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Science Literacy Profile in Science Learning Solar System Material for Students in Elementary Schools

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ABSTRACT

Students need to know how much they have learned about scientific principles when studying science. The ability to solve problems, base decisions on science, and use acquired knowledge in everyday life is known as scientific literacy. The aim of this research is to conduct a scientific analysis of scientific literacy skills related to the solar system among students at the Brambang State Elementary School. This research is a quantitative descriptive study. This approach was chosen because it aims to describe the profile of elementary school students' scientific literacy specifically on the solar system material. The data obtained will be analyzed quantitatively to produce a clear and objective picture. The subjects of the study were 17 grade VI students. Data collection used a written test to measure students' scientific literacy skills. Data analysis was carried out using a quantitative descriptive method by looking at the results of students' written tests. Based on observations, research results showed that the scientific literacy skills of Brambang State Elementary School students were very poor, many students had very low scientific literacy skills in learning about the solar system. The results of the student questionnaire also showed that 77% of students still did not understand basic knowledge and concepts of the solar system. The findings of this research can be used as empirical evidence that there is still room for increasing students' scientific literacy at the Brambang State Elementary School in terms of learning about the solar system.
Keywords: *Scientific Literacy; Science Learning; Solar system*

ABSTRAK

Siswa perlu mengetahui seberapa banyak yang telah mereka pelajari tentang prinsip-prinsip ilmiah ketika mempelajari sains. Kemampuan untuk memecahkan masalah, mendasarkan keputusan pada sains, dan menggunakan pengetahuan yang diperoleh dalam kehidupan sehari-hari dikenal sebagai literasi sains. Tujuan dari penelitian ini adalah untuk melakukan analisis ilmiah tentang keterampilan literasi sains yang berhubungan dengan tata surya pada siswa di Sekolah Dasar Negeri Brambang. Penelitian ini merupakan penelitian deskriptif kuantitatif. Pendekatan ini dipilih karena bertujuan untuk menggambarkan profil literasi sains siswa sekolah dasar secara spesifik pada materi tata surya. Data yang diperoleh akan dianalisis secara kuantitatif untuk menghasilkan gambaran yang jelas dan objektif. Subyek penelitian adalah peserta didik kelas VI yang berjumlah 17 peserta didik. Pengumpulan data menggunakan tes tulis untuk mengukur kemampuan literasi sains peserta didik. Analisis data dilakukan dengan cara deskriptif kuantitaif melihat hasil tes tulis peserta didik. Berdasarkan observasi diperoleh hasil penelitian yang menunjukkan bahwa keterampilan literasi

sains siswa Sekolah Dasar Negeri Brambang sangat kurang, banyak siswa yang memiliki keterampilan literasi sains dalam pembelajaran tata surya sangat rendah. Hasil angket peserta didik juga menunjukkan bahwa 77% peserta didik masih kurang memahami tentang pengetahuan dasar dan konsep tata surya. Temuan penelitian ini dapat digunakan sebagai bukti empiris bahwa masih ada ruang untuk peningkatan literasi sains siswa di Sekolah Dasar Negeri Brambang dalam hal pembelajaran tentang tata surya.
Kata Kunci: Literasi Sains; Pembelajaran IPAS; Tata Surya

INTRODUCTION

Scientific literacy is one of the most important components of education that aims to prepare students for the opportunities and challenges of the twenty-first century. Scientific literacy encompasses not only factual information but also the capacity to think critically, solve problems, and apply that knowledge in pertinent circumstances. Science literacy is closely related to students' ability to understand the environment, nature and its surroundings. The sustainability of nature and its surroundings is highly dependent on human treatment as subjects who occupy and utilize nature and its contents (Chasanah et al., 2022). To provide pupils with solid scientific foundations, scientific literacy needs to be taught from an early age in the context of basic education. PISA focuses on a number of scientific literacy-related variables or measuring domains. According to the most recent data from the Program for International Student Assessment (PISA), there is still a significant problem with scientific literacy among students worldwide. The Organization for Economic Co-operation and Development (OECD) administers the PISA exam every three years to assess the reading, math, and science proficiency of 15-year-old students. On December 5, 2023, the study results of the 2022 Program for International Student Assessment (PISA) were released. Indonesia is rated 68th with scores in math (379), science (398), and reading (371). According to the most recent PISA findings, many students still struggle to apply their science knowledge in authentic, challenging circumstances, even though there have been gains in several areas. Problem solving skills are the fundamental abilities needed to solve challenges involving critical, logical, and systematic thinking, while science literacy is the capacity to engage with science-related concerns (OECD, 2019a). Thus, problem-based learning that is incorporated with scientific topics is appropriate for enhancing scientific literacy and problem-solving abilities. Socio-scientific issues (SSI) serve as the foundation for the problem-based learning (PBL) learning approach (Hestiana & Rosana, 2020).

Scientific literacy is a skill that needs to be mastered even from elementary school age so that students can prepare for their future well (Andriana et al., 2023). Scientific literacy emphasizes the importance of thinking and action abilities, such as thought mastery and applying scientific thinking to understand and respond to societal challenges. Scientific literacy is required for pupils to comprehend the environment, health, economy, current culture, and technology. Therefore, analyzing scientific literacy is necessary to measure the degree of students' scientific literacy in order for Indonesia's educational quality to improve and compete with other nations (Pratiwi et al., 2019). Scientific literacy is a crucial ability that students should acquire. With scientific literacy, it will form individual characters who are sensitive to problems that occur in the surrounding environment (Safira et al., 2023). Scientific literacy is essential for tackling scientific challenges. This is because scientific literacy may help students

understand and analyze challenges, enabling them to discover solutions based on their scientific understanding. The many worlds of work require that jobs have high skills, thus requiring people to learn science, reason, think creatively, solve problems and make decisions (Agustina et al., 2020). Scientific literacy refers to a person's ability to comprehend scientific phenomena, analyze data, design scientific research, and interpret data based on scientific evidence to solve real-world problems (Ananda Putri et al., 2024).

An educator promotes his pupils' scientific literacy to improve: 1) understanding and investigation of natural sciences, 2) oral and written language required to understand and express science, and 3) the relationship between science, technology, and society (Pertiwi et al., 2018). Students must be able to study throughout their lives, from a variety of sources, and learn to collaborate, adapt, and solve issues. For this reason, the learning paradigm must be changed and position students as the center of learning (student centered), where students learn to construct their own knowledge based on natural phenomena that occur around them. The role of teachers in learning must shift to being learning designers so that students actively seek new knowledge and as facilitators or mediators for learning. Teachers as facilitators must be able to provide learning that can accommodate students to develop the skills that are in demand in the current era (Choirunnisa et al., 2023). Students are expected to be actively involved in learning by using new and interesting concepts in real life (Nurhanifah & Diah Utami, 2023). The factor that causes problems in students' scientific literacy skills is because the learning approach applied in the school is still centered on the teacher where the communication pattern that occurs is only one way, students are not used to sharing ideas or concepts with other students so that the learning process is not interactive(Nada Karima Fasya et al., 2023). Another obstacle that occurs is that teachers have not used an integrated model in the learning process

One of the important materials in the science curriculum for grade 6 students is the solar system. This material not only introduces students to the basic components of the solar system, but also teaches them how to understand the natural phenomena that occur around us. Education about the solar system can spark students' curiosity about science and how various cosmic phenomena affect life on earth. However, scientific literacy at the elementary school level often faces challenges, including a lack of student interest and difficulty in understanding abstract concepts such as planetary movement and the influence of gravity. A good understanding of the solar system material can foster students' curiosity and interest in science, as well as improve their critical thinking and problem-solving skills. Although the solar system material is important to learn, learning it is often faced with several challenges. One of the challenges is that the solar system material is abstract and complex, making it difficult for students to understand (Prabawa & Maryani, 2024).Teachers and students are important subjects or main actors in the world of education (Nada Karima Fasya et al., 2023). Teachers must keep up with the times and be able to enhance their skills in generating intriguing, interactive, and fun learning media and applying them to teaching and learning activities that use technology. Natural Sciences is an example of a subject that makes use of technology through creative, innovative, and interactive learning materials.

Scientific literacy skills must also have an impact on new knowledge. The new knowledge in question is good literacy skills, which enable students to understand, analyze, and use information effectively. Scientific phenomena are also seen as part of scientific literacy. Scientific literacy is also the ability to comprehend scientific information, recognize flaws, and develop conclusions based on current facts in order to understand and make decisions about nature and human-caused changes. Scientific literacy is used for various aspects including knowledge of scientific content, understanding of science and its application in the field of science, knowledge of science, freedom in learning science, and scientific thinking skills (Wayan et al., 2024). PISA (Program for International Student Assessment) defines scientific literacy as (a) the ability to describe scientific phenomena, (b) evaluating and designing scientific research, and (c) interpreting scientific data and evidence (Hestiana & Rosana, 2020). A person is said to be able to carry out scientific literacy when he is able to apply some or all aspects of scientific literacy (Prabawa & Maryani, 2024). The use of multimedia learning is important to help students identify scientific opinions, conduct scientific literature searches, understand elements, solve scientific problems, understand and interpret basic statistics, and make inferences, predictions, and draw conclusions (Agustina et al., 2020). Science literacy skills can be developed through the use of technology in learning.

Learning media integrated with technology can create more effective, interesting, and relevant learning with the times (Ananda Putri et al., 2024). Teaching methods and learning media are two essential components of the teaching and learning process that are inextricably linked. The choice of teaching approach will determine the suitable sort of learning media. (Miftah & Nur Rokhman, 2022). Good coordination between teaching approaches and learning material can help you reach your learning objectives (Munawar et al., 2023). Currently, the government is attempting to increase students' science literacy abilities by developing an integrated curriculum in the hopes that students will absorb the subject content holistically and integratively. Providing learning facilities has not supported these initiatives, whether science literacy-based textbooks or science literacy skills questions as an evaluation method (Syahrani et al., 2024). Scientific literacy skills in Indonesia need more attention and improvement in the future (Aryungga et al., 2021).

Based on the dimensions of its components, scientific literacy can be in the form of (1) scientific explanation of a phenomenon (content knowledge); (2) making plans and steps for evaluating scientific inquiries (procedural knowledge), and (3) the process of interpreting data scientifically accompanied by supporting evidence or epistemic knowledge (Safira et al., 2023). According to Ki Hajar Dewantara, the philosophy of education is also built on independence, known as the among system, which bans pupils from being punished or coerced because it can kill their independent spirit and inventiveness. From the concept of They Learn. Ki Hajar Dewantara, Minister of Education, Culture, Research, and Technology, Nadiem Anwar Makarim, has finally announced the concept of Independent Learning as a new policy program for the Ministry of Education and Culture. Independent Learning suggests that both teachers and students have the freedom to develop and explore their own potential, talents, and abilities without being limited by the rules and provisions that regulate learning (Ainia, 2020).

Based on The results of observations at SD Negeri Brambang in April 2024 during learning about the solar system, that students continued to be passive during the learning process, the focus of the learning process was on the teacher, which caused students to be less enthusiastic about learning, and the learning outcomes achieved were below standard. . The results of the student questionnaire also showed that 77% of students still did not understand basic knowledge and concepts of the solar system. Results of an interview with the class teacher also showed that in the learning process about the solar system, the teacher carried out learning using the lecture method and used learning media such as laptops, projector screens displayed in front of the class and textbooks. This of course shows that students' interest in learning is still low, considering the importance of students' ability to think logically to understand logical concepts, think critically and solve problems as well as the importance of involving media during the learning process. Therefore, to achieve learning goals, it is necessary to create learning experiences that utilize media.

Interactive learning multimedia can be an alternative media to overcome the problem of learning quality in schools. This media is able to develop sensory abilities while attracting attention and increasing students' interest in learning (Kumalasani, 2018). In addition, this interactive multimedia is also in accordance with the implementation of the Independent Learning concept, namely differentiated learning that prioritizes the learning process according to the learning style of students (Ningsih et al., 2023).

In scientific education, teachers continue to use routine questions to measure students' comprehension. However, literacy-based inquiries are increasingly important in science education. Thus, this study intends to determine the profile of scientific literacy in solar system content in primary schools, so that educators can utilize it as a basis for increasing students' scientific literacy skills.

METHODS

Type and Design

The purpose of this study is to examine elementary school kids' scientific literacy profile when studying about the solar system. This study used a scientific literacy test instrument to assess students' scientific literacy profiles in solar system learning, which includes three indicators: explaining concepts, analyzing, assessing, and responding to questions about scientific knowledge or information. This research is a quantitative descriptive study. This approach was chosen because it aims to describe the profile of elementary school students' scientific literacy specifically on the solar system material. The data obtained will be analyzed quantitatively to produce a clear and objective picture. The subjects of the study were 17 grade VI students. Data collection used a written test to measure students' scientific literacy skills. Data analysis was carried out using a quantitative descriptive method by looking at the results of students' written tests.

In this study, the assessment of scientific literacy abilities was carried out based on the characteristics of literacy skills that were adjusted to the age range of pupils, which were:

1. The ability to explain scientific phenomena based on data.
2. The capacity to design simple research.

3. The ability to understand simple data.

The methodology for this study is as follows: (1) The researcher conducted a literature review related to scientific literacy (2) The researcher focuses on finding assessments and indicators of scientific literacy, such as able to mention the names of the planets in the solar system. (3) The researcher created a scientific literacy test instrument to assess the scientific literacy profile of sixth-grade primary school students studying the solar system. (4) The researcher ran a little trial. (5) The researcher employed a scientific literacy test instrument to evaluate the scientific literacy profile of 17 students in the solar system content. (6) The researcher drew conclusions and conducted analyses based on the test instrument results.

RESULTS AND DISCUSSION

The results of instrument validation in the science literacy test are shown in Table 1. Media and material expert validation sheet. Validation aims to determine the level of validity of the learning media used for grade VI students. The validation sheet used in this study is a non-test assessment, namely respondents choose answers in the form of a checklist containing statements or questions to obtain an assessment from the validator with a Likert scale score. Validation is carried out by experts according to their fields who are called validators.

Table 1. Results of validation and reliability of scientific literacy test instruments

Aspect	Validation Indicator	Assessment			Score	Criteria	R
		V1	V2	V3			
Head	Appropriateness of the item to the topic	4.0	3.0	3.0	3.33	Valid	√
	Correspondence of question items to indicators	4.0	3.0	3.0	3.33	Valid	√
	Appropriateness of questions to the profile of science literacy	4.0	3.0	3.0	3.33	Valid	√
Arrangement	Clarity of instructions on how to do the questions	4.0	3.0	4.0	3.67	Valid	√
	Clarity of questions and answer choices	4.0	3.0	4.0	3.67	Valid	√
Language	Communicative sentences	4.0	3.0	4.0	3.67	Valid	√
	The use of interrogative sentences does not give rise to multiple interpretations	4.0	4.0	4.0	4.00	Valid	√
	Good and correct language	4.0	4.0	4.0	4.00	Valid	√
Rate-rate		4.0	3.2	3.6	3.6	Valid	√
Conclusion: The scientific literacy test instrument is valid and reliable.							

Table 2 shows that Brambang State Elementary School students have very low scientific awareness in the solar system. Only four of the 17 students were rated as "good." It is clear that not all pupils have reached completeness in the scientific literacy measures for the solar system. The average pre-test scores indicate that Brambang State Elementary School students have very low scientific literacy. Table 2 displays the results of the Brambang State Elementary School students' solar system-related scientific literacy tests.

Table 2. Score results

No	Student Name	Score	Category
1	CKPK	70	Good
2	DAR	60	Enough
3	ES	50	Very low
4	HAA	60	Enough
5	MFAH	60	Enough
6	MRMR	40	Very low
7	MDO	50	Very low
8	MPD	40	Very low
9	MPA	70	Good
10	MDNR	40	Very low
11	MRS	40	Very low
12	MA	80	Good
13	NAG	80	Good
14	NZDS	50	Very low
15	NA	40	Very low
16	RZA	60	Enough
17	RF	50	Very low
Average score		**55,3**	**Very low**

Based on these findings at table 2, it is clear that measures must be made to strengthen Brambang State Elementary School students' scientific knowledge about the solar system. The PISA evaluation is used to preserve, improve the quality of life, and build public policy so that students understand the importance of science to society and individuals and how to attain it optimally (Bieber T and Martens K, 2011). Students rely heavily on their literacy skills. Students that have strong levels of scientific literacy can master the material's principles. Aside from that, scientific literacy is useful for applying knowledge to real-world circumstances and scientific difficulties. Only a few students excel at mastering indicators used to explain scientific phenomena, evaluate and design scientific investigations, and analyze data and scientific evidence. Not all pupils can meet these criteria. Previous research have validated these conclusions. Students' SLA is low due to a lack of a scientific attitude, hence scientific research is required (Kusumah RGT, 2019).

Table 2 shows that up to 77% of students still do not understand the notion of evaluating and answering questions about scientific knowledge or information. Many teachers continue

to use traditional methods of instruction, which makes learning uninteresting and reduces students' motivation to articulate ideas, study scientific subjects, and solve difficulties. The instructional materials provided by the teacher only employ full text and are less engaging. This is because teachers' teaching materials are limited to textbooks, which contain formulas, concepts, and material packaged classically, making them difficult for students to understand. Good teaching materials should include a variety of intriguing representations that will encourage pupils to learn about the solar system. Teachers must create one-of-a-kind, creative, and original teaching materials in order to improve students' conceptual understanding. Interactive e-modules can assist students learn to understand material independently from anywhere (Abdul Muizz et al., 2023). To promote scientific literacy, teachers can create scientific literacy-based instructional resources.

One approach that is considered suitable for producing interesting and meaningful educational experiences for students is the use of media. Students' interests and abilities will influence their learning outcomes because of the availability of learning media (Wayan et al., 2024). One means to further develop the learning experience so that it is more optimal is the use of media in learning. Accuracy in choosing learning media is very important so that the function and use of media in the learning experience is used optimally and efficiently (Aulia & Mintohari, 2023).

CONCLUSION

In the context of this research in Indonesia, Brambang State Elementary School pupils' scientific literacy profile in learning solar system curriculum remains quite low. This is evident from the results of the scientific literacy test, which consisted of ten questions answered by Brambang State Elementary School students. Up to 77% of students still do not understand the concept of evaluating and answering questions concerning scientific knowledge or the solar system. The findings of this study can be used to demonstrate that Brambang State Elementary School pupils' scientific literacy in learning about the solar system still needs to be enhanced. The weakness of this study is that it only includes 17 primary school kids. To address this issue, additional research is needed on primary school level scientific literacy in understanding solar system topics namely the development of media to improve students' scientific literacy in solar system material.

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