



# Teachers' Perspective on Enhancing Science Literacy of Primary School Students'

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## ABSTRACT

This research aims to understand teachers' perspectives on enhancing science literacy among primary school students in Sidoarjo District. This study employed a quantitative survey design using a questionnaire as the primary data collection instrument. The population consisted of 362 teachers from various primary schools, and purposive sampling was used to select 116 participants. The results indicate that teachers' perspectives on enhancing science literacy are relatively high, suggesting that teachers have made substantial efforts to promote science literacy despite concerns regarding national literacy and numeracy achievement. The findings provide empirical evidence that science literacy practices in Indonesian primary schools are being implemented through visual stimuli, healthy debates, and student investigations. These results contribute to a better understanding of teachers' roles in supporting science literacy development at the elementary level.

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## 1. INTRODUCTION

In the 21<sup>st</sup> century, education must prepare learners to face challenges in various aspects of life. In addition, the development of technology has encouraged the implementation of distance learning, especially during the COVID-19 pandemic. Learning activities are carried out using information and communication technology such as the internet, videos, and digital communication platforms, allowing teaching and learning processes to continue even without face-to-face interaction (Sayadi & Pangandaman, 2025; Yadav, 2024). In this context, knowledge has a very significant influence on progress and provides a major impact on human civilization (Parisu et al., 2025). In the era of revolution, education is required to continuously innovate and develop in order to take advantage of technological advancements (Barus, 2022). The ability to understand knowledge is a skill that needs to be developed to face the global era, as it allows learners not only to understand but also to apply scientific ideas in everyday life (Widyasari & Haryanto, 2022).

According to PISA, scientific literacy is defined as “the capacity to use scientific knowledge, to identify questions and to draw evidence-based conclusions in order to understand and help make decisions about the natural world and the changes made to it through human activity (Sutrisna, 2021; Timotheou et al., 2023). Scientific literacy skills are related to mastery and understanding of scientific principles and procedures that enable someone to make informed choices and participate in citizenship, culture, and economic activities (Anggraeni & Mukhlis, 2023). Science learning should provide students with direct experience to develop their competencies, enabling them to explore and understand their environment scientifically (Widiastuti & Purnawijaya, 2021). This shows that understanding scientific concepts is not only theoretical but also closely related to real-life practices, such as the use of plants containing bioactive compounds for health purposes (Pai et al., 2022; Sijinjak et al., 2025). States that scientific literacy is the main goal in science education, which means that science teaching is aimed at improving students’ scientific literacy skills. One way to implement science learning in primary schools is through lessons called Natural and Social Sciences (Putri et al., 2026).

Primary school is the first official stage for children to learn knowledge, making it a very suitable moment for them to understand science in the right way, which can strengthen their understanding from a young age. Learning processes that are dominated by teacher-centered methods, such as lectures, tend to make students passive and reduce their engagement, which can negatively affect their scientific literacy skills (Irsan, 2021). Scientific literacy refers to an individual’s ability to understand science, communicate scientific ideas, and apply scientific knowledge to solve problems in everyday life (Hartono et al., 2023).

Generally, based on Program for International Student Assessment (PISA) data, science literacy skills among Indonesian students are still below the global average score. Various studies indicate that there are weaknesses in students’ science literacy skills during the learning period (Ayu et al., 2025). States that the elements of science as attitudes and processes are often overlooked because science education still focuses on presenting science as a product that must be memorized. In addition, research by Suroso found that science lessons are conducted only to prepare for school exams, without considering the needs of students which should be connected to their daily situations (Prasasti & Dewi, 2026). Students’ abilities in scientific literacy with minimal critical thinking skills after the Creative problem-solving method was applied were lower compared to students who received treatment using the problem posing method. The use of fossil fuels has various

environmental risks, including damage during exploration, transportation, and oil spill incidents that threaten ecosystems (Setiyo et al., 2021).

Based on objects comparable to the Problem Posing technique, the challenge of the more advanced Problem Posing method functions as a teaching method that can improve students' thinking skills because, in the learning process, students are given the opportunity to seek as much information as possible, then it can be organized into questions and solutions. Therefore, the Problem Posing method is very effective in enhancing science literacy skills. One of element that can influence the ability in science literacy is critical thinking skills. Integrating technology into science learning can be one of the best solutions to improve students' achievement and motivation in learning (Auliya & Muchlis, 2024). This aligns with the goal of integrated science teaching as stated in the 2013 curriculum, which is to develop students with high science literacy.

Scientific literacy is the understanding and knowledge of scientific concepts and processes that can help individuals make decisions based on their knowledge, as well as participate in national, cultural, and economic development, encompassing the specific skills possessed by the individual. Therefore, the role of educators is very crucial in human life. Education is a means of teaching material to students through guidance, instruction, or preparation for their future careers (Nurdiana & Sartika, 2024). The minimum competency assessment is designed to measure students' ability to think critically when responding to data and texts, as well as to determine their level of knowledge in applying that knowledge in real-life situations. This activity is created to assess students' skills so that they can evaluate the success of the learning that has been conducted. In order to know whether students understand the material being taught, teachers need to carry out learning research for students. Science learning is closely related to real-life phenomena, including the environment, living organisms, and natural events that occur in everyday life (Warmadewi, 2022).

Through its assessment framework, PISA evaluates students ability to apply scientific knowledge and reasoning in addressing real-world problems. According to data from a Narrative Systematic Review based on Google Scholar, websites, and textbooks from 2014 to 2022 that have been verified for reliability, it was revealed that PISA scores for science literacy among students in Indonesia remain low and have never met the score levels set by PISA. Based on PISA data, Indonesia's scientific literacy level is still relatively low compared to other countries, indicating the need for improvement in science education (Nurwidiyanti & Sari, 2022). One reason for the low science literacy among Indonesian students is due to misunderstandings about Natural Sciences among students, but other factors also influence it, such as the learning process, which tends to rely solely on lectures (Dwisetiarezi & Fitria, 2021). Students also do not fully understand the content delivered because the methods and learning tools applied are still not engaging. Emerging contaminants originate from various sources such as pharmaceuticals and personal care products, which can accumulate in living organisms and persist in the environment, causing negative impacts on human health and ecosystems (Dewi et al., 2021). As times progress, marked by technological developments, society must be able to adapt and continuously develop its abilities through education. Good education is an important factor in creating a competitive workforce in the future. A country is considered advanced if it has a high-quality workforce (Purnawati & Yakin, 2025).

Although previous studies have investigated science literacy practices, most have been conducted in international settings and have not specifically addressed their implementation in Indonesian primary schools. In addition, limited attention has been given

to the integration of visual stimuli, healthy debates, and student investigations as key components of science literacy learning. Thus, the novelty of this study lies in providing empirical evidence regarding the implementation of these three components in Indonesian elementary education. Therefore, this study aims to: (1) examine teachers' use of visual stimuli, (2) analyze the implementation of healthy debates, and (3) explore how teachers facilitate student investigations to support science literacy development.

## 2. METHODS

### 2.1. Research Design

The research design used is a quantitative type of research that implements the survey method. As previously explained in the earlier section, this study focuses primarily on primary school teachers as the main subjects. The participants in this study consisted of 362 teachers from various primary schools in Sidoarjo District, Sidoarjo Regency, East Java Province, Indonesia. These participants were selected because they were directly involved in classroom teaching and were therefore in a position to implement science literacy practices. Primary school teachers were chosen as the focus of this study since science literacy development begins at the elementary level and teachers play a key role in facilitating such learning experiences. Thus, the selected sample was considered suitable for investigating the implementation of visual stimuli, healthy debates, and student investigations in science literacy learning. The sampling method used in this study is purposive sampling to ensure objective sample representation. The sample obtained consisted of 116 teachers, comprising 23.3% male and 76.7% female. The variation of the sample based on demographic factors can be seen in **Table 1**.

**Table 1.** Sample Variations

<i>Background</i>	<i>Amount (N)</i>	<i>Total (%)</i>
Male	27	23.3
Female	89	76.7
Total	116	100

### 2.2. Research Instruments

The instrument used in this study is a questionnaire related to teachers' views on improving science literacy among primary school students. This questionnaire is divided into three types: (1) a questionnaire on using visual stimuli consisting of 6 questions, (2) a questionnaire on providing healthy debates consisting of 6 questions, and (3) a questionnaire on facilitating investigations for students consisting of 10 questions. This questionnaire has been tested for validity and reliability by expert validators. Therefore, this researcher's questionnaire is considered reliable or suitable for testing.

### 2.3. Data Collection Techniques

In this study, information was collected using a hybrid data collection method, which means combining two or more different systems through offline and online surveys. In the offline survey, questionnaires were distributed directly to several schools in the Sidoarjo District. In the online survey, the questionnaire link was shared via WhatsApp group (<https://forms.gle/pMfq8zM8cQgaN5P48>). The main topic of this study will focus on teachers' views regarding the improvement of science literacy skills in primary-level students. In this context, this can be assessed by looking at the percentage distribution of

scores chosen in responses, using a scale with an interval of 1-5, from never to very often. Furthermore, the data analysis results will be presented using descriptive statistics to show the response patterns for each survey item.

### 3. RESULTS AND DISCUSSION

#### 3.1. Primary School Teachers' Knowledge on Using Visual Stimuli

The research results on primary school teachers' knowledge about the use of visual stimuli on primary school students can be analysed using descriptive statistics. As a summary of the descriptive analysis results, based on the information in **Table 2**, taken from 116 primary school teacher samples, consisting of 23.3% male teachers and 76.7% female teachers. The use of technology-based media, such as images, videos, and interactive platforms, can significantly improve students' understanding and engagement in learning activities. Technology also allows students to access various learning resources more easily and supports independent learning (Rabani et al., 2023).

**Table 2.** Knowledge with Visual Stimuli

Question	Percentage (%)	Category
I am able to increase students' motivation through engaging visuals.	83.1	Very good
I give image-based assignments to help students understand science concepts	79.83	Good
I gave the students an assignment to describe something through creative activities to enhance their critical thinking skills.	81.55	Very good
I enhance students' ability to express their ideas verbally or in writing through enjoyable activities	84.14	Very good
I improve students' memory by having them replace presented images to construct differences with the previous images.	79.13	Good
I asked the students to describe in detail the images that had been presented after the images were removed.	74.31	Good

Based on **Table 2**, to see the teachers' perspective using this visual stimulus, the data comes from a questionnaire designed according to the teachers' habits in using visual stimuli. The collected data will be accumulated, and the next step is to calculate the percentage for each different statement. From Table 2, it can be seen that 83.1% of 116 teachers have implemented visual stimuli very well in teaching and learning activities by increasing student motivation through attractive images. As many as 79.83% of teachers have also assigned image-based tasks to help students understand science concepts. Then, many teachers have given students assignments to depict something through creative activities to enhance their critical thinking skills, as shown by 81.55%. The teachers have also implemented teaching and learning activities through enjoyable activities to improve students' ability to convey their ideas, demonstrating good speaking and writing skills, which is evident from 84.14% of 116 being categorized as very good. Then, as many as 79.13% of teachers have improved students' memory through activities that involve changing the presented images to construct differences from the previous images. Furthermore, 74.31% of teachers will ask students to mention the details of the images that have been shown after the images are removed, indicating that the students have understood the teaching concepts that have been explained.

A research and publication institution in the field of computers, namely Computer Technology Research (CTR), revealed that individuals can only remember 20% of what they see and 30% of what they hear. However, a person can remember 50% of a combination of what they see and hear, and 80% of everything seen, heard, and done simultaneously. The results of this study indicate that visual media play an important role in forming long-term memory in children, especially because psychologically, children tend to have a stronger inclination to observe visually and imagine vividly. Various studies, such as those conducted by Knolton; Levied and Dickie; Peiber; and Winn, have shown that there are at least four studies on illustrations or images, memory about images, learning and cognition, as well as appropriate responses to images. This indicates that overall, teachers have benefited from the presence of this visual stimulus and are classified as "Good." This finding is demonstrated by the improvement in primary students' abilities after they received visual stimulation with the help of images. Students' abilities in critical and creative thinking after receiving visual stimulation through image media have shown significant progress in each statement. According to Sipayung & Sihotang (2022), an educator must have innovative and new ideas in planning teaching methods by maximizing various types of student learning styles, whether visual, auditory, or motor skills, efficiently.

### 3.2. Primary School Teachers' Knowledge in Providing Healthy Debates

Teachers' knowledge of providing healthy debates was examined to assess their understanding of discussion-based learning practices that support science literacy development. The results for each indicator are presented in **Table 3**.

**Table 3.** Knowledge Provides a Healthy Debate

Question	Percentage (%)	Category
I facilitate healthy debates to identify differences in describing and explaining topics.	75.69	Very good
I provide special strategies to help participants engage in healthy debates.	75.17	Good
I describe activities with pictures individually to encourage students to think more independently.	78.96	Good
I give students time to discuss in groups to boost their confidence in expressing their opinions.	82.41	Very good
I use the debate method to help students develop critical thinking skills.	73.1	Good
I train students to learn to support and defend their ideas with evidence through debate.	73.27	Good

Based on **Table 3**, it can be seen that many teachers have already implemented healthy debates in the educational process. This is indicated by 75.69% of teachers facilitating healthy debates to identify differences in describing and explaining topics. Furthermore, as many as 75.17% of teachers have provided specific strategies to help students engage in healthy debates. Teachers have also conducted learning activities involving individual picture descriptions to encourage students to think more independently, as shown by 78.96% of 116 falls into the good category. Then, many teachers have provided opportunities for students to engage in group discussions, which can boost their confidence in expressing opinions, as shown by 82.41%. As many as 73.1% of teachers have used debate methods to support students in enhancing their critical thinking skills. In addition,

73.27% of teachers will train and support students in defending their ideas through healthy debates.

This indicates that overall, teachers are helped by the presence of healthy debates, which fall into the 'Very Good' category. A healthy debate is a form of dynamic two-way communication, in which students exchange ideas and strive to reach a mutual understanding. Learning activities that involve active student participation can improve students' understanding and help them construct knowledge through interaction and discussion (Sajidin & Ashadi, 2021). The research results of Prameswari, Widodo, and Qosim show that debating techniques can support the development of critical thinking skills in science lessons. By using constructive debate strategies, it is expected that students can be more active, including in problem-solving, asking questions when facing difficulties, obtaining information independently, and in other aspects as well (Martini et al., 2021). The use of this debate method aims to support the educational paradigm in the 21<sup>st</sup> century, which is driven by a number of advantages, one of which is the ability to support educators to increase efficiency in the teaching process. According the benefits of the method include: 1) training and triggering students to think critically; 2) training students to express opinions well and correctly; 3) seeking the truth about hot issues; 4) training understanding of other people's different views; 5) encouraging students to create new ideas or concepts based on research analysis; 6) triggering exploration of issues that trigger debate; 7) learning how to think regularly and analytically; and 8) learning how to convey the results of thinking to others.

### 3.3. Primary School Teachers' Knowledge in Facilitating Investigations for Students

Teachers' knowledge of facilitating investigations for students was examined to assess their understanding of inquiry-based learning practices that support science literacy development. The results for each indicator are presented in **Table 4**.

**Table 4.** Facilitating Investigations for Students

Question	Percentage (%)	Category
I enhance students' abilities to construct stories or hypotheses that explain why an object is in a certain position or how an event could occur.	76.21	Good
I develop students' ability to be able to name the objects in the picture, as well as their colours, shapes, and positions accurately.	81.55	Very good
I can develop students' qualities so that they are more motivated to pay close attention when given tasks and describe what they observe.	81.03	Very good
I provide image-based observation assignments to make it easier for students to connect abstract concepts with the real world.	79,14	Good
I ask the students to explain what they observe to improve their critical thinking skills.	81.89%	Very good
I ask students to be more actively involved in learning when they are asked to explain their observations.	83.62%	Very good
I ask students to focus on certain parts of the material in order to help them understand the concepts in depth.	81.2%	Very good
I assign tasks that require students to focus in detail to practice improving their attention.	82.24 %	Very good
I use enjoyable methods to make science material easier for students to understand.	82.58 %	Very good
I use technology and interactive media in science learning to improve students' science literacy.	81.89 %	Very good

Based on Table 4, shows that many teachers have facilitated investigations for students. This is indicated by 76.21% of the 116 teachers effectively facilitating investigations for students in teaching and learning activities through students' ability to compose stories or hypotheses. Additionally, 81.55% of teachers have facilitated students in correctly identifying objects in pictures, including their colours, shapes, and positions. Furthermore, many teachers have guided students to be more motivated to pay attention to details when given tasks and to describe what they observe, as shown by 81.03%. Teachers have also implemented teaching and learning activities through image-based observation assignments to make it easier for students to connect abstract concepts with the real world, as shown by 79.14% of 116 being categorized as good. Teachers have also facilitated students in asking them to explain what they have observed to improve their critical thinking skills, indicated by 81.89% of 116 being categorized as very good. Furthermore, teachers have also encouraged students to take a more active role in the learning process when asked to elaborate on their observations, as shown by 83.62% of 116 being categorized as very good. Then, 81.02% of teachers have asked students to focus on specific parts of the material to help them understand concepts in depth. Furthermore, 82.24% of teachers have given assignments that require students to focus in detail to practice improving attention. Teachers have also used enjoyable methods that can make science material easier for students to understand, as shown by 82.58% of 116 falling into the very good category. Additionally, 81.89% of teachers have also facilitated technology and interactive media in the science learning process to enhance students' science literacy.

This indicates that overall, teachers are helped by facilitating investigations for students, which falls into the "Very Good" category. Education is one of the steps designed to create a learning environment and teaching process so that students can optimize the abilities within themselves, enabling them to have character, self-control, spiritual strength in religion, intelligence, as well as skills for personal and societal purposes (Martini et al., 2021). Referring to the complex aspects of this competition, students must develop critical, creative, and reflective thinking skills (Yusmar & Fadilah, 2023).

Critical thinking is a skill in considering and assessing ways of thinking with the aim of improvement. Critical thinking skills are very important for 21<sup>st</sup> century learners to understand various ideas and theories, including situations and problems encountered in daily life (Wicaksono et al., 2022). Critical thinking is an innate thought process that focuses on problem-solving, decision-making assessment, analysis, observation, as well as the development of ideas and scientific attitudes. Despite these positive findings, several limitations of this study should be acknowledged. First, the participants were limited to primary school teachers in Sidoarjo Regency, which may restrict the generalizability of the findings to other educational settings. Second, the study relied on self-reported questionnaire data, which may be subject to response bias. Third, the research focused on teachers' knowledge of facilitating investigations rather than direct observations of classroom practices. Therefore, future studies should involve participants from broader regions and employ multiple data collection methods, such as classroom observations and interviews, to provide a more comprehensive understanding of science literacy implementation.

#### 4. CONCLUSION

Based on the findings from the study conducted, it can be concluded that teachers' perspectives on improving science literacy skills in primary school students in Sidoarjo subdistrict are relatively very good. From the results of the questionnaire involving 116

respondents, it can be seen that the use of visual stimuli in the learning process has been applied significantly by the teachers. Furthermore, from the results of a questionnaire also involving 116 respondents, it can be observed that the implementation of healthy debates in the teaching and learning process has become a fairly common practice among teachers. The majority, more than 75% of teachers, have implemented healthy debates in the learning process. Based on a questionnaire involving 116 respondents, it can be seen that the use of inquiry in the learning process has been significantly applied by the teachers. Most teachers have facilitated teaching and learning activities through inquiry, which falls into the good category. Suggestions for further research are to conduct the same study but using different methods in order to examine more deeply teachers' perceptions in boosting science literacy of primary school students in the Sidoarjo District, Sidoarjo Regency, East Java Province, Indonesia.

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## 6. AUTHORS' NOTE

The authors declare that there is no conflict of interest regarding the publication of this article. Authors confirmed that the paper was free of plagiarism.

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