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Integrating Rebana-Based Local Wisdom into Physics Learning: Analyzing Students' Science Literacy by Region

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ABSTRACT

This study aims to analyze the level of scientific literacy among students from various regions, including regions that are not generally recognized as religious cities, by incorporating the context of local wisdom of the rebana musical instrument into the physics literacy instrument. This study uses a quantitative descriptive approach to measure and compare the level of physics literacy of students based on region. The results of the study indicate that scientific literacy is not only influenced by the religious background of a region but also by the relevance of the learning model, exposure to local culture, and the alignment between learning materials and students' life experiences. These findings emphasize the importance of integrating local and cultural contexts in physics learning to create meaningful learning experiences and encourage deeper understanding of concepts.

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INTRODUCTION

Solving simple problems related to everyday phenomena will never be separated from scientific literacy skills (Kelp et al., 2023). Therefore, scientific literacy has become a major focus of global education because it enables individuals to make scientifically informed decisions (OECD, 2019). According to Gormally (2012), science literacy is defined as the ability to distinguish scientific facts from various information by analyzing using scientific investigation methods, as well as the ability to organize, analyze, and interpret quantitative data and scientific information (Deta et al., 2023). However, research shows that students' science literacy, especially in developing countries, remains at a relatively low level (Charro et al., 2021).

The science literacy skills of Indonesian students are interpreted based on the results of the PISA survey, which is conducted every three years to assess reading, mathematics, and science literacy skills in each country. PISA measures science literacy using a framework that assesses science in general, so it can refer to some or all branches of natural sciences (OECD, 2023). The results of the 2022 PISA survey showed a significant decline in every country, which may be attributed to the fact that most countries participating in PISA were still affected by the COVID-19 pandemic, including Indonesia (Schleicher, 2023). Indonesia's average scores in each aspect of the 2022 PISA assessment were below the average of all participants (Alfaruqi & Nurwahidah, 2025; Yuda & Rosmilawati, 2024). The PISA score data indicates that the science literacy skills of

students in Indonesia are in the low category (Habibi et al., 2023; Hasnawati et al., 2024; Suparya et al., 2022).

Students' science literacy skills are measured based on three competencies, which consist of explaining scientific phenomena scientifically; constructing and evaluating designs for scientific investigations and critically interpreting scientific data and evidence; and researching, evaluating, and using scientific information for decision-making and action (OECD, 2022). Thus, students are said to have high or low science literacy skills based on the scores they achieve in instruments that contain these competency weights. Low science literacy skills can be influenced by factors such as the curriculum and education system, teaching methods and models chosen by teachers, learning facilities and resources, learning materials, and other factors related to student learning outcomes (Deta et al., 2023). Additionally, low science literacy can also be caused by a lack of connection between lesson materials and students' real-life contexts, making learning less meaningful and difficult to understand conceptually. Therefore, teachers play a crucial role in education as professionals responsible for planning learning, guiding the learning process, and conducting learning evaluations (Nurzannah, 2022).

The role of teachers is not only to convey information but also to design meaningful and contextual learning experiences to improve students' science literacy skills, especially in complex and challenging science learning. One of the most challenging science subjects is physics. Physics aims to introduce students to the complex phenomena occurring in the universe, necessitating an educational approach that emphasizes the underlying concepts and principles of such phenomena (Laos & Tefu, 2019). Connecting phenomena occurring in society with learning can be oriented toward culture-based learning, which can produce a science-literate generation (Habibi et al., 2023). Therefore, physics learning innovation needs to be integrated with a local wisdom approach (Dewi & Kuswanto, 2023).

Local wisdom stems from the development of culture, traditions, and knowledge in a region that has been established and adapted to prevailing values and norms, its relationship with nature, and adaptive changes (Deta et al., 2023). Local culture can be used as a stimulus in learning, including physics education (Nisa & Suprapto, 2023). The integration of local culture can strengthen the relevance of physics education while supporting cultural preservation (Nasution et al., 2025). This is supported by various studies that have examined local wisdom from the perspective of physics concepts (Nadzirin et al., 2024; Nasution et al., 2024; Saphira et al., 2022; Suprapto et al., 2023). One of the local wisdoms known in every region of Indonesia is the rebana. The rebana is a musical art form that has undergone cultural acculturation, becoming the traditional rebana musical art (Fajrie & Muslimin, 2023).

The rebana is a musical instrument that originated from the Arab people before Islam was preached by the Prophet Muhammad SAW (Pratama, 2023). The rebana musical instrument emerged and developed around the 13th century during the spread of Islam in Indonesia, including Java, where Islam was first spread by the Walisongo, namely Sunan Gresik (Al'asqolani & Musthofa, 2020). The rebana is played by striking it like a drum, which has a tubular shape without a flat lid. The rebana is held in the left hand, while the right hand strikes it. This is the distinctive feature of this type of membranophone instrument. The rebana, when played, is an integral part of Islamic music and poetry accompaniment, which has been accepted and developed in Indonesia due to the majority of its population being Muslim. Rebana music in Indonesia is performed in banjari, hadrah, and qosidah arts. In these arts, the rebana serves as the central musical instrument used to accompany vocal performances of shalawat, performed in groups with rhythmic patterns that create a lively and enthusiastic atmosphere.

The art of rebana music in banjari, hadrah, and qasidah has spread to various regions of Indonesia because it is often used to accompany Islamic holidays. The spread of rebana music in each region has led to developments in its form and rhythm, adapting to the local wisdom of each region. This has made rebana a distinctive part of traditional music in each region. Thus, rebana music represents the culture of a particular community through its distinctive tones, functions, or sounds, which are passed down from generation to generation as traditional music (Sinaga,

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2001). Although rebana traditional music in every region, the sounds produced by the rebana are still divided into two types: "dung" and "tak." The "dung" sound is produced when the hand strikes the rebana skin and the hand bounces back. The "tak" sound is produced when the hand strikes the rebana without bouncing back and the skin is slightly pressed. These two types of strikes form the basic notes of a rebana musical instrument performance, which are then arranged into a rhythm (Bektiarso et al., 2023). A set of rebana musical instruments commonly played is shown in Figure 1.



Figure 1. A set of rebana musical instruments

Figure 1 shows various types of tambourines commonly used in Java and Madura. The art of tambourine music in this region is known as hadrah and banjari. Tambourines used in Java and Madura generally have circular metal pieces (similar to jingles on a tambourine) attached to their wooden frames, although some do not use jingles, depending on the needs of the group playing. The size of tambourines in this region varies greatly, from small to large, depending on the needs of the group and their function in the performance. However, the largest rebana typically used in Java and Madura has a diameter of approximately 45 cm. This rebana musical instrument serves as a central element in shalawat, zikir, and religious celebrations, accompanying da'wah with poetry and music that Islamic spiritual values (Iswanto, 2015).

Rebana musical instruments on the island of Java are more often used in religious events, especially in areas known as religious cities, such as Gresik and Jombang. Rebana music in Gresik is not only a religious medium but also a means of character building for santri (Islamic boarding school students). For example, in Manyar District, Gresik, the Muslim Rebana Group performs rebana on a grand scale during religious gatherings and other religious activities to reinforce Islamic values within the community (Bakhruddin & Risasongko, 2022). Additionally, in Gresik, which frequently features rebana music performances ranging from young children to adults, festivals such as banjari or hadrah are often held. For instance, the Al-Akbar Mosque Youth Group at SMAN 1 Kebomas, Gresik, collaborates with the school to organize the 'FAST' Festival Al Banjari at the Smanemas Event, held annually since 2007. The event was initiated because the school community has a deep love for shalawat and desires for its echoes to always resonate. This practice demonstrates that in a city like Gresik, known for its religious heritage, rebana is not only familiar but also frequently played as an integral part of religious and local cultural life.

Another form of rebana music is known in the art of rebana burdah and qasidah, which developed as Islamic praise art that is not only used to accompany religious sermons but also present at weddings in West Sumatra (Cantika & Wimbrayardi, 2020; Marlisna & Marzam, 2020). The rebana burdah on the island of Sumatra has a diameter of about 50 cm and does not have a metal ring in its wooden frame. The size of the rebana burdah is considered medium because there is a rebana biang that has a larger diameter. The rebana biang has a diameter of about 60 cm to 90 cm, but like the rebana burdah, it does not have a metal ring in its wooden frame. The rebana biang is commonly used in weddings, religious gatherings, and Betawi traditional ceremonies (Nur, 2015). Although there are various types of rebana known in Indonesia, the basic rhythm of the rebana in each region still follows the basic pattern as shown in Figure 2.

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Blow 1
Base: DTT. DDDT. TD. TT
Go on 1: TTTT. TDDD. DDDD. DDTT
Go on 2: TTDT. TDTT. TTDT. TD
Go on 3: T. TTTT. TTTT. TTDT. TDTT 3X
Down: TDDT. TTDT. TD
Note: a period with a short pause
an underscore means a little faster

Blow 2
Base: D.T. DDD. TD. T
Go on 1: TTTT. TTTD. DDDD. DDDD
Go on 2: T.T.T. D. TT. TT. TTTD. TT. TD
Go on 3: T.T.T. TT. T.T.TT. T D. TT.T.D 3X
Down: DD. TT. T. DD. TT. TD
Note: a period with a short pause
an underscore means a little faster

Figure 2. The basic rhythm of the rebana in each region

Based on the description of the diversity of tambourines in Indonesia, it can be said that Indonesian people generally know and understand how to use tambourines. However, the use of tambourines as a learning medium in physics is still rare (Nugraha & Prabowo, 2022). A qualitative study shows that there are physics concepts used in rebana music that can be utilized in learning (Bektiarso et al., 2023). This indicates that the rebana musical instrument not only has cultural value but also incorporates physics concepts. The rebana musical instrument can be analyzed from a physics perspective based on its shape and when it is played. When the rebana is struck, vibrations occur on the membrane, producing sound waves. On the other hand, when the rebana is struck, the principle of elasticity is also involved in the struck membrane.

Research conducted by Nugraha and Prabowo (2022) states that physics learning utilizing the local wisdom of the rebana musical instrument in teaching elasticity is considered more contextual and enjoyable based on student questionnaire data. However, there has been no research examining the application of rebana-based learning in terms of its effectiveness in improving science literacy skills. This is an interesting area to explore in various regions by integrating the rebana as the context for sound wave material in science literacy assessment instruments. Thus, this study aims to analyze students' science literacy levels in various regions, even though their locations are not specifically designated as "religious cities."

RESEARCH METHOD

This study uses a quantitative descriptive method that aims to describe the level of students' science literacy based on the results of preliminary tests with questions that use local wisdom, even though the students have not yet received local wisdom-based learning (Creswell, 2014). This study employs a quantitative descriptive method, thus not requiring hypothesis testing; however, the results of this study will be used as a consideration for developing local wisdom-based learning tools to enhance students' science literacy skills (Saphira et al., 2022). This study uses a research method show in Figure 3.



Figure 3. Research flowchart

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Figure 3 shows that this study uses a quantitative descriptive method because it allows researchers to present data in numerical form and analyze it statistically to obtain an overview of students' abilities in science literacy (Arikunto, 2010). The subjects in this study were 231 high school students from several schools in East Java who had received material on sound waves in accordance with the applicable curriculum but had never participated in learning that integrated local contexts such as the rebana musical instrument. The research instrument was a science literacy test developed based on the PISA 2025 science literacy indicators.

These indicators include the competencies of explaining phenomena scientifically, evaluating and designing scientific investigations, and interpreting scientific data and evidence (OECD, 2022). The research instrument was developed to disseminate the test in the form of essay questions related to sound phenomena in the context of local wisdom regarding the rebana (Suryawati & Osman, 2018). The research instruments used are as shown in Figure 4 with the three questions to measure students' abilities in science literacy on the subject of sound waves, which is done for 30 minutes by students.

Competency Skills Science Literacy	Science Literacy Competency Indicators	Question Item
Explaining phenomena scientifically	Using various forms of representation and translating them	The rebana is a traditional musical instrument that produces sound through the vibration of the membrane and air inside the rebana tube. Two types of strikes are performed, namely in the middle and on the edge, producing different sounds. Analyze the concepts of frequency and period that cause differences in sound due to different strike locations!
Developing and evaluating designs for scientific investigations and critically interpreting scientific data and evidence.	• Proposing an appropriate experimental design • Interpreting the relationship between variables in graphs or tables of experimental results	A student conducted research on the rebana musical instrument, and the data obtained from their activities is presented in a table. Based on the results of their observations, how does the air column affect the frequency and wavelength produced? f(Hz) | λ(m) | L(m) 300 | … | 0,276 … | … | 0,236 … | 0,84 | 0,211 450 | … | 0,186 … | 0,67 | 0,166 Formulate a research question and hypothesis on the effect of the position of the strike on the frequency and period of the sound!
Researching, evaluating, and using scientific information for decision-making and action.	Distinguishing claims based on strong scientific evidence, experts vs. non-experts, opinions, and providing reasons for the differences.	The rebana is played in two different locations: a closed hall and an open field. In the hall, the sound is louder and echoes. Meanwhile, in the field, the sound quickly fades and is weaker. Analyze this phenomenon by relating the concepts of frequency, period, and wavelength of the tambourine sound!

Figure 4. Research instruments

The instruments used in the study are shown in Figure 4 and consist of three questions to measure students' science literacy skills on the topic of sound waves in the context of the local wisdom of the traditional musical instrument rebana. Students had to complete the three questions within 30 minutes. The test questions used in Figure 4 employ a scoring rubric to assess science literacy skills, with a maximum score of 5 for each item. The data on students' science literacy skills were analyzed using descriptive quantitative data analysis techniques to provide an objective overview and conclusions based on numerical data. The test results for science literacy skills that were obtained were then used to calculate the percentage using Equation 1.

$$percentage(\%) = \frac{the\ number\ of\ scores\ obtained}{maximum\ score} \times 100\%$$

Based on the results of Equation 1, conclusions will be drawn using the score interpretation criteria presented in Table 1, using the average percentage values obtained (Nasution et al., 2024). Furthermore, each value category will be analyzed to determine the overall level of indicator

achievement. The results of this interpretation will then be used as a basis for evaluating the learning that has been carried out and providing learning recommendations for design solutions.

Table 1. Score interpretation criteria

Practicality Percentage (%)	Effective Categories
0–20	Not Effective
21–40	Less Effective
41–60	Quite Effective
61–80	Effective
81–100	Very Effective

RESULTS AND DISCUSSION

This study uses a quantitative descriptive approach, which means that it does not involve hypothesis testing. This study invites students to engage with questions by analyzing the information in the question items, evaluating the statements presented with arguments, and drawing conclusions based on the available data and information. They are also expected to articulate their answers clearly (Sunarti et al., 2021). Based on these responses, the researchers can then assess the scientific literacy skills of 231 high school students from four schools in East Java. The research subjects were students who had studied sound waves but had never participated in learning that integrated the local context of the rebana musical instrument.

The research subjects came from four different schools, namely Gresik, Ngawi, Ponorogo, and Surabaya. The selection of these four schools was based on their proximity to local wisdom, which served as the context for the science literacy test questions. Gresik Regency is known as a "religious city" due to the historical role of Islamic figures in Indonesia, particularly on the island of Java, such as Sunan Maulana Malik Ibrahim, Sunan Giri, and Habib Sayyid Ja'far Shadiq. As a result, many Islamic boarding schools and madrasahs have been established in Gresik Regency, serving as pioneers of Islamic propagation in the region. As a result, religious activities such as shalawat, zikir, and religious celebrations are frequently held in Gresik Regency. These religious events in Gresik Regency are always accompanied by poetry and music that contain Islamic spiritual values, using the rebana musical instrument (Iswanto, 2015).

In Gresik Regency, Islamic holidays are often celebrated with festivals featuring rebana music. The abundance of activities involving rebana in Gresik Regency has prompted rebana craftsmen in Gresik to keep up with developments, resulting in a wide variety of rebana in Gresik, each tailored to its function and the needs of its performance. Therefore, it can be said that the close relationship between the people of Gresik and the rebana musical instrument, which has contributed to the development of rebana music in the region, makes the rebana a local wisdom of Gresik Regency. Unlike the four other regions in this study, Ngawi District, Ponorogo District, Lamongan District, and Surabaya City, these areas cannot be considered regions with local wisdom in rebana music, despite their geographical proximity to Gresik District.

Ngawi Regency, Ponorogo Regency, and Lamongan Regency were selected as research locations to represent regencies that do not have cultural ties to the local wisdom of the rebana musical instrument as developed in Gresik Regency. Although these three regions are geographically located within the same regional area in East Java, culturally, the dominant traditional art forms in Ngawi, Ponorogo, and Lamongan differ. For example, Ponorogo is more renowned for its Reog art form, while Ngawi and Lamongan have distinct agrarian cultural characteristics and local traditions that are not centered around rebana music. Therefore, the involvement of students from these regions is important to measure the quality of science literacy in areas without cultural experience or emotional connection to the rebana, enabling comparison with regions where the rebana is integrated into contextual learning. These results will reveal whether the presence of certain local wisdom has a real impact on science literacy achievements, or whether other factors such as teaching approaches and learning environment conditions are more dominant in shaping such abilities.

The city of Surabaya was chosen as one of the research locations because of its status as a large city synonymous with advanced education and access to more adequate learning resources compared to rural areas. As the center of government and education in East Java, Surabaya represents the characteristics of a community that generally has complete learning facilities, qualified teachers, and greater exposure to learning technology. Thus, the selection of Surabaya allows for the measurement of the extent to which the scientific literacy of students living in urban areas is developed, particularly in the context of science education, even though they do not have a connection to specific local wisdom such as the rebana musical instrument that has developed in religious rural areas like Gresik. The results of this measurement are important to determine whether administrative and educational infrastructure development in an area correlates with students' science literacy skills, compared to students in districts that adopt a learning approach based on local culture.

Based on the three distinct regional characteristics in this study, the integration of local wisdom regarding the rebana musical instrument was used as the context for the science literacy test instrument in physics lessons on sound waves, with the aim of analyzing the science literacy abilities of students from the four regions. The selection of Gresik was motivated by the community's close relationship with the rebana musical instrument, which has become part of local tradition and religious life. Meanwhile, Ngawi, Ponorogo, and Lamongan were chosen to represent districts that are administratively related but do not have a cultural connection to the rebana. On the other hand, Surabaya represents an urban educational environment that generally has more advanced learning facilities. Given these differing characteristics, the study aims to examine how cultural and geographical backgrounds influence students' science literacy levels, particularly when they are exposed to a learning context based on the local wisdom of the rebana. The science literacy assessment instruments used to measure this were systematically developed and then distributed to students from the four regions. Table 2 shows the characteristic data of the research subjects obtained from the students' science literacy test on sound waves.

Table 2. Characteristics of the respondents

Tested regions	Class	Male	Female	Total student
Gresik	XII	21	29	50
Ngawi	XI	12	20	32
Ponorogo	XI	17	31	48
Lamongan	XII	18	33	51
Surabaya	XI	22	28	50

Based on Table 2, the data obtained from this study involved 231 students from five different regions in East Java, namely Gresik Regency, Ngawi Regency, Ponorogo Regency, Lamongan Regency, and Surabaya City. The distribution of students by region, grade level, and gender is shown in Table 2. The science literacy test instrument was distributed to students who had received instruction on sound waves at their respective schools but had not yet participated in learning that integrated the local context of the rebana musical instrument. This condition was chosen to ensure that the test results reflect science literacy skills derived from a general understanding of the material without the influence of a contextual learning approach based on local culture. Thus, the measurement conducted is neutral and can be compared across regions with different cultural backgrounds and educational characteristics.

The data shows that the highest number of participants came from Lamongan Regency with 51 students, followed by Gresik and Surabaya with 50 students each. Participants from Ponorogo Regency numbered 48 students, while the lowest number came from Ngawi Regency with 32 students. In fact, the survey instruments were distributed to each region to obtain data from 50 respondents who took the test. However, some regions could only provide fewer than 50 participants, while others had more than 50. When looking at gender distribution, the distribution of participants tends to be balanced, with a slight tendency for more female students than male

students in most regions. For example, in Ponorogo there were 31 female students and 17 male students, while in Lamongan there were 33 female students and 18 male students. Differences in grade levels are also evident, with participants from Gresik and Lamongan being from grade XII, while participants from other regions are from grade XI. This distribution is designed to represent the diversity of geographical contexts and student backgrounds, enabling a comprehensive measurement of science literacy skills among students from regions with different cultural and educational characteristics.

To represent the scientific literacy profiles of students from the five regions that were the locations of the study, a descriptive analysis was conducted on the test results data. This analysis included measures of central tendency (mean and median) and measures of dispersion (range, interquartile range, standard deviation, and variance), as well as the minimum and maximum values for each region. The data was obtained based on a test instrument with four scientific literacy indicators. The complete results of this descriptive analysis are presented in Table 3, which shows the differences in the distribution of science literacy scores among students in Gresik Regency, Ngawi Regency, Ponorogo Regency, Lamongan Regency, and Surabaya City. Through this table, it is possible to observe the trends in scores, the level of consistency in achievement, and the distribution of students' abilities in each region.

Table 3. Statistical data from the many places

Category	Gresik	Ngawi	Ponorogo	Lamongan	Surabaya
Mean	68.13	30.77	40.63	30.90	86.43
Median	59.00	31.00	41.00	29.50	88.00
Minimum	27	13	13	9	71
Maximum	80	52	60	64	100
Range	53	39	35	55	29
Interquartile Range	21	11	12	14	12
Standard deviation	12.42	10.10	12.10	12.49	8.14
Variation	154.46	102.04	102.04	154.99	66.25

Based on the data shown in Table 3, measured using a science literacy test instrument consisting of three questions containing four science literacy indicators. The test instrument, which was developed based on local wisdom, was equipped with an assessment rubric that had been validated by three validators. The average assessment data obtained can be used to interpret the science literacy criteria in the region, as shown in Table 4. There are significant differences in science literacy performance among the five study areas. The city of Surabaya showed the highest score with an average (mean) of 86.43, a minimum of 71, a maximum of 100, and a median of 88, indicating high performance and consistency with a relatively narrow range of 29 and a low standard deviation of 8.14.

In contrast, Ngawi and Lamongan districts recorded the lowest performance with means of 30.77 and 30.90, respectively, with minimum values of only 9 and 13, a wide range of 39 to 55, and a high standard deviation of 10 to 12, indicating significant variability in results among participants. Meanwhile, Gresik Regency achieved a mean score of 68.13, and Ponorogo Regency had a mean score of 40.63. Both regencies are in the middle range, but Gresik is significantly higher than Ponorogo. Gresik showed a fairly good distribution of scores with a median of 59 and a range of 53, while Ponorogo, despite only achieving an average score, demonstrated high variability as evidenced by its range and standard deviation of 12.10. This data was obtained when the scores were analyzed using SPSS.

The results of this data analysis are consistent with the findings of Novita et al. (2021), who reported that, in general, science literacy among students in Indonesia remains low, ranking 70th out of 79 countries in the PISA survey. The data also shows significant disparities between regions. Surabaya, as an urban area with strong infrastructure and learning resources, achieved outstanding science literacy performance, consistent with the expectation that educational

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facilities can improve student learning outcomes. In contrast, the districts studied in this research—Gresik, Ngawi, Ponorogo, and Lamongan demonstrated limitations in resources and educational interventions, reflected in low scores and high variability. Specifically, Gresik, despite its reputation for local wisdom in rebana, achieved relatively high literacy scores with a mean of 68, but still far below Surabaya. This indicates that contextualizing local culture can be helpful, but educational facilities and professional support in urban areas have proven to be more influential on science literacy (Novita, 2021).

Table 4. Score interpretation criteria from many places

Tested regions	Average score	Effective Categories
Gresik	68.13	Effective
Ngawi	30.77	Less effective
Ponorogo	40.63	Less effective
Lamongan	30.90	Less effective
Surabaya	86.43	Very Effective

Based on Table 4, the interpretation of the average scores indicates the results of the local wisdom-based learning approach using the rebana instrument can enhance students' science literacy skills, with an average score of 68 achieved by Gresik being higher than those of Ngawi, Ponorogo, and Lamongan. This aligns with the findings of Nugraha & Prabowo (2022), who stated that learning media based on traditional musical instruments can attract students' interest in learning and contextualize physics concepts in daily life. However, the highest score was achieved by Surabaya with an average score of 86, despite the fact that the region did not utilize local wisdom. Instead, it demonstrated a more systematic and intensive science learning approach, such as through the use of active laboratories, digital simulations, and literacy reinforcement guidance. This finding supports the view that contextualization through local culture must be balanced with the quality of pedagogical strategies and adequate learning environments (OECD, 2022).

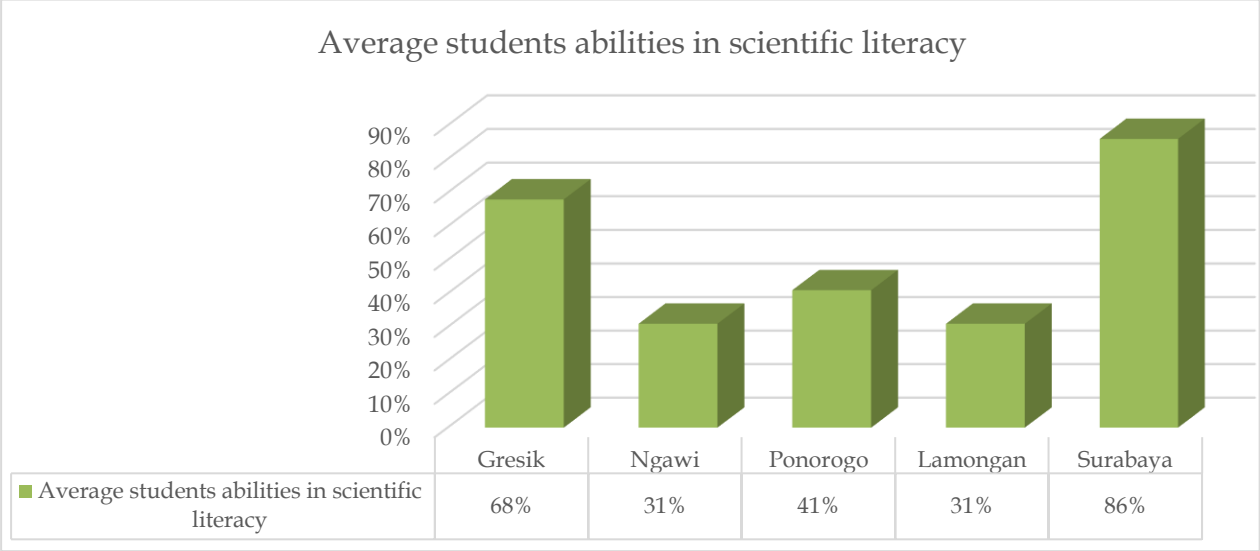


Figure 5. Data graph of average student abilities in scientific literacy

The fact that Gresik, which is the region of origin of the local wisdom of rebana that became the context in the test instrument, did not rank at the top shows that the success of the local wisdom approach is highly dependent on consistent implementation, teacher support, and strengthening basic science literacy competencies. Furthermore, science literacy is not only shaped by cultural content but also by access to learning resources, experimental experiences, and the quality of instruction. Figure 5 is a graph of the average science literacy test results for

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students from each tested region. The research subjects had received instruction on sound waves without a local wisdom context in the previous semester.

Based on Figure 4, show that science literacy skills are measured using a science literacy test. The science literacy test instrument consists of three questions containing four indicators of science literacy skills. The science literacy questions are assessed by considering the content of the answers with scoring criteria where a score of 0 means the student did not answer, a score of 1 means the student answered all questions and explanations incorrectly, a score of 5 means the student answered and explained correctly but incompletely, and a score of 15 means the student answered and explained correctly and appropriately. Each question answered by the student has a maximum score of 15 points, but each question has its own weight.

Questions that involve two science literacy skills or two questions that the student must answer to find the solution will receive a maximum score of 30. Students who do not answer perfectly will receive a score according to the assessment rubric mentioned for each science literacy indicator or each question answered by the student. The possible scores for this type of question are 0, 1, 2, 5, 6, 15, 16, 20, and 30, depending on the content of the student's answer. The possible scores obtained from question types that measure one science literacy skill or one question that must be answered by the student are 0, 1, 5, and 15, depending on the content of the student's answer. Table 6 is an average results score of each science literacy test for students from each region that was tested. Each science literacy test coded in Table 5.

Table 5. Description

Question Number	Science Literacy Indicators in Questions
1 A	Using various forms of representation and translating them
2 B	Proposing an appropriate experimental design
2 C	Interpreting the relationship between variables in graphs or tables of experimental results
3 D	Distinguishing claims based on strong scientific evidence, experts vs. non-experts, opinions, and providing reasons for the differences.

Table 6. Average score for each science literacy indicator for students

Tested regions	A		B		C		D	
	Score	Category	Score	Category	Score	Category	Score	Category
Gresik	60.00	Quite Effective	100.00	Very Effective	100.00	Very Effective	73.33	Effective
Ngawi	40.00	Less Effective	46.66	Quite Effective	33.33	Less Effective	33.33	Less Effective
Ponorogo	46.66	Quite Effective	33.33	Less Effective	60.00	Quite Effective	40.00	Less Effective
Lamongan	33.33	Less Effective	33.33	Less Effective	33.33	Less Effective	40.00	Less Effective
Surabaya	100.00	Very Effective	100.00	Very Effective	86.66	Very Effective	86.66	Very Effective

Based on the average scores shown in Table 5, it can be seen that Surabaya, the most developed city in East Java, has high science literacy skills even though it is not very familiar with the local wisdom of the rebana musical instrument. The Gresik region, known for its familiarity with the rebana musical instrument, has a score below Surabaya. This indicates that local wisdom used as a context in learning can create meaningful learning experiences and promote the development of students' science literacy (Muskania et al., 2024). The regions of Ngawi, Ponorogo, and Lamongan have similar scores but their average scores are below those of Surabaya and Gresik. Students in non-religious labeled areas demonstrated varying levels of scientific literacy, influenced by the relevance of instructional models, cultural exposure, and the

alignment between learning content and their lived experiences. These results highlight the importance of incorporating local and cultural contexts into science education to foster deeper understanding, regardless of regional religious labels. This may occur because students have a limited understanding of the rebana musical instrument. However, this study demonstrates that the learning from the previous class, where they were taught about sound waves, did not last long in their memory because they were unable to answer all the questions correctly.

An explanation of students who are unable to retain their memory of the concept of sound waves that they have learned requires meaningful learning so that students can remember more deeply for a longer period of time. One approach that can be employed is integrating local wisdom-based activities into science literacy skills. This way, the concepts learned through such instruction will remain longer in students' memories (Sapitri et al., 2020). Using this instructional design can also foster students' love for their culture. This is supported by research by Munandar et al. (2022), which shows an increased curiosity about physics concepts in certain local Bima cultures, leading to improved physics learning outcomes compared to previous approaches without local wisdom integration.

CONCLUSION

This study was conducted by incorporating the context of local wisdom of the rebana musical instrument into the physics literacy ability instrument aimed at analyzing the level of scientific literacy among students in various regions, including areas that are not generally recognized as religious cities. The findings of the study indicate that scientific literacy can be influenced by the relevance of the teaching model, cultural exposure, and the alignment between learning content and their life experiences. These results highlight the importance of incorporating local and cultural contexts into physics learning to foster deeper understanding. Because this study has limitations, it only tested the assessment of scientific literacy skills with a physics learning design integrated with the context of local wisdom without implementing the learning series. Therefore, recommendations for further research can be made to develop physics learning based on local wisdom so that learning outcomes are more optimal.

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