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Improving Elementary Students' Science Literacy through the Scientific Inquiry Approach at SDN 1 Cenggu

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Abstract

This study aims to improve the scientific literacy skills of fourth-grade students at SDN 1 Cenggu by using scientific literacy teaching materials. The type of research used is classroom action research. The classroom action research model used in this study is the Kemmis PTK design. This model consists of four stages: planning, action, observation, and reflection. The research instruments used in this study are tests and documentation. The technique in data analysis is using written tests in the form of multiple choices and essays to determine cognitive abilities in students' scientific literacy abilities. The results of this study indicate that there is an increase in students' scientific literacy abilities seen in cycles I and II. The results of the data analysis obtained are that in cycle I the number of students who completed was 10 people and those who did not complete were 14 people with a percentage of completion of 41.6% and incompleteness of 58.4%. In addition, in cycle II, there was an increase in completion, namely 20 students and 4 students who did not complete it, with a completion percentage reaching 83.4% and incompleteness of 16.6%. Thus, the use of the Scientific Inquiry approach can improve students' scientific literacy skills in science learning for fourth-grade students at SDN 1 Cenggu.

Keywords: Science Literacy, Teaching Materials

Abstract

his study aims to improve the scientific literacy skills of fourth grade students at SDN 1 Cenggu by using science literacy teaching materials. The type of research used is classroom action research. The classroom action research model used in this study is the Kemmis PTK design. This model consists of four stages, namely planning, implementation (action), observation (observing), and reflection (reflection). The research instruments used in this study are tests and documentation. The technique in data analysis is using written tests in the form of multiple choices and essays to determine cognitive abilities in students' scientific literacy skills. The results of this study indicate that there is an increase in students' scientific literacy skills which is seen in cycles I and II. The results of the data analysis obtained were that in cycle I the number of students who completed was 10 people and those who did not complete were 14 people with a percentage of completion of 41.6% and incompleteness of 58.4%. In addition, in cycle II there was an increase in completion, namely 20 people and 4 people who did not complete it with a percentage of completion reaching 83.4% and incompleteness of 16.6%. Thus, the use of the Scientific Inquiry approach can improve students' scientific literacy skills in science learning for grade IV students at SDN 1 Cenggu.

***Keywords**:*Science Literacy, Teaching Materials.

Research Background

Elementary school is the first level of education, providing a strong foundation for subsequent levels (Efendi, 2022). The goal of elementary education is to lay the foundation for intelligence, knowledge, noble character, and skills for independent living and further education. Students' literacy skills are related to reading skills, which culminate in the ability to understand information analytically, critically, and reflectively. Literacy skills are considered essential because they can determine the success of the learning process (Putra et al., 2021).

The results of the 2018 Programme for International Student Assessment (PISA) study, released in December 2019, involved 12,098 students across 399 schools (Tohir, 2019). These schools were spread across Indonesia and considered representative. The PISA assessment aims to evaluate the education system, particularly in three key areas: mathematics, science, and literacy. The PISA assessment was designed to help students understand that knowledge has a specific value for each individual and society in improving and maintaining the quality of life within the development of knowledge.

At the elementary school level, there are various types of literacy that are applied with the hope of forming literate students, one of which is scientific literacy. According to Arohman in (Nuro & Majid: 2020) Scientific literacy can be defined as scientific knowledge and skills to be able to identify questions, gain new knowledge, explain scientific phenomena, and draw conclusions based on facts, understand the characteristics of science, awareness of how science and technology shape the natural, intellectual, and cultural environment, and the willingness to be involved and care about issues related to science (Niswatuzzahro, 2018). Scientific literacy also applies scientific knowledge to solve problems so that they have a high attitude and sensitivity towards themselves and their environment in making decisions based on scientific literacy considerations. (Yuliati: 2017). So it can be concluded that scientific literacy is knowledge that identifies a concept to gain new knowledge that aims to solve problems so that conclusions can be drawn based on facts.

Students' scientific literacy in Indonesia remains low. This statement is supported by the results of the PISA and TIMSS (Trends in International Mathematics and Science Study). The 2018 PISA results in Indonesia showed low scientific literacy, ranking 70th out of 78 countries with a score of 396, out of an international average of 489 (Pujana, 2022).

Students' low scientific literacy skills are influenced by many factors, including the curriculum, education system, method selection, facilities, and other factors. Observations at SDN 1 Cenggu revealed that literacy activities have not been optimally implemented. Several obstacles hinder their implementation, including a lack of books in each classroom, teachers not implementing 15 minutes of reading before starting lessons, teachers tending to use conventional learning methods, and a lack of teacher-created teaching materials.

This research is also in line with the research conducted by Siregar (2020) with the title "Scientific literacy through a scientific approach to elementary school science learning in the 21st century. MODELING". The results of the study show that scientific literacy through a scientific approach is guaranteed to be able to deliver students in the ability to have a scientific process, scientific attitude and be able to communicate a problem scientifically. Scientific literacy is also very much needed in elementary school science learning in the '21st century', considering that the Indonesian nation is currently 'lagging behind' in scientific and literacy aspects when compared to developed countries.

This is in line with research conducted by Muflikatun & Ismaya in 2021 entitled "Development of Microsoft Sway-based digital teaching materials to improve elementary school students' scientific literacy." The final result of this research is Microsoft Sway-based digital teaching materials in the form of links and a teaching material usage guidebook. Based on gain tests, normalization tests, homogeneity tests, hypothesis tests, student responses, and teacher interviews, the developed teaching materials are effective in improving elementary school students' scientific literacy.

And also supported by research conducted by Juniawan & Rengga in 2023. With the title "Literature study: analysis of science learning media to improve elementary school students' scientific literacy". The results of the research or study indicate that the accessibility of learning media is very important to improve scientific literacy, especially in elementary schools. Video Animation Media, ICT Media, Audio Visual Media, Linktree Media, Pop Up Books, Apollo and Comet Media, Air Fence Media, Learning Media Using Ispring Suite 9 Software, Digital Books, and Circuit Media Know Me are examples of high-level learning media that can improve scientific literacy.

To improve students' scientific literacy skills, it is necessary to implement an innovative and creative learning approach. In general, the scientific approach consists of many sequential steps, namely: observing, asking questions, collecting information, conducting experiments, processing data, and communicating results. The learning process using a scientific approach, including the 5Ms (observing, asking, trying, analyzing, and communicating), runs well. The application of a scientific approach in learning is supported by the opinion (Lazim in Rokhayati, 2022) that with a scientific approach, students understand the material using a scientific approach and learning is not merely a transfer of knowledge from teacher to student. Learning with a scientific approach brings direct experience to students so that learning is more meaningful for students. Therefore, researchers are interested in researching "Improving Elementary School Students' Scientific Literacy Skills Through the Scientific Inquiry Approach at SDN 1 Cenggu"

Formulation of the problem

Based on the background above, the problem formulation in this study is how to apply the Scientific Inquiry approach to improve students' scientific literacy skills at SDN Cenggu?

Research purposes

The purpose of this study is to determine the application of the Scientific Inquiry approach to improve students' scientific literacy skills at SDN Cenggu.

Benefits of research

This research is expected to provide the following benefits:

Theoretical Benefits: Contributing to the development of science related to the preparation and application of science learning materials through the Scientific Inquiry Approach.

Practical Benefits

For Students: Improve the learning experience by providing teaching materials that suit the needs and characteristics of each individual, thereby supporting understanding and motivation to learn.

For Teachers: Provide validated teaching resources to support diverse teaching strategies.

For Schools: Introducing innovations in learning tools that can improve the quality of education and mathematics learning outcomes.

For Researchers: To increase insight and experience in developing learning materials, and encourage further research in this field.

Method

This study used the classroom action research (CAR) method and sought to improve and refine educational practices at the classroom level by highlighting teachers' efforts to enhance students' scientific literacy skills (Rustiyarso, 2021). This study was conducted in the second semester of the 2024/2025 academic year. The primary objective of this study was to improve the scientific literacy skills in science learning of 24 fourth-grade students by implementing scientific literacy teaching materials.

This design follows the Kemmis and McTaggart model, as described by experts in the field. The implementation of this CAR method consists of two main cycles, depicted in a cycle chart, encompassing the planning, action, observation, and reflection stages. Each cycle is designed to improve and adjust learning practices based on observations from the previous cycle, thereby continuously increasing the effectiveness of the learning process.

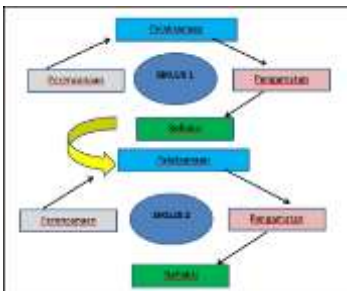


Figure 1. Stages of Classroom Action Research

This classroom action research is planned to consist of two cycles. The first cycle aims to identify problems and try initial solutions as well as to conduct a more comprehensive reflection on the success or shortcomings of the action. So the second cycle is to improve learning in the first cycle because PTK not only looks at the results but also the process. In implementing the action in each cycle includes the following stages: (1) planning, (2) implementation of the action, (3) observation and evaluation, (4) reflection. In detail, the classroom action research procedure is described as follows:

Cycle 1

Planning: At this stage, the researcher held discussions and reached agreements with the teachers on the material to be focused on in the research. The next step was to create a learning plan consisting of: Compiling the Merdeka curriculum teaching module, preparing the materials and preparing the observation sheets to be used, and creating instruments to collect data consisting of: observation sheets of teacher and student activities, questionnaires, and learning outcome test questions for each cycle.

Implementation of Action: Once the action planning stage has been completed, the next step is to implement the plan in class, guided by the previously prepared teaching module. At this stage, the teacher and researcher collaborate to implement the learning process in class. Observations are conducted during the learning process, so this stage runs concurrently with the implementation phase. The researcher acts as the teacher (implementation) with the assistance of a teacher as an observer. Observations are conducted throughout the learning process to observe teacher and student activities throughout the learning process.

Reflection is intended to comprehensively review the actions taken, or analyze observation and evaluation data to determine whether the activities have improved students' scientific literacy skills. If they haven't, then solutions and actions should be sought to improve elementary school students' scientific literacy skills.

Cycle II

Planning at this stage is to evaluate the results of cycle I, prepare new innovations in

learning, create teaching modules and prepare materials and prepare observation sheets to be used and create data collection instruments consisting of observation sheets for teacher and student activities, learning outcome tests for each cycle.

Implementation/Action At this stage, the researcher carried out the same actions as cycle 1 which aimed to see the improvement in students' scientific literacy skills.

During this observation stage, the researcher acts as the teacher (implementation), assisted by a teacher as observer. Observations are conducted throughout the learning process to observe teacher and student activities and assess improvements in students' scientific literacy skills.

Reflection, analyzing data from observations and evaluations, whether the activities carried out can improve students' scientific literacy skills.

The subjects of this research were 24 fourth grade students at SDN 1 Cenggu in the 2024/2025 academic year.consisting of 10 males and 14 females. Furthermore, the object of this study is to improve students' scientific literacy skills in science learning by using a scientific inquiry approach.

In accordance with the teaching module used in this study, the data collection techniques used were tests, questionnaires, and documentation. This study used quantitative and descriptive qualitative data analysis, namely:

Analysis of literacy skills results

Literacy ability is a student's mastery of the material, which is indicated by the test scores obtained by students to assess the learning completeness of each individual student and the completeness of each student's group. To determine the increase in student abilities, it can be seen from the test results in the Cognitive domain of the Science subject which has reached the Minimum Completeness Criteria (KKM) which is ≥ 70 by calculating the percentage of learning completeness with the formula:

$$P = \frac{siwa\ yang\ tuntas}{siswa\ keseluruhan} x\ 100$$

Information :

P = Percentage of completion

Activity analysis

This analysis was conducted using an assessment questionnaire, which aims to observe the learning process in the classroom. To determine the learning process's activities, observation sheets for student learning activities and teacher teaching activity sheets can be used.

Results and Discussion

The results of this study are presented based on two cycles conducted to improve students' scientific literacy through the Scientific Inquiry approach. Each cycle consists of planning, implementation, observation, and reflection.

Cycle 1 Research Results

In the first cycle, Scientific Inquiry was implemented as the learning approach. Observations during the learning process showed that students were beginning to show interest in learning through the Scientific Inquiry approach, but they still encountered obstacles in understanding some of the material, particularly in analyzing and applying science learning to problem-solving.

Table 1. Results of Students' Scientific Literacy Skills

NO	ACHIEVEMENT	RESULTS
1.	Average value	55.8
2.	The highest score	80
3.	Lowest Value	30
4.	Total Completed	10
5.	Incomplete Amount	14
6.	Completed Percentage	41.6%
7.	Incomplete Presentation	58.4%

In the data of science literacy ability in cycle 1, it shows that students achieved an average score of 55.8% with the highest score of 80 and the lowest score of 30. The number of students who did not complete the science lesson reached 14 people and who had achieved learning completion was 10 people with a minimum standard of science literacy score of 70. In the percentage of learning completion reached 41.6%, while incompleteness reached 58.4%. In this cycle I, students have not achieved maximum completion because students have not fully understood the material taught and improvements are needed in the next learning design. However, in the activeness of the Scientific Inquiry approach it is in accordance with observations, it appears that students are actively involved and enthusiastic in learning even though their science literacy abilities are not yet optimal.

Research Results Cycle 2

In the second cycle, the learning strategy was improved by adding more case examples, increasing student engagement through interactive discussions, and providing small project-based assignments that encouraged them to apply the material directly. Table 1.2 Results of Students' Cognitive Abilities

NO	ACHIEVEMENT	RESULTS
1.	Average value	87.7
2	The highest score	100
3.	Lowest Value	65
4.	Total Completed	20
5.	Incomplete Amount	4
6.	Completed Percentage	83.4%
7.	Incomplete Presentation	16.6%

The results of science literacy skills in cycle II showed that the average score of students had increased, namely from 55.8 in cycle I to 87.7 in cycle II. The number of students who had completed the science lessons was 20 people and 4 people who did not complete them. So in percentage, it shows that 83.4% achieved completion and 16.6% of the percentage of incompleteness. So, the science literacy skills of science through the Scientific Inquiry approach showed a significant increase.

Comparative Data of Cycle 1 and Cycle 2

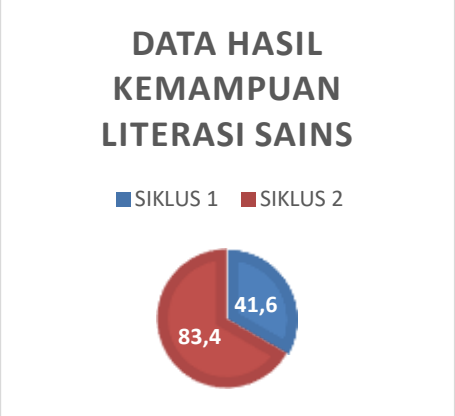
To provide a clearer picture of the effectiveness of implementing the Scientific Inquiry approach in learning, the following is a comparison of the results of students' scientific literacy abilities between cycle 1 and cycle 2.

Table 3.3 Comparison Results of Cycle 1 and Cycle 2

NO	ACHIEVEMENT	Cycle 1	Cycle 2
1.	Average value	55.8	87.7
2	The highest score	80	100
3.	Lowest Value	30	65
4.	Total Completed	10	20
5.	Incomplete Amount	14	4
6.	Completed Percentage	41.6%	83.4%
7.	Incomplete Presentation	58.4%	16.6%

To better visualize these results, a pie chart will be presented that illustrates the increase in students' scientific literacy skills from cycle 1 to cycle 2.

Pie chart of student ability results



The diagram shows a comparison of scientific literacy skills in cycle 1 and cycle II, showing a significant increase in the percentage of student completion in the science learning process through the Scientific Inquiry approach.

Discussion

The results of the study indicate that the use of the Scientific Inquiry approach has a positive impact on improving students'

scientific literacy skills in science learning. Based on the results of the ability test in the first cycle, the average student score reached 55.8 with a completion percentage of 41.6%. This increase is quite significant compared to the initial conditions before the implementation of the Scientific Inquiry approach. However, in the first cycle, several obstacles were still found, such as a lack of student involvement in exploration. After improvements to the learning strategy in the second cycle, the average student score increased to 87.7 with a completion percentage reaching 83.4%. This increase indicates that optimizing the Scientific Inquiry approach, such as project-based assignments and discussion forums, contributes to improving students' scientific literacy skills.

Based on the results of this study, it can be concluded that implementing the Scientific Inquiry approach is an effective strategy for improving students' scientific literacy skills in science learning. This success is due to the combination of engaging and interactive material presentation. Therefore, this approach can serve as a model for other schools wishing to adopt Scientific Inquiry in their learning processes.

Conclusion

This classroom action research shows that there is an increase in students' scientific literacy skills which is seen in cycle I and cycle II in the fourth grade science lessons at SDN 1 Cenggu. The results of the data analysis obtained are that in cycle I the number of students who completed was 10 people and those who did not complete were 14 people with a percentage of completion of 41.6% and incompleteness of 58.4%. In addition, in cycle II there was an increase with data on the number of students who completed were 20 people and those who did not complete were 4 people with a percentage of completion reaching 83.6% and incompleteness of 16.4%. Thus, it can be concluded that the use of scientific literacy teaching materials can improve students' scientific literacy skills in science learning in fourth grade at SDN 1 Cenggu.

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