT MNSQ	OUTFIT ZSTD
MEAN	12.5	16.0	-1.08	.35	.97	-.08	1.01	.07
SEM	.6	.0	.06	.01	.04	.11	.04	.09
P.SD	5.6	.0	.63	.06	.42	1.06	.42	.85
S.SD	5.6	.0	.64	.06	.42	1.06	.42	.85
MAX.	37.0	16.0	1.21	.53	2.12	2.73	2.76	3.34
MIN.	4.0	16.0	-2.35	.29	.33	-2.06	.39	-1.37

REAL RMSE	.39	TRUE SD	.50	SEPARATION 1.30	Person RELIABILITY	.63
MODEL RMSE	.36	TRUE SD	.52	SEPARATION 1.46	Person RELIABILITY	.68
S.E. OF Person MEAN = .06						

Person RAW SCORE-TO-MEASURE CORRELATION = .98
CRONBACH ALPHA (KR-20) Person RAW SCORE "TEST" RELIABILITY = .69 SEM = 3.11
STANDARDIZED (50 ITEM) RELIABILITY = .87

Based on the Rasch analysis conducted using Winsteps, the mean student ability was -1.08 logits with a standard deviation of 0.63. The classification of student ability levels was determined using the criteria presented in Table 3, which are based on the mean logit value and standard deviation. Using these criteria, the ability categories of high school students in Banjarbaru City were established as presented in Table 5.

Table 5. Students Ability Criteria in Banjarbaru City

Logit Value of Student Ability	Ability Criteria
$X \geq$ -0.135	Very High
-0.765 < X < -0.135	High
-1.395< X < -0.765	Moderate
-2.025 < X < -1.395	Low
$X \leq$ -2.025	Very Low

Students' science literacy levels were determined using the person-measure logit values obtained from the Rasch analysis. These logit values were then compared with the classification criteria presented in Table 5 to categorize students according to their science literacy levels. The distribution of students across the science literacy categories is presented in Table 6.

Table 6. Science Literacy in Banjarbaru City

Category	Quantity	Percentage
Very High	4	4.04
High	27	27.27
Moderate	37	37.37
Low	22	22.22
Very Low	9	9.09
Total	99	100

Based on Table 6, the overall science literacy profile of high school students in Banjarbaru City can be classified as moderate. This finding is indicated by the fact that the largest proportion of students (37.37%) was categorized in the moderate literacy level. In addition, 27.27% of students were classified in the high category, 22.22% in the low category, 9.09% in the very low category, and only 4.04% in the very high category. These results suggest that although some students have achieved high levels of science literacy, the majority still demonstrate only a moderate level of competence.

3.2 Science Literacy Competencies across Student Ability Levels

Students' science literacy skills were further analyzed based on the three science literacy competencies defined in the PISA framework. Items representing each competency were grouped and analyzed separately using Winsteps to obtain the corresponding logit values. The average logit value for each competency was then calculated across student ability categories. Using the classification criteria presented in Table 5, the competency achievement levels for each student category were determined, as shown in Table 7.

Table 7. Analysis of each Competency

Students Category	Competency	Logit Value	Criteria
Very High	1	1.32	Very High
	2	0.11	Very High
	3	0.56	Very High
High	1	-0.64	High
	2	-0.77	Moderate
	3	-0.35	High
Moderate	1	-1.37	Moderate
	2	-1.15	Moderate
	3	-1.23	Moderate
Low	1	-2.10	Very Low
	2	-1.98	Low
	3	-1.77	Low
Very Low	1	-3.26	Very Low
	2	-3.19	Very Low
	3	-1.81	Low

Table 7 shows differences in science literacy competency achievement across student ability levels. Students in the very high category achieved very high criteria in all three science literacy competencies, indicating that they had mastered the competencies of explaining scientific phenomena, interpreting scientific data and evidence, and evaluating and designing scientific investigations. Students in the high category achieved high criteria in explaining scientific phenomena and evaluating and designing scientific investigations. However, their performance in interpreting scientific data and evidence remained at the moderate level, suggesting that this competency was relatively more challenging.

Students in the moderate category achieved moderate criteria across all three competencies, indicating that these competencies had begun to develop but still required further improvement. In contrast, students in the low and very low categories did not demonstrate sufficient achievement in any of the three competencies. These findings indicate that science literacy competencies tend to develop progressively with increasing student ability levels, although interpreting scientific data and evidence remains the most challenging competency even for students with relatively high literacy levels.

3.3 Wright Map Analysis of Student Ability and Item Difficulty

One of the advantages of Rasch analysis is its ability to display student ability and item difficulty on the same logit scale through a Wright map. In this map, students with higher ability levels are positioned at the upper part of the scale, whereas students with lower ability levels are positioned at the lower part. Similarly, more difficult items are located at higher logit values, while easier items are located at lower logit values. Therefore, the Wright map provides a comprehensive overview of the relationship between student ability and item difficulty in science literacy.

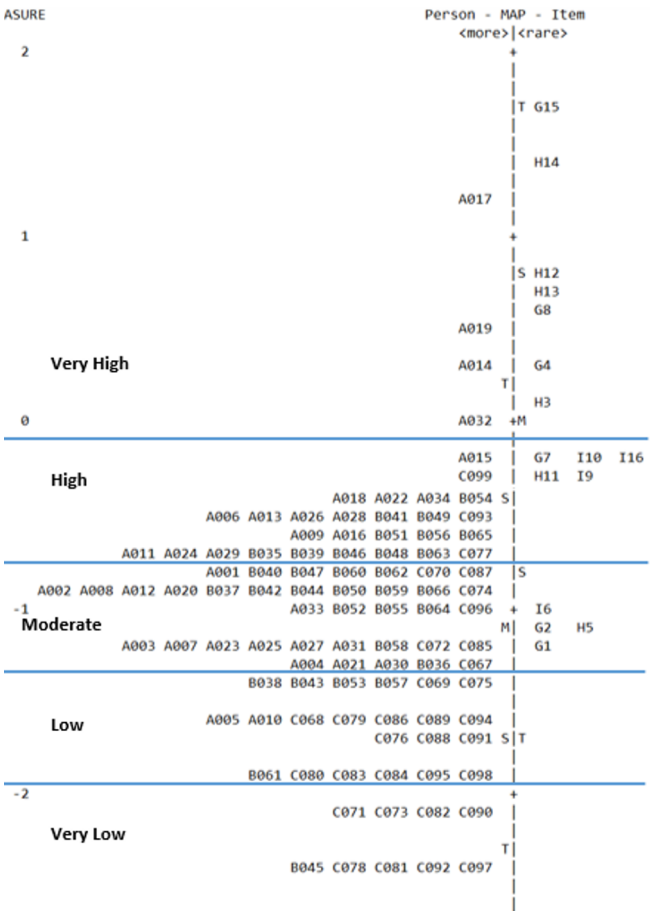


Fig. 1. Variable Maps

Figure 1 presents the Wright map showing the distribution of student ability and item difficulty on a common logit scale. The left side of the map represents the distribution of students according to their science literacy ability, whereas the right side represents the distribution of test items. Students located at higher positions on the map demonstrate higher science literacy ability, while students positioned lower on the scale exhibit lower levels of science literacy. Likewise, items located at higher logit values are more difficult, whereas items at lower logit values are easier for students to answer.

Based on the Wright map, students were distributed across five ability categories: very high, high, moderate, low, and very low. Students in the upper region of the map demonstrated higher science literacy ability, whereas those in the lower region showed lower ability levels. The distribution of students across these categories is consistent with the classification presented in Table 6.

Very Low and Low Literacy Students. According to Figure 1, nine students were classified in the very low science literacy category, consisting of one student from School B and eight students from School C. These students obtained logit values below -2.025, indicating substantially lower science literacy ability compared with the overall sample. The Wright map shows that students in this category were unable to successfully respond to items representing any of the three science literacy competencies. This finding suggests that they experienced considerable difficulties in explaining scientific phenomena, interpreting scientific data and evidence, and evaluating and designing scientific investigations.

A closer examination of student C081 illustrates the characteristics of the very low literacy category. The student correctly answered only one of six items related to explaining scientific phenomena, two of six items related to interpreting scientific data and evidence, and one of four items related to evaluating and designing scientific investigations. In most cases, the student selected an answer without providing an appropriate scientific justification. This pattern suggests that the few correct responses may have resulted from guessing rather than from a genuine understanding of scientific concepts. Therefore, the performance of student C081 supports the classification of very low science literacy ability identified in the Rasch analysis.

The low science literacy category consisted of 22 students, including two students from School A, five students from School B, and fifteen students from School C. These students obtained logit values ranging from -2.025 to -1.395. Similar to the very low category, students in the low category were generally unable to demonstrate adequate achievement across the three science literacy competencies. The Wright map indicates that most items representing these competencies remained beyond their ability level.

Student B061 was selected as a representative example of the low literacy category. The student answered only two of six items related to explaining scientific phenomena, two of six items related to interpreting scientific data and evidence, and one of four items related to evaluating and designing scientific investigations. Although several responses were partially correct, the student was unable to provide sufficient scientific reasoning to demonstrate mastery of the competencies assessed. These results indicate that students in the low category have not yet developed the minimum level of science literacy required to effectively apply scientific knowledge and reasoning in contextual situations.

The findings for both the low and very low categories are consistent with the competency analysis presented in Table 7, which shows that these students did not achieve satisfactory performance in any of the three science literacy competencies. This result suggests that limited conceptual understanding and difficulties in providing evidence-based explanations remain major challenges for students with lower levels of science literacy. Similar findings have been reported in previous studies, which indicate that students with low science literacy often struggle to connect scientific concepts with real-world contexts and to justify their answers using scientific evidence [38, 39].

Moderate Literacy Students. The moderate science literacy category comprised 37 students, representing the largest proportion of the sample. This group consisted of 15 students from School A, 15 students from School B, and 7 students from School C. Students in this category obtained logit values ranging from -1.395 to -0.765, indicating an intermediate level of science literacy ability compared with the overall sample.

Based on the Wright map shown in Figure 1, students in the moderate category were able to answer several items that could not be solved by students in the low and very low categories, including items G1, G2, H5, and I6. These items represent the three science literacy competencies assessed in this study. The ability to answer these items suggest that students in the moderate category had begun to develop competencies in explaining scientific phenomena, interpreting scientific data and evidence, and evaluating and designing scientific investigations. However, their performance remained limited, indicating that these competencies had not yet been fully mastered.

A more detailed analysis of student B052 provides an example of the characteristics of this category. The student successfully answered three of six items related to explaining scientific phenomena, although several responses contained incomplete scientific reasoning. Similarly, the student answered three of six items related to interpreting scientific data and evidence and three of four items related to evaluating and designing scientific investigations. While the student demonstrated an emerging understanding of the assessed competencies, the explanations provided were often incomplete and lacked sufficient scientific justification.

These findings indicate that students in the moderate category have already developed the three science literacy competencies assessed in this study, but their proficiency remains limited. This interpretation is consistent with the competency analysis presented in Table 7, where all three competencies were classified within the moderate category. The results suggest that students at this level are able to recognize scientific concepts and apply basic reasoning to contextual problems, yet they still experience difficulties in constructing complete scientific explanations and evidence-based arguments.

The predominance of students in the moderate category is an important finding because it reflects the overall science literacy profile of high school students in Banjarbaru City. This result indicates that most students possess foundational science literacy skills but still require further learning experiences that promote scientific reasoning, data interpretation, and evidence-based decision making. Similar patterns have been reported in previous studies, which found that students at intermediate literacy levels are generally capable of understanding basic scientific concepts but often encounter difficulties when required to justify answers, analyze evidence, or apply scientific knowledge in unfamiliar contexts [40].

High and Very High Literacy Students. The high science literacy category consisted of 27 students, including 13 students from School A, 11 students from School B, and 3

students from School C. Students in this category obtained logit values ranging from -0.765 to -0.135. Based on the Wright map, students in the high category were able to answer more challenging items than those in the moderate, low, and very low categories. Several items, including G7, H11, I9, I10, and I16, could only be answered by students in the high category or above, indicating a higher level of science literacy proficiency.

Analysis of item distribution showed that students in the high category demonstrated strong performance in explaining scientific phenomena and evaluating and designing scientific investigations. Most items representing these competencies could be successfully answered by students in this category. However, interpreting scientific data and evidence remained relatively challenging. Only a limited number of items related to this competency could be answered correctly, indicating that data interpretation and evidence-based reasoning were still developing despite the students' overall high literacy level.

Student A034 was selected as a representative example of the high literacy category. The student successfully answered four of six items related to explaining scientific phenomena, with most responses supported by appropriate scientific reasoning. In addition, the student correctly answered three of four items related to evaluating and designing scientific investigations. In contrast, performance on items related to interpreting scientific data and evidence was lower, as only two of six items were answered correctly. This pattern supports the competency analysis presented in Table 6, which shows that students in the high category achieved high criteria in two competencies while remaining at the moderate level for interpreting scientific data and evidence.

The very high science literacy category consisted of four students, all of whom were from School A. These students obtained logit values above -0.135 and occupied the highest positions on the Wright map. Several of the most difficult items, including G15, H14, H12, H13, G8, G4, and H3, could only be answered by students in this category. This finding indicates that students in the very high category possessed advanced science literacy skills and were capable of responding successfully to items requiring higher levels of scientific reasoning and evidence-based thinking.

Student A017 provides an example of the characteristics of the very high literacy category. The student successfully answered five of six items related to explaining scientific phenomena and five of six items related to interpreting scientific data and evidence, with most responses receiving the maximum score. The student also demonstrated strong performance in evaluating and designing scientific investigations. The few unanswered items were located at the end of the test, suggesting that time limitations rather than conceptual difficulties may have contributed to the missing responses. Overall, the performance of student A017 indicates mastery of all three science literacy competencies assessed in this study.

The findings from the high and very high categories demonstrate that science literacy competencies develop progressively as student ability increases. Students in the very high category showed mastery across all competencies, whereas students in the high category still experienced difficulties in interpreting scientific data and evidence. This result is consistent with the competency analysis presented in Table 7 and suggests that evidence-based reasoning and data interpretation are among the most demanding aspects of science literacy. Similar findings have been reported in previous studies, which identify scientific data interpretation as one of the most challenging competencies for secondary school students, even among those with relatively high levels of science achievement [41, 42].

3.4 Summary of Competency Achievement and PISA Proficiency Level

The results of this study indicate clear differences in science literacy competency achievement across student ability levels. Students in the very high category demonstrated mastery of all three science literacy competencies, namely explaining scientific phenomena, interpreting scientific data and evidence, and evaluating and designing scientific investigations. Students in the high category also showed strong performance in explaining scientific phenomena and evaluating and designing scientific investigations, although their ability to interpret scientific data and evidence remained at a moderate level. Meanwhile, students in the moderate category demonstrated emerging proficiency across all three competencies but still required further development. In contrast, students in the low and very low categories were unable to demonstrate adequate achievement in any of the assessed competencies.

An important finding of this study is that interpreting scientific data and evidence emerged as the most challenging competency across student ability levels. Even students in the high category experienced difficulties in answering items related to data interpretation and evidence-based reasoning. This finding suggests that students may be more familiar with recalling scientific concepts than with analyzing evidence, interpreting data, and constructing scientifically justified conclusions. Similar results have been reported in previous studies, which found that data interpretation and scientific reasoning are among the most demanding aspects of science literacy for secondary school students [42].

Overall, the science literacy profile of high school students in Banjarbaru City was categorized as moderate, as the largest proportion of students (37.37%) belonged to the moderate literacy category. Based on the PISA proficiency framework, students in this category can be associated with Level 1a, where learners are able to use basic scientific knowledge to recognize simple scientific explanations, identify straightforward relationships between variables, and interpret information presented in familiar contexts. However, students at this level generally experience difficulties when confronted with more complex scientific problems requiring higher-order reasoning and evidence-based argumentation.

These findings have important implications for science education. The predominance of students in the moderate category indicates that foundational science literacy skills have been established, but further instructional support is needed to strengthen higher-order competencies, particularly scientific reasoning, data interpretation, and evidence-based decision making. Learning activities that incorporate contextual problems, inquiry-based investigations, and scientific argumentation may provide opportunities for students to develop these competencies more effectively.

Furthermore, the use of science literacy instruments based on local wisdom and the Pancasila Student Profile offers a contextual approach to assessing students' scientific understanding. By connecting scientific concepts with students' everyday experiences and local contexts, such instruments may help students construct meaningful scientific knowledge and improve their engagement with science learning. Therefore, the findings of this study may serve as a reference for educators and policymakers in designing learning and assessment practices that support the development of science literacy in Indonesian schools.

4 Conclusion

The present study examined the science literacy profile of high school students in Banjarbaru City using an instrument based on local wisdom and the Pancasila Student Profile. The findings revealed that the overall science literacy level of students was classified as moderate, with the majority of students (37.37%) belonging to the moderate category. Analysis of science literacy competencies showed that students in the very high category demonstrated mastery of all three competencies, namely explaining scientific phenomena, interpreting scientific data and evidence, and evaluating and designing scientific investigations. Students in the high and moderate categories had developed these competencies to varying degrees, although interpreting scientific data and evidence remained the most challenging competency. In contrast, students in the low and very low categories were unable to demonstrate adequate achievement across the three competencies.

These findings indicate that most students have acquired foundational science literacy skills but still require further support to strengthen higher-order competencies, particularly scientific reasoning, data interpretation, and evidence-based decision making. The use of local wisdom and the Pancasila Student Profile as contextual elements in science literacy assessment may provide meaningful opportunities to connect scientific concepts with students' everyday experiences and local environments.

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References

1. Sholihah, A., Syahmani, S., Suyidno, S.: The Effectiveness of STEM Integrated Problem-Based Learning in Enhancing Student Science Literacy on Temperature and Heat Materials. Jurnal Ilmiah Pendidikan Fisika. 7, 1–9 (2023). https://doi.org/10.20527/JIPF.V7I1.5639.
2. Hetherington, L., Chappell, K., Ruck Keene, H., Wren, H., Cukurova, M., Hathaway, C., Sotiriou, S., Bogner, F.: International educators' perspectives on the purpose of science education and the relationship between school science and creativity. Research in Science & Technological Education. 38, 19–41 (2020). https://doi.org/10.1080/02635143.2019.1575803.
3. Murti, W.W., Sunarti, T.: Pengembangan Instrumen Tes Literasi Sains Berbasis Kearifan Lokal di Trenggalek. ORBITA: Jurnal Kajian, Inovasi, dan Aplikasi Pendidikan Fisika. 7, (2021).
4. Kusumawati, A.T., Wasis, Sanjaya, I.G.M., Kholiq, A.: ELITE (Ebook Literacy) for Junior High School Student's Scientific Literacy in Solar System Material. J. Phys. Conf. Ser. 1491, (2019).
5. OECD: PISA 2022 Assessment and Analytical Framework. OECD, Paris (2023). https://doi.org/10.1787/53F23881-EN.
6. Hanfstingl, B., Gnambs, T., Porsch, R., Jude, N.: Exploring the association between non-specialised science teacher rates and student science literacy: an analysis of PISA data across 18 nations. Int. J. Sci. Educ. 46, 874–892 (2024). https://doi.org/10.1080/09500693.2023.2262729.
7. Saroughi, M., Cheema, J.: Mediating effect of sense of belonging on the relationship between teacher support and science literacy: evidence from Lebanon. Current Psychology. 42, 15277–15286 (2023). https://doi.org/10.1007/S12144-022-02803-X/METRICS.
8. Kang, J.: Interrelationship Between Inquiry-Based Learning and Instructional Quality in Predicting Science Literacy. Res. Sci. Educ. 52, 339–355 (2022). https://doi.org/10.1007/S11165-020-09946-6/TABLES/6.
9. Rahayuni, G.: Hubungan Keterampilan Berpikir Kritis dan literasi Sains Pada Pembelajaran IPA Terpadu dengan Model PBM dan STM. Jurnal Penelitian Pembelajaran IPA. 2, 133 (2016).
10. Arifin, L., Sunarti, T.: the Improvement of Students' Scientific Literay Through Guided Inquiry Learning Model on Fluid Dynamics Topic. Jurnal Penelitian Fisika dan Aplikasinya (JPFA). 7, 68 (2017). https://doi.org/10.26740/jpfa.v7n2.p68-78.
11. Insani, N.F., Sunarti, T.: Keterlaksanaan Model Pembelajaran Sains Teknologi Masyarakat Untuk Meningkatkan Literasi Sains Dalam Pembelajaran Fisika. Inovasi Pendidikan Fisika. 7, 149–153 (2018).
12. Almeida, T. da S., Lima, P.H. de C., Carvalho, R.L. de, Silva, W.G. da: Improvement in Logisim to Digital Systems Simulation in Higher Levels of Abstraction and Synthesis. International Journal ofApplied Information Systems. 12, 1–7 (2018).

13. Ariefianti, M., Sholahuddin, A., Wati, M.: The Validity of The Student Worksheet of Thermal Energy Material Based on Science, Technology, Engineering, Mathematics (STEM) and Local Wisdom to Enhance Scientific Literacy. Jurnal Ilmiah Pendidikan Fisika. 7, 487–499 (2023). https://doi.org/10.20527/jipf.v7i3.9379.
14. Fadlila, N., Hilmi, I., Sugiman: Students' statistical literacy: An analysis in solving PISA-like problems. AIP Conf. Proc. 2622, (2024). https://doi.org/10.1063/5.0133938/3286762.
15. Chusni, M.M., Zakwandi, R., Hasanah, A., Malik, A., Ghazali, A.M., Ubaidillah, M.: Scientific Literacy: How is it Evolved to Pre-Service Physics Teacher? Jurnal Ilmiah Pendidikan Fisika Al-Biruni. 7, 219–226 (2018). https://doi.org/10.24042/jipfalbiruni.v7i2.2781.
16. Hartini, S., Khairiyah, N., Wati, M., Dewantara, D., Zainuddin, Ismail, Saehana, S., Rahman, N.F.A.: STUDENT'S SCIENCE LITERACY SKILL THROUGH IMPLEMENTATION OF INTEGRATING TEACHING MODULES WITH SETS APPROACH ON RENEWABLE ENERGY TOPICS . Journal of Engineering Science and Technology. 19, 1693–1715 (2024).
17. Hartini, S., Latifah, R., Salam, M.A.: Developing of physics teaching material based on scientific literacy. J. Phys. Conf. Ser. 1171, (2019).
18. Fadila, D., Suliyanah, S., Deta, U.A.: Analysis of Interest and Scientific Literacy Skills of Senior High School in Learning Physics. Lensa: Jurnal Kependidikan Fisika. 8, 39–47 (2020). https://doi.org/https://doi.org/10.33394/j lkf.v8i2.3195.
19. Deta, U.A., Agustina, P.Z.R., Fadillah, R.N., Prakoso, I., Lestari, N.A., Yantidewi, M., K, P.B.: The Science Literacy Profile of Tsunami Disaster Mitigation od Non-Science Undergraduate Student in Universitas Negeri Surabaya. J. Phys. Conf. Ser. 1417, (2019). https://doi.org/10.1088/1742-6596/1417/1/012095.
20. Wati, M., Husna, A., Miriam, S., Mahtari, S.: Developing Cognitive Instruments Based on Science Literacy on Sound Materials. In: 1st International Conference on Creativity, Innovation and Technology (2018).
21. Wati, M., Mahtari, S., Muthi'ah, A., Dewantara, D., Suharno, S.: The Scientific Literacy Test Instrument on Particle Dynamics for High School Students. Asian Journal of Assessment in Teaching and Learning. 13, 46–56 (2023). https://doi.org/10.37134/AJATEL.VOL13.2.5.2023.
22. Kruit, P.M., Oostdam, R.J., van den Berg, E., Schuitema, J.A.: Assessing students' ability in performing scientific inquiry: instruments for measuring science skills in primary education. Research in Science & Technological Education. 36, 413–439 (2018). https://doi.org/10.1080/02635143.2017.1421530.
23. Bellová, R., Melicherčíková, D., Tomčík, P.: Possible reasons for low scientific literacy of Slovak students in some natural science subjects. Research in Science & Technological Education. 36, 226–242 (2018). https://doi.org/10.1080/02635143.2017.1367656.
24. Parno, Yuliati, L., Hermanto, F.M., Ali, M.: A case study on comparison of high school students' scientific literacy competencies domain in physics with different methods: PBL-stem education, PBL, and conventional learning. Jurnal Pendidikan IPA Indonesia. 9, 159–168 (2020). https://doi.org/10.15294/jpii.v9i2.23894.

25. Kholiq, A.: Development of B D F-AR 2 (Physics Digital Book Based Augmented Reality) to train students' scientific literacy on Global Warming Material. Berkala Ilmiah Pendidikan Fisika. 8, (2020).
26. Winarni, E.W., Hambali, D., Purwandari, E.P.: Analysis of language and scientific literacy skills for 4th grade elementary school students through discovery learning and ict media. International Journal of Instruction. 13, 213–222 (2020). https://doi.org/10.29333/iji.2020.13215a.
27. Wahyu, Y., Suastra, I.W., Sadia, I.W., Suarni, N.K.: The effectiveness of mobile augmented reality assisted STEM-based learning on scientific literacy and students' achievement. International Journal of Instruction. 13, 343–356 (2020). https://doi.org/10.29333/iji.2020.13324a.
28. Dewantara, D., Mahtari, S., Misbah, M., Haryandi, S.: Student Responses in Biology Physics Courses Use Worksheets Based on Scientific Literacy. Prisma Sains : Jurnal Pengkajian Ilmu dan Pembelajaran Matematika dan IPA IKIP Mataram. 7, 192–197 (2019).
29. Hidayat, R., M, A.S., Dewantara, D.: The development of electronic teaching materials on linear impulse and linear momentum to improve students' scietific literacy. J. Phys. Conf. Ser. 2104, (2021).
30. Mustika, A.N., Wati, M., Mahtari, S.: The development of scientific literacy test instrument for high school material elasticity of solids. AIP Conf. Proc. 2622, (2024). https://doi.org/10.1063/5.0133888/3286691.
31. Wati, M., Miriam, S.: Pengembangan Instrumen Kognitif Literasi Sains Pada Pokok Bahasan Tekanan Di Kelas VIII SMP Kota Banjarmasin. Jurnal Ilmiah Pendidikan Fisika. 1, 113–125 (2017).
32. Zainab, Z., Wati, M., Miriam, S.: Pengembangan instrumen kognitif literasi sains pada pokok bahasan tekanan di kelas VIII SMP kota Banjarmasin. Jurnal Ilmiah Pendidikan Fisika. 1, 113–125 (2017).
33. Yusmar, F., Fadilah, R.E.: ANALISIS RENDAHNYA LITERASI SAINS PESERTA DIDIK INDONESIA: HASIL PISA DAN FAKTOR PENYEBAB. LENSA (Lentera Sains): Jurnal Pendidikan IPA. 13, 11–19 (2023). https://doi.org/10.24929/LENSA.V13I1.283.
34. Istyadji, M., Sauqina: Conception of scientific literacy in the development of scientific literacy assessment tools: A systematic theoretical review. Journal of Turkish Science Education. 20, 281–308 (2023). https://doi.org/10.36681/tused.2023.016.
35. Syahmani, Sauqina, Hafizah, E.: Correlation of students' environmental literacy and scientific literacy after students' involvement in wetlands-based stem educational approach. IOP Conf. Ser. Earth Environ. Sci. 758, 012014 (2021). https://doi.org/10.1088/1755-1315/758/1/012014.
36. Wati, M., Dewantara, D.: Asesmen literasi sains bermuatan kearifan lokal dan profil pelajar Pancasila. ULM Press, Banjarmasin (2023).
37. Piesesa, M.S.L., Camellia, C.: Desain Proyek Penguatan Profil Pelajar Pancasila untuk Menanamkan Nilai Karakter Mandiri, Kreatif dan Gotong-Royong. Jurnal Moral Kemasyarakatan. 8, 74–83 (2023). https://doi.org/10.21067/JMK.V8I1.8260.
38. Dewantara, D., Wati, M., Hartini, S., Haryandi, S., Fajariah, I., Syifa, N.A., Fitri, M.R.: Analysis of Item Response Theory in Science Literacy Assessment Containing Local

Wisdom and Pancasila Student Profile. Tarbiyah : Jurnal Ilmiah Kependidikan. 13, 229–243 (2024). https://doi.org/10.18592/TARBIYAH.V13I2.13771.

39. Dewantara, D., Fajariah, I., Hartini, S., Zainuddin: Physics science literacy profile using local wisdom-based instrument and profile of Pancasila students in particle dynamic. Momentum: Physics Education Journal. 9, 58–68 (2025). https://doi.org/10.21067/MPEJ.V9I1.10682.
40. Hartini, S., Khairiyah, N., Wati, M., Dewantara, D., Zainuddin, Z., Ismail, I., Saehena, S., Farahwahidah, N., Rahman, A.: STUDENT'S SCIENCE LITERACY SKILL THROUGH IMPLEMENTATION OF INTEGRATING TEACHING MODULES WITH SETS APPROACH ON RENEWABLE ENERGY TOPICS. Journal of Engineering Science and Technology. 19, 1693–1715 (2024).
41. Mustika, A.N., Wati, M., Mahtari, S.: The development of scientific literacy test instrument for high school material elasticity of solids. AIP Conf. Proc. 2622, (2024). https://doi.org/10.1063/5.0133888/3286691.
42. Fitri, M.R., Wati, M., Mahtari, S., Dewantara, D.: Profile of Science Literacy in Physics with Local Wisdom and Profile of Pancasila Students. Berkala Ilmiah Pendidikan Fisika. 13, 377–388 (2025). https://doi.org/10.20527/BIPF.V13I3.22527.

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