Eduvest – Journal of Universal Studies
Volume 5, Number 2, February, 2025
p- ISSN 2775-3735- e-ISSN 2775-3727

PROFILE OF SCIENCE LITERACY ABILITY AND SCIENCE LEARNING OUTCOMES OF RIYADUL MUBAROK INTEGRATED HIGH SCHOOL STUDENTS

Maya Ainul Quroh, Siti Patonah, Ari Susatyo Nugroho, M. Syaipul Hayat
Universitas PGRI Semarang, Indonesia
Email: mayam0966@gmail.com

ABSTRACT

Indonesia's scientific literacy is in 70th position out of 78 countries based on PISA 2018. This research aims to determine (1) the scientific literacy abilities of Riyadul Mubarok Integrated High School students in class X on renewable energy material using PISA test questions; and (2) Learning outcomes of Riyadul Mubarok Integrated High School students on renewable energy material. The selected sample was 20 class X students using purposive sampling technique. This type of research is descriptive qualitative using daily values on renewable energy material for learning outcomes and PISA test questions totaling 6 essay questions. This research shows that the learning outcomes of Riyadul Mubarok Integrated High School students are in the medium category with an average score of 77.95, which is slightly above the KKM. Meanwhile, the results of scientific literacy on the three indicators show (1) the average value of scientific literacy ability on the indicator of identifying scientific problems is 40, which means that students' scientific literacy ability is in the low category. (2) the results of scientific literacy skills in the indicator explaining scientific phenomena are in the medium category with an average score of 62. (3) the results of scientific literacy skills in the category of using scientific evidence are in the low category with an average score of 37. Literacy scores Overall student science is 55 which is included in the medium category, this is in accordance with the results of the scientific literacy test conducted by PISA in 2018.

KEYWORDS *scientific literacy, learning outcomes, renewable energi*

INTRODUCTION

Physics plays a very important role in the development of science and technology (Ramadani, et.al, 2020; Sari, et.al, 2022). In an increasingly modern era, the development of science and technology is growing very rapidly (Noperman, 2020; Asry, 2020; Handayana, et.al, 2019) so students must be ready to compete on the international stage. The importance of students' understanding of science must be developed with science learning that supports students to increase students'

How to cite: Quroh M.A et all. (2025). Profile of Science Literacy Ability and Science Learning Outcomes of Riyadul Mubarok Integrated High School Students. *5*(2), 3164-3178
E-ISSN: 2775-3727

knowledge and understanding of scientific concepts (Widiadnyana, et.al, 2014; Prastiwi, et.al, 2018).

Fundamental science learning is certainly not just about remembering (Nofiana, 2017; Sholeha, 2019) and understanding the concepts discovered by scientists. Science learning emphasizes students' direct experience so that students can better understand the surrounding environment (Mulyawati, 2019; Izudin, 2019). The aim of science learning is to increase students' understanding of scientific literacy (Zahro, et.al, 2019; Juniati, et.al, 2020) which can improve students' ability to understand science by looking at the content, process and broader context. The relationship between science learning and scientific literacy can be seen in two ways, namely (1) science learning makes scientific literacy clearer in general, (2) science learning helps science become more valuable (Situmorang, 2016). Science learning becomes more meaningful if students master scientific literacy (Perwitasari & Linuwih, 2016). As times and learning processes in Indonesia develop, scientific literacy is chosen as the main goal of science education (Setiawan et.al, 2017; Prasetyo, 2017). This is based on the importance of literacy skills as indigenous people, citizens and even world citizens (Rohim, 2017; Azizah, 2021).

Scientific literacy is a complex process (Syofyan et.al, 2020; Dianti, et.al, 2023) because it is related to the ability to analyze scientific issues that exist in society (Aan, et.al, 2017). Scientific literacy is an understanding of the concepts and processes (Narut, 2019; Dewantari et.al, 2020) of science, understanding scientific facts and the relationship between science, technology and the surrounding environment. The definition of scientific literacy can be interpreted as a form of understanding of scientific principles (Saadah, 2020) and the ability to solve problems in everyday life based on scientific concepts (Murtikasari, 2024).

According to Sulistiawati (2015) and Rohmah et al. (2021), a person's response to PISA exam questions can reveal their level of scientific understanding. The Program for International Student Assessment (PISA) was developed by the Organization for Economic Co-operation and Development (OECD) with the aim of evaluating the education systems of its member countries. Every three years, fifteen-year-old students from randomly selected schools around the world take reading, math, and science tests. These test findings provide a general idea of how well students understand the fundamental ideas in this subject.

Indonesia consistently scores poorly in PISA when compared with other Asian countries in terms of scientific literacy (OECD, 2013). For example, Indonesian students had scientific literacy scores of 393, 395, and 395 in the PISA surveys conducted in 2000, 2003, and 2006, respectively (Winata et al., 2018). According to Winata et al. (2018), Indonesia's scientific literacy score fell slightly to 383 in 2009, and was ranked 57th out of 65 countries. This score fell again to 382 in 2012, placing Indonesia in 63rd place out of 64 participating countries (OECD, 2013).

A study that offers a summary of students' scientific understanding besides PISA is the Trends in International Mathematics and Science Study (TIMSS) which is carried out every four years. According to this poll, Indonesia was ranked 35th out of 49 countries in 2007; however, in 2011, the country dropped to 40th out of 42 countries (Buckley, 2012).

Indonesia is now ranked 70th out of 78 countries participating in the 2018 PISA study, which shows that this country's scientific literacy is declining (OECD,

2019). This shows that there is still much to be done to help Indonesian students understand science, despite efforts to improve the quality of education.

The results of the PISA scientific literacy test show differences in performance between participating countries. In Toharudin's research cited in Erni's (2019) paper, male students generally showed a slight advantage over female students. In Japan, for example, female students got a score of 546 while male students got a score of 550. Korea, where men got a score of 546 and women got a score of 527, and Macau, China, where men got a score of 529 and women got a score of 521 , both show comparable trends. .

Male students in Indonesia have higher achievements than female students, even though the total test results in this country are still low. Male students got an average score of 396, while female students got an average score of 394, according to Toharudin. Additional examination of the 2009 PISA test data, as reported by Tjalla and cited in Zuhara et al. (2019), shows similar results, where the average number of male students in Indonesia is 399 and female students 387. This gap shows that male students are 12 points ahead of female students.

This pattern was largely maintained in the 2015 PISA exam results, with male students scoring on average 15 points better in scientific literacy than female students, particularly in the areas of recognizing scientific problems and explaining scientific phenomena (OECD, 2016). However, there is one exception, namely in Finland, where female students perform better than male students. This variation implies that although male students generally tend to have better scientific literacy skills, this finding is not constant and may change depending on national and educational situations.

Research conducted in various regions in Indonesia shows striking differences between the academic achievements of male and female students (Rohmah, 2021; Haerani, 2020). According to Wasis (2020), male students outperform female students in some places, but female students overall perform better. For example, research findings conducted in 2012 in East Kalimantan and Yogyakarta by the Indonesia National Assessment Program (INAP) revealed interesting variations in the field of natural sciences (IPA). The average score for female students in Yogyakarta is 533.08, higher than the average score for male students (527.58). In contrast, in East Kalimantan, the average score of male students is slightly higher (506.96) than female students (502.99) in the same area.

Various psychological characteristics that influence the interests, abilities, attention spans, and IQ levels of men and women may be the reason for these differences in scores. Ebuoh (2011) argues that many variables, such as individual attitudes, education, family support, cognitive abilities, and sociocultural influences, may contribute to the gender gap in academic achievement. According to the OECD (2016), these variables may also have a significant impact on how well students perform academically across countries.

Apart from that, differences in these results can also be influenced by differences in educational settings in each region, including the quality of the faculty, facilities at the school, and the curriculum used. In some cases, social support from family and community may also have a major influence on a student's drive to succeed academically. For example, students often perform better than those who live in locations where there is less support from family and community.

Overall, there is no clear trend regarding the academic achievement gap between male and female students in Indonesia. When examining student academic performance, it is important to consider a range of psychological, social, and educational elements that are specific to each location and impact learning outcomes.

The four main dimensions of the PISA scientific literacy assessment are the context, knowledge, competence and attitude domains (OECD, 2014). The main goal of PISA is to increase students' awareness of the value of science for society and society, as well as how science can improve and preserve the quality of life (Pratiwi, 2019; Asyhari, 2015). As a result, PISA scientific literacy questions were created to represent real-world scenarios that are relevant to the social, cultural and individual environment.

As an evaluation tool, PISA questions center on scenarios that include these elements. Therefore, this evaluation evaluates the application of students' scientific abilities and attitudes in various circumstances in addition to their understanding of scientific ideas (Pratiwi, 2019; Afina et al., 2021). Students may be asked to examine climate change statistics, understand the impact of new technology on everyday life, or evaluate scientific material they find in the media, among other types of questions.

These assessment context domains serve as a framework for the circumstances in which scientific knowledge is implemented. Meanwhile, the knowledge domain evaluates how well students understand basic scientific ideas. While the attitude domain measures students' attitudes and opinions about science, including their enthusiasm for the subject and understanding of its significance for society, the competency domain assesses students' ability to use their knowledge to solve scientific problems.

With this method, students' scientific literacy will be seen more fully—not only as a collection of factual information, but also as critical thinking skills and the practical application of that knowledge. Therefore, the findings of this assessment can be used to pinpoint areas where students may need additional help and can help lawmakers create more impactful educational initiatives to increase students' scientific literacy levels.

In the context of scientific literacy, actions taken to answer questions or solve problems—such as identifying problems, describing supporting data, and drawing conclusions—are referred to as components of scientific competence or processes (Utami et al., 2022; Novili et al., 2017) . These skills include the ability to recognize a scientific problem or question, understand the types of evidence required for scientific investigation, and draw conclusions that make sense of the information at hand.

Because it includes the critical and analytical thinking processes necessary to understand and apply scientific information, the competency component of scientific literacy is very important. For example, in scientific studies, a person must be able to identify problems that need to be solved, collect and analyze data, and draw reasonable findings. These skills are critical to academic achievement and everyday life, as judgments are often made based on scientific knowledge and supporting data.

PISA states that science teaching is very important to educate the country's future generations (Jufri, 2017; Magdalena et al., 2020). In addition to imparting knowledge, science education seeks to develop the analytical and critical thinking

skills necessary to assess data and reach appropriate conclusions. Therefore, science learning needs to help students understand scientific concepts as well as the advantages and disadvantages of science from a broader perspective.

Understanding how science operates in society and how scientific information can be applied to everyday problems is also an important component of effective science education. For example, knowing the basics of ecology can help students make more informed judgments regarding environmental protection, and being familiar with medical technology can help them understand the impact of recent advances in the medical profession.

Therefore, preparing students to become critical thinkers, understand and use scientific information, and become knowledgeable citizens who can benefit society is the main goal of science education. This means that, in addition to conveying factual information, science education must also foster the attitudes and abilities needed to apply that knowledge in practical contexts.

Riyadul Mubarok Integrated High School is one of the junior high schools located in Banjarharjo District, Brebes Regency, more precisely in Bandungsari Village. Bandungsari Village itself is a cross-provincial route with West Java. The school's location in the border area with Salem and Kuningan districts is interesting for conducting research on the profile of scientific literacy abilities and learning outcomes. This secondary school is also an integrated school or boarding school where the use of gadgets and the internet is very minimal, so learning resources can be said to be very minimal. Analysis of scientific literacy abilities is important to determine the scientific literacy abilities of students at the school. It is important to conduct research to analyze scientific literacy abilities so that in the future ways can be found to improve students' scientific literacy abilities if low results are obtained on students' scientific literacy abilities. Furthermore, ways can be found so that there are no longer differences in the results of scientific literacy abilities even though class separation based on gender is still implemented.

RESEARCH METHOD

Research Design

The research population studied was class X students of Riyadul Mubarok Integrated High School. Purposive sampling was used for the sampling process, namely selecting ten male students and ten female students randomly. The classes covered were diverse, and all students had received information about renewable energy, therefore a purposive sampling approach was used.

Purposive sampling was used in this research to ensure samples were selected with certain attributes related to the objectives of the investigation. To get a fair perspective for both genders regarding their awareness of renewable energy, ten male students and ten female students were selected. Because heterogeneous courses reflect diverse backgrounds and skill levels among students, it is hoped that the selected sample will provide a more complete picture of the knowledge and application of information discussed in class.

The fact that all students have been given material about renewable energy, which is the main subject of this research, was also a consideration in selecting this sample. Research findings are expected to be more consistent and relevant if the sample as a whole has the same basic understanding of the subject matter. To

conduct a more thorough and precise analysis, researchers may concentrate on participants deemed most capable of providing the necessary information using a purposive sampling approach.

In addition, this method makes it easier to understand how male and female students react to information about renewable energy and how they use it in everyday life. Therefore, this study attempted to assess not only students' academic knowledge but also the practical application of the content to students with different backgrounds.

Method of collecting data

Several approaches used in this research to obtain data include:

1. Written Test: This assessment technique measures students' proficiency in scientific literacy. The six questions taken from the 2009–2015 PISA question pool are a written description test. These are questions selected for their applicability and rigorously verified criteria that assess students' understanding of scientific literacy. This exam is intended to assess students' knowledge, understanding, and analytical skills in addition to other components of scientific literacy.
2. Student Learning Results: This information is obtained from the daily test scores obtained by students on topics related to renewable energy. The results of this daily test are used to assess how well students understand renewable energy material in class. Researchers can find out whether students are successful in learning lesson material by checking daily test results. This allows them to pinpoint any areas that may require further repair or strengthening.
3. Interview: A sample of students selected based on the highest, middle and lowest grades were interviewed. Researchers can learn more about students' understanding and learning processes by using this strategy. Researchers may obtain qualitative data from interviews that may not be obtained from written exams or daily test results. In addition, by identifying variables such as learning motivation, learning techniques, and environmental support, this interview helps identify factors that influence student achievement.

To get a complete picture of students' scientific literacy abilities, various data collection methods were used. Although daily learning outcomes provide additional information about how students use their knowledge in real-world academic settings, written assessments offer organized, quantitative data about students' knowledge and abilities. In contrast, interviews provide a rich qualitative perspective on students' educational experiences and can help clarify the dynamics of classroom learning.

Researchers can conduct a more thorough and complete study that reflects students' level of scientific literacy and the variables that influence it by combining data from these various sources. The findings of this research should provide in-depth information to educators and decision makers about how to improve scientific literacy teaching and learning methods.

Data Analysis Methods

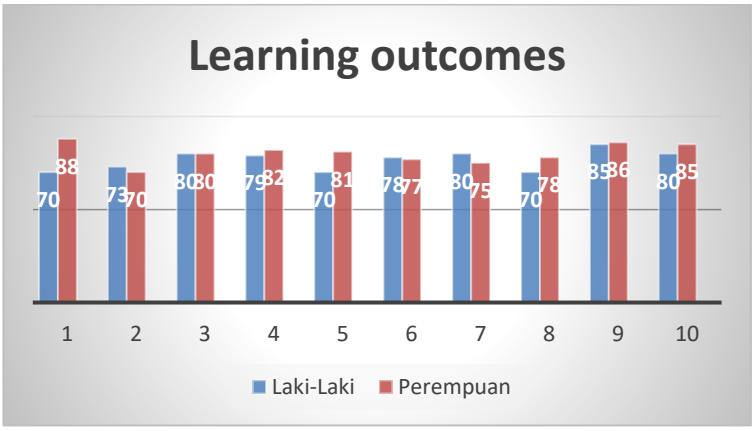
This research uses a descriptive qualitative approach which is a preliminary study to look at students' scientific literacy abilities and learning outcomes. The data obtained was analyzed using the process of data classification, data reduction, data presentation, data interpretation and drawing conclusions.

Table 1. Score Interpretation

Score	Criteria
> 72%	High
50% - 72%	Normal
<50%	Low

RESULT AND DISCUSSION

Student Learning Outcome Profile



Gambar 1. Student Learning Outcome

Based on Figure 1, it shows that the learning outcomes of Riyadul Mubarok Integrated High School students on renewable energy material with an average score of 77.95 are included in the medium category and exceed the KKM determined at school. This shows that the learning process is quite good but needs to be improved in several aspects. Such as being given lots of varied practice questions so that students are able to answer various types of questions well. The learning process that makes students as the center must be increased, providing examples that are related to everyday life and are relevant. Apart from that, there needs to be more learning resources for students, because the learning resources they can get are limited, teachers must provide more current facts, information and related issues. So that students are able to absorb knowledge well. Restricting the use of devices is appropriate so that students can focus on learning so that student learning outcomes can tend to increase. This is in accordance with research conducted by Farich Purwanto which states that the influence of devices on learning outcomes is negative (Purwanto, 2023) which means that the more often students use devices, the The negative influence on learning outcomes is getting higher, this is in line with Nurhati's research. In her research, devices have an influence on learning outcomes by 15.5% (Nurhati, 2022). The rest can be influenced by other factors including environmental factors..

Student Scientific Literacy Profile

Research on scientific literacy ability tests using PISA indicators on alternative energy materials as follows:

Table 2. Indicators in Competency Domains

Number	Indicator	Description
1	Indicator 1	Identify scientific problems
2	Indicator 2	Explain scientific phenomena
3	Indicator 3	Using scientific evidence

The results of the analysis of students' scientific literacy abilities on alternative energy material are as follows:

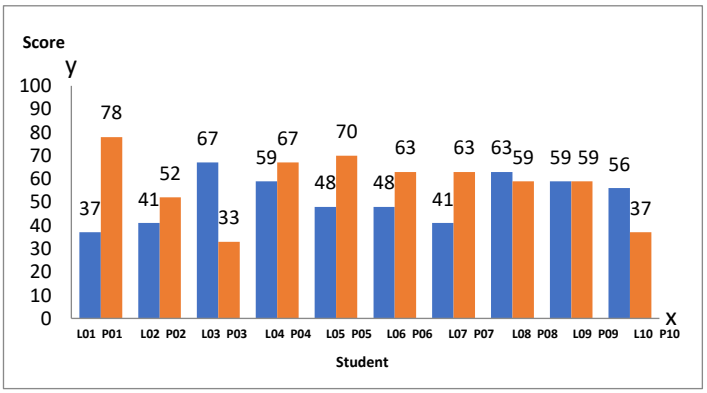


Figure 2. Scientific Literacy Results

Based on Figure 2, it shows that the average scientific literacy ability of 20 students is in the medium category, namely 55. This category is in accordance with research conducted by Herawati at one of the State Vocational Schools in Makassar City (Herawati, 2019). Students' scientific literacy abilities are influenced by several aspects: science learning is not yet in accordance with PISA indicators, the variety of learning methods and models is less varied, and the lack of literacy-based questions is given so that students have difficulty working on scientific literacy questions. This value will then be divided into three indicators as follows:

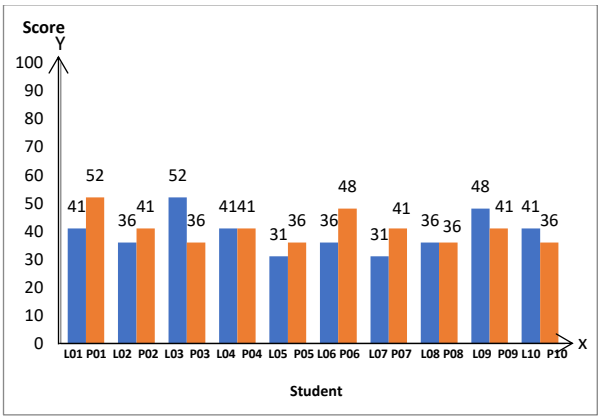


Figure 3. Identifying Scientific Problems

Figure 3 shows that students' scientific literacy abilities in indicator 1 are in the low category with an average score of 40. This shows that almost all students

write answers that cannot solve problems scientifically. In theory, questions with this indicator are the easiest questions when compared to the other two indicators. Questions on this indicator require students to remember content knowledge that is appropriate to the situation and used as a source of interpretation of a problem (OECD, 2019). The low ability of students to answer correctly on this indicator can be caused by a lack of delivery related to learning with the surrounding environment, a lack of practice questions based on problem solving, as well as a lack of sources of knowledge obtained by students, so that books and teachers become their main source of knowledge. This identifies that students' understanding is incomplete, in line with research conducted by Fitria at SMAN 1 Kuripan (Rahmadani, et.al, 2022).

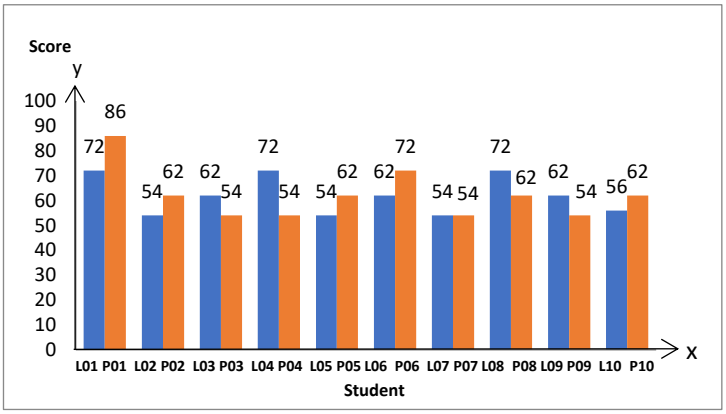


Figure 4. Explaining Scientific Phenomena

With an average score of 62, Figure 4 shows that students' scientific literacy abilities are in the medium group in interpreting scientific phenomena. This shows that, in contrast to the first indication, students are more able to provide accurate answers to the questions in this indicator. These results are in line with the OECD (2019) assessment that students must be able to describe scientific phenomena confidently. By using these skills, students can analyze and explain interesting scientific events using information relevant to the situation at hand. Nonetheless, a number of circumstances contributed to students' incomplete responses to these questions. Students' inability to apply the scientific information they receive is one of the main factors. Additionally, students had difficulty describing the scientific situation accurately and concisely in their responses. These problems are a reflection of students' difficulties in integrating and explaining science in increasingly complex situations.

These results are in accordance with research conducted at SMP Negeri 11 Pekalongan by Dianita. Dianita also found in her research that students' understanding of scientific phenomena was in the middle range (Ning, 2020). When compared with the other two categories examined in the research, this indicator truly represents the best category. These results highlight the need to help students become adept at interpreting scientific facts within a larger framework. This involves the ability to effectively convey their understanding and apply theoretical information to real-world scenarios. Students can relate scientific principles to real-world situations using a variety of interactive, problem-based learning methodologies to develop these abilities. As a result, teachers must focus more on

improving these abilities through creative and encouraging teaching strategies. Students can learn how to describe scientific phenomena in greater detail through the use of demanding project assignments, class discussions focused on problem solving, and practical experiments. By doing this, it is believed that children will be able to remember scientific facts and use them appropriately in a variety of situations, which will ultimately improve their general scientific literacy skills.

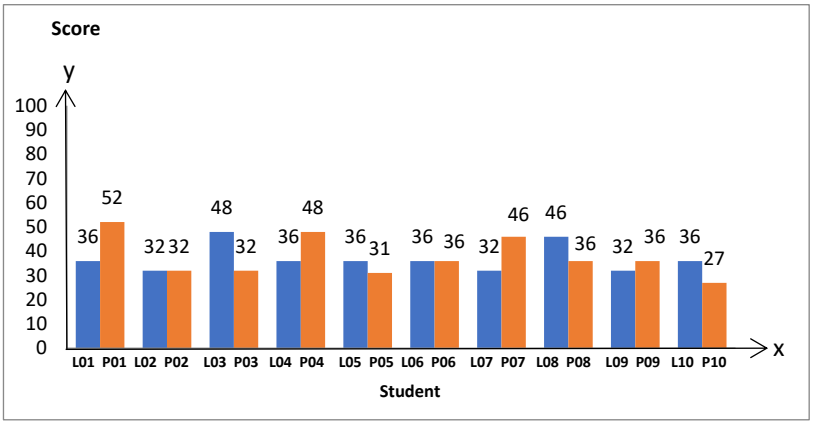


Figure 5. Using Scientific Evidence

With an average score of 37, Figure 5 shows that students' scientific literacy abilities in the third indicator are included in the Low group. This result makes sense because students rarely practice analyzing, drawing conclusions, and finding solutions to problems based on existing facts. Yes, here. When faced with the inability to prove their claims with relevant scientific data, individuals often recall information they have memorized. When compared with the other two categories evaluated by this study, the category of use of scientific evidence shows the lowest average value in this context. Underperformance on this metric may be due to a number of root causes. One of them is that students do not practice acquiring the analytical skills necessary to recognize, assess, and use scientific data in the context of addressing scientific issues. These poor outcomes may also be due to a lack of opportunities to engage in real activities that encourage the use of scientific facts to solve problems.

The category that provides the greatest challenge among the three things considered is indications of the use of scientific evidence. This is in line with the results of OECD (2019) which emphasizes that one of the most difficult components of scientific literacy to measure is the ability to use scientific evidence. It is argued that in the context of scientific research or analysis, students should be given additional encouragement to acquire the capacity to recognize and communicate relevant scientific evidence. Therefore, increasing students' scientific literacy abilities can be done by using a learning style that places more emphasis on developing the ability to analyze and apply scientific evidence. Students can develop a deeper and more useful understanding of scientific topics, for example by participating in experiments or case studies that require the use of scientific evidence to support claims. This is intended so that students can overcome the difficulties posed by this indication and improve their scientific literacy skills in general.

Based on this research, the presentation of scientific literacy at Riyadul Mubarok Integrated High School is the lowest in the indicator of the use of scientific evidence. This shows that students' capacity to solve scientific puzzles with the available data is limited. These results suggest that more work needs to be done to help students become more adept at creating scientific answers that are supported by related data. The teacher's position as a facilitator in the learning environment is very determining. Teachers sometimes have to present difficulties or problems related to everyday life and require scientific methods to solve them. The goal is to assist students in understanding and using scientific ideas in real-world situations. To ensure students can develop their analytical and critical skills well, this technique becomes increasingly important considering the limited learning resources available in schools.

This strategy is in line with research conducted by Rima at a high school in Tasikmalaya which also revealed that the indicator for the use of scientific evidence received the lowest score in the field of science competency (Fadlika, et al., 2020). Providing examples of questions related to learning is one way to get around this problem. By practicing using these example questions, students can gain an understanding of the material and use it as a basis for scientific thinking and developing acceptable answers. Students' scientific literacy abilities are predicted to be greatly improved by using learning strategies that build the ability to use scientific evidence. This not only prepares students for exams and assessments, but also equips them to face future real-world problems that require a strong understanding of scientific ideas and the capacity to apply them in a variety of situations.

This research shows that the scientific literacy abilities of students at Riyadul Mubarok Integrated High School are in the low category. This is in accordance with research findings by Nurul Hidayah and Indah Budi Handayani which show that students at one of the high schools in Pati Regency have scientific literacy abilities that fall into the low category, namely between 25 and 30 percent (Hidayah, et.al. .al, 2019; Handayani, et al, 2020). As stated previously, students' scientific literacy abilities are classified as moderate for several reasons: (1) only a few students have very high scores, thereby increasing the average; (2) there is no division for each indicator; and (3) the difference between the average PISA test results of medium and low is not too large, thus indicating that there is no significant boundary between the low and medium categories. Nevertheless, considering the support provided by the average findings for each indicator and interviews, we can draw the conclusion that students' scientific literacy scores are generally poor. This may indicate that the learning process has not been utilized optimally. Because education must enable students to use the scientific ideas they have learned to explain phenomena and provide answers to questions. Therefore, the educational framework that facilitates the process of increasing students' understanding of scientific literacy must be substantially improved.

CONCLUSION

Based on the research that has been conducted, it can be concluded that: The scientific literacy abilities of students at Riyadul Mubarok Integrated High School are relatively low. Where indicators one and three show low results, while indicator two is included in the medium category. The highest result of the three indicators

is for the indicator explaining scientific phenomena, while the lowest result is for the indicator using scientific evidence. The learning outcomes of class X students at Riyadul Mubarok Integrated High School on renewable energy material are classified as moderate, This can be influenced by limited use of devices so that it has a positive effect. This can be further improved by increasing student learning resources so that student learning and knowledge is maximized.

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