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Article

Enhancing Students' Scientific Literacy Skills at SMPN 1 Jenangan on Substance Density: A Survey of Integrated Science Learning

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ABSTRACT

This study is motivated by the importance of scientific literacy skills in 21st-century learners as a foundation for understanding, applying, and making decisions regarding scientific phenomena in daily life. The purpose of this research is to describe the scientific literacy abilities of students at SMP Negeri 1 Jenangan in the topic of density. This research employed a descriptive quantitative approach using a survey method involving 106 seventh-grade students. The research instrument was a scientific literacy questionnaire based on three main indicators: conceptual knowledge, attitude toward learning, and application of concepts in daily life. The results showed that students' scientific literacy skills were categorized as good, with mean scores of 3.03 for conceptual knowledge, 3.11 for learning attitude, and 2.93 for concept application. These findings indicate that students have demonstrated good scientific understanding and positive attitudes but still need improvement in applying scientific concepts to real-life contexts. This study provides insights for educators to design more contextual and applied science learning strategies to enhance students' scientific literacy skills.

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INTRODUCTION

One of the determining factors in improving human resources is education. Quality resources are of course based on how the value of education is embedded in individuals. Not only that, education also plays a role in shaping individual character and abilities so that they can compete in the global arena (Sanga & Wangdra, 2023). The rapid progress of the times in the transformation of the curriculum, learning methods and goals of education is one of the efforts to answer the dynamics of changing times. Education is placed in a position that has a sharp spotlight due to the complex and diverse challenges of the past due to entering the 21st century era (Jaya et al., 2023). In the 21st Century, education is faced with unexpected demands.

The more advanced technology is, today students are required to master various abilities. 21st century abilities are indispensable to solve various problems faced by students using logical reasoning and solutions from appropriate problems (Markhus et al., 2019). In science

learning, science literacy skills are needed to welcome the 21st century skills of students. Because science literacy itself includes the process of understanding science, science skills, and *problem-solving* skills (Febrianti, 2021).

According to Izzatunnisa et al, (2019) in (Nurlaili et al., 2023) stated that with 21st century skills needed by students, namely science literacy which is useful in improving the ability to understand scientific processes and obtain meaningful scientific information from data that already exists in daily life. Science literacy itself is a person's ability to master and apply science to solve real problems that are pleasing to science and technology in life.

With high science literacy skills, students will have knowledge of science concepts to consider, have awareness, and actively discuss, as well as have the ability and care and be able to make decisions related to problems that arise in the real world (Rohmaya, 2022). Science literacy is also a very real highlight that based on data released by the OECD, Indonesia's science literacy ability or PISA score from 2006, 2009, 2012, 2015 has an average science literacy score of 382-403. However, it declined again in 2018 (Yusmar & Fadilah, 2023). Based on this data, Indonesia occupies the 71st position in 2018 regarding PISA scores (Rohmaya, 2022)

Therefore, this study aims to find out the science literacy ability of students at SMP Negeri 1 Jenangan related to science learning on substance density materials. Previous research has mostly discussed the application of a method, model, or approach to students' science literacy skills in science learning. The novelty of this study is to measure the ability of science literacy in science learning through a survey process.

LITERATURE REVIEW

The ability of individuals to use knowledge, data, and scientific evidence to identify questions, acquire new knowledge, and evaluate scientific information and arguments in understanding natural phenomena. Science literacy includes aspects of knowledge, skills, understanding, and scientific values that encourage a person to think logically, critically, and responsibly about science issues in daily life (Hasasiyah et al., 2020). According to the PISA 2025 framework (OECD, 2024), science competencies include three main aspects, namely explaining phenomena scientifically, constructing and evaluating scientific investigations and interpreting data critically, and using scientific information for decision-making and action. These three competencies are the basis for assessing students' ability to apply science concepts logically and responsibly in daily life (Thomas, 2025). Based on Toharudin, et al. (2011) in (Jayanti & Nurfathurrahmah, 2023) science literacy is defined by a person's ability to understand science, communicate science orally and in writing well, and apply scientific knowledge in overcoming and solving problems so that they have a high attitude and sensitivity towards themselves and the environment to determine decisions based on scientific considerations.

In the quote of Yus Mochamad Cholily, et al. (2025), the science literacy achievements of Indonesian students based on the 2022 PISA results show that Indonesia's science literacy level is still below the OECD average. Indonesia obtained an average score of 383 and ranked 65th out of 81 participating countries, which indicates that most Indonesian students are not able to understand, evaluate, and use science concepts optimally in their daily activities (Cholily, 2025). Thus, science literacy is one of the important indicators in assessing the quality of science learning at the junior high school level. Students need to have science literacy skills by having knowledge, the ability to identify questions, and draw conclusions based on evidence to understand and make decisions related to nature and the changes made have an impact on nature through human activities. Science learning is one part of education that produces and shapes students to have science literacy skills who can think critically, logically, creatively, innovatively, and globally competitively (Ida Ayu Putu Nova Warmadewi, 2022).

In the realm of science education, the experiential learning model is closely related to scientific reasoning. The paradigm of scientific inquiry put forward by John Dewey (1938), which includes the activity of observing phenomena, formulating hypotheses, testing through practice, and revising theories based on observations, shows a deep compatibility with the structure of Kolb's learning cycle, which also emphasizes reflective and experimental processes in building scientific understanding. Thus, science learning that is oriented to direct experience and reflection supports the formation of students' scientific thinking skills gradually and contextually (Chen et al., 2025).

One of the important concepts in science learning is the density of substances or density. The density of a substance is defined as the ratio of the mass of an object to its volume ($\rho = m/V$). This concept is a basic physics subject that students must master because it is closely related to everyday phenomena, such as why objects can sink or float in water (Giancoli & Douglas, 2005). Through simple but meaningful experimental activities, students can understand how density determines the behavior of an object in a fluid. The process of observation, measurement, and analysis of data trains scientific thinking skills and the use of empirical evidence to logically explain the phenomenon of two core abilities in the PISA science literacy framework (OECD, 2023).

METHOD

This study uses a descriptive quantitative approach with a survey method. This approach was chosen to describe the level of science literacy ability of SMP Negeri 1 Jenangan students towards substance density materials through data collection using a Likert scale questionnaire instrument. According to Sugiyono (2019), the survey method is used to obtain data from certain natural places, but researchers carry out treatments in data collection, for example by distributing questionnaires (Sugiyono, 2019). This research was carried out at SMP Negeri 1 Jenangan, Ponorogo Regency, in the odd semester of the 2025/2026 school year. The location was chosen purposively because it is the place where the internship program is carried out for 2 students of Tadris Science, UIN Kiai Ageng Muhammad Besari Ponorogo. The population in this study is all grade VII students of SMP Negeri 1 Jenangan who have received substance density material. The sampling technique is carried out by simple random sampling, so that each student has the same opportunity to become a respondent. The number of research samples was adjusted to the number of students who filled out the survey instrument at the time of the study (Harlen, 2010).

The research instrument is in the form of a survey questionnaire on science literacy ability developed based on three main dimensions, namely scientific knowledge about substance density (cognitive), attitude towards learning density of substances (affective), and behavior and application of density concepts (psychomotor or application) (Rustaman, 2016). Each statement is compiled using a four-level Likert scale, namely 1 (Strongly Disagree), 2 (Disagree), 3 (Agree), and 4 (Strongly Agree). This instrument refers to the science literacy framework put forward by the OECD (2019) in the PISA Framework for Scientific Literacy, which emphasizes the three main components of science literacy, namely knowledge, scientific competence, and attitude towards science (OECD, 2019).

The data was collected by distributing questionnaires directly to students after the learning of the substance density material was completed by 106 students. Each student is asked to fill out a questionnaire honestly according to their level of understanding of the material. The data from filling out the questionnaire was then analyzed using quantitative descriptive analysis techniques. The analysis was carried out by calculating the average score of each indicator to get an idea of the level of science literacy of students. The interpretation criteria of the analysis results refer to the category proposed by Riduwan (2012), namely the score of 3.25–4.00 is categorized as very good, 2.50–3.24 is good, 1.75–2.49 is adequate, and 1.00–

1.74 is less. The results of the analysis are presented in the form of a table or diagram to clarify the distribution of students' science literacy skills (Riduwan, 2012).

RESULT AND DISCUSSION

Result

Based on the results of the descriptive analysis by considering the validity and reliability test prerequisites, valid and reliable tests. The results of the calculation of science literacy ability can be seen in figure 1.

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
pk	106	2	4	3.03	.351
af	106	1	4	3.11	.442
ps	106	1.80	4.00	2.9368	.45252
Valid N (listwise)	106				

Figure 1. Descriptive Analysis Results

Based on the mean value of the concept knowledge indicator of 3.03, it can be seen that students have good concept understanding skills. With a standard deviation value of 0.351, indicating that most of the students' answers are homogeneous or equal to a slight variation, this indicates that the student's knowledge of the concept of substance density has the same perception or that the student understands the substance density material.

Based on the mean affective indicator or attitude towards learning of 3.11, it shows that students have a good attitude towards learning substance density. With a standard deviation value of 0.442, it can be seen by students' answers that are still homogeneous to the questionnaire and are less varied or tend to be the same.

Based on the mean value of the student's application or psychomotor indicators for substance density material of 2.9369, it shows that the student's ability to apply substance density material in daily life is sufficient. It is known that the students' answers seen from the standard deviation of 0.452 show data that is still homogeneous but more varied than the indicators of knowledge, concepts and attitudes towards learning.

Discussion

Based on the mean results of the concept knowledge indicator in the science literacy of grade VII students of SMP N 1 Jenangan showed that the results were good with a score of 3.03 with homogeneous and less varied answers for each student, this shows that students have the same perception or understanding of substance density material. Science knowledge in it includes knowledge of content, techniques or procedures, and science epistologics (Febriana et al., 2024). Based on PISA (Sumarni et al., 2021) concept or content knowledge is student knowledge about theory, information, and concepts. And facts about a science. It is very important for students to know the knowledge and understanding of science because of the decision making about scientific phenomena. Understanding science can find out various important information about how to deal with current global problems and potential new problems in the future such as climate change, the need for clean water, sustainable energy production and other problems (Kintan Limiansih et al., 2024).

Based on the results of the mean indicators of attitude towards learning of Grade VII students of SMP N 1 Jenangan show that the results of students' learning attitudes towards substance density materials with integrated science learning are evidenced by a mean value of 3.11 hats, which shows that students' attitudes towards learning density substances make it easier for students to understand the concept of substance density. Students also feel that conducting experiments makes students more interested in the application of technology based on substance density materials. And more interested in the application of substance density in

daily life. With the application of science literacy, science literacy can cause students to develop their mindset and behavior as well as the development of students' character to become more caring students, have a sense of responsibility for themselves, society, and the environment as well as for the problems that are being faced at this time (Harahap & Lubis, 2025). Science attitudes are also important in science literacy, according to PISA, science attitudes include attitudes in supporting science inquiry, interest in science, and attitudes of responsibility towards the environment and resources. This is in accordance with the educational goals, namely developing students' attitudes to be interested in imitation issues, and acquiring and applying science and technology knowledge for their own interests, social and global (Mentari Darma Putri, 2021).

The mean results of psychomotor indicators or learning applications in the daily lives of grade VII students of SMP N 1 Jenangan showed sufficient results where the mean was known with a value of 2,936. Based on the results of the questionnaire that has been given to students, students still have confusion about the correct use of balance sheets, this is because currently there are many uses of digital balance sheets compared to balance sheets in laboratories. In the substance density material, students also apply the knowledge of kondep by calculating the density of irregular objects. The ability to read science thinking scientifically is very necessary to deal with and recognize problems that occur such as environmental, social and so on problems (Lestari et al., 2022). Therefore, the application of science literacy is useful for students to increase their attitude of caring for the environment, themselves, and society.

CONCLUSION

Based on the results of the research on the science literacy ability of SMP Negeri 1 Jenangan students on substance density material, it was found that the science literacy ability of students was in the good category with the average score of each indicator showing positive results. The concept knowledge indicator has an average value of 3.03 which shows that students' understanding of science concepts is relatively good and relatively homogeneous. The attitude to learning indicator obtained an average score of 3.11 which indicates that students have a positive interest and attitude towards science learning, especially in substance density materials. Meanwhile, the application or psychomotor indicators showed sufficient results with an average of 2.93, which means that students still need to improve in applying the concept of substance density in the context of daily life.

In general, these results indicate that students already have a good scientific understanding and attitude towards science learning, but it is necessary to strengthen the aspect of applying concepts so that science literacy skills can develop in their entirety. This research contributes conceptually in providing an overview of the level of science literacy of junior high school students through a survey approach to substance density materials, and can practically be a basis for educators in designing learning strategies that are more contextual and oriented towards improving students' applicative abilities.

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