Effectiveness A Science Textbook Based on Local Wisdom of Grenden Village to Improve the Science Literacy of Junior High School Students

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Abstract

Science learning aims to deepen students' understanding of scientific concepts and equip them with the necessary scientific literacy skills for everyday life. However, the 2022 PISA survey results show that Indonesian students' science literacy is still low. This study aims to assess the effectiveness of a science textbook based on the local potential of Grenden Village to improve the science literacy of junior high school students. The research method used is the ADDIE development model, which includes analysis, design, development, implementation, and evaluation. The research subjects were seventh-grade students at Junior High School 1 Puger. The research data consisted of effectiveness sheets, interviews, and documentation. The results showed that the developed textbook obtained effectiveness with an N-gain score of 0.58. The student response questionnaire obtained an average score of 82%. This study concludes that the developed textbook is valid, practical, and effective in improving the science literacy of junior high school students. The developed science textbook can be utilized to the fullest by students, teachers, and schools to effectively improve the science literacy of junior high school students, while further research can enhance the textbook by incorporating additional varied exercises and student activities tailored to their needs.

How to Cite

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INTRODUCTION

Science studies natural phenomena that include living beings and inanimate objects in life (Wahyuni et al.,2021). The rapid development of science in the 21st century forces students to adapt and keep up with these trends (Rusdianto et al., 2023). Science learning aims to deepen the understanding of concepts, not only deepening the understanding of science concepts but also equipping students with the literacy skills needed to understand and analyze information in the context of daily life (Handayani et al., 2023).

Science literacy etymologically consists of two words: 'literacy,' which means the ability to read and write, and 'science,' which means knowledge. Science literacy is the ability to use scientific knowledge to recognize questions and draw conclusions to understand nature and the transformations caused by human actions. Science literacy enables students to understand natural phenomena and everyday life better and fosters their curiosity and ability to explore complex questions (Abdi et al., 2023).

The PISA 2022 survey shows that the average science literacy score of Indonesian students is 371 points, 118 points below the global average (489 points), ranking 70th out of 79 countries. Based on research by (Mabsutah et al., 2021) The science literacy of students at Senior High School Ibrahimy 3 Sukorejo is categorized as low, due to the science teaching materials that are not engaging enough to encourage students to read. Many students may be less interested in science because it is perceived as difficult or irrelevant to their daily lives (Tabun, 2024). The low level of science literacy is also caused by the absence of textbooks that include components of science literacy, resulting in difficulties in understanding the material (Humairah et al., 2024).

The success of Natural Science learning is influenced by the availability of teaching materials (Ansya & Salsabilla, 2024). One type of teaching material that can be used is textbooks. Textbooks that are created innovatively and creatively will attract students' interest in reading, which will later help foster a culture of science literacy within them (Wisudawati & Sulistyowati, 2022). With literacy, students will be helped to think critically and not react impulsively. Literacy teaches students to read carefully and analyze information in depth. By understanding the context, background, and sources of information, students can evaluate the accuracy and relevance of what they read (Prihatin, 2023).

The low culture of literacy and the lack of innovative teaching materials are problems that need to be addressed. There is a need for the development of innovative, creative, and relevant textbooks that relate to students' daily lives (Jasrial et al., 2023). There is a need for locally-based textbooks to enhance students' conceptual understanding, particularly in Natural Science learning that is grounded in science literacy and aligned with their comprehension needs (Aria & Silaban, 2024). Quality, illustrated textbooks can make the material more engaging and support Natural Science learning that develops students' knowledge, skills, and scientific attitudes. Therefore, the researcher is developing textbooks to enhance science literacy among junior high school students (Nissa et al., 2023).

Jember Regency has local potential that can be developed into science teaching materials, especially in Puger District, Grenden Village. According to the Jember Regency BPS (Central Statistics Agency), there are around 300-400 hectares of agricultural land, with the main commodity being corn. The average corn production can reach 4-6 tons per hectare, depending on the season and cultivation techniques. Utilizing this potential can enhance the application of learning and student engagement in the educational process. Agricultural products in Grenden Village, such as corn, can serve as a real example in relevant science learning. One of these local potentials is the corn silk tea product (Siqhny et al., 2020). As is known, corn silk tea has advantages from a herbal perspective. This product has been shown to contain components such as flavonoids, phenols, and other phenolic compounds that function as antioxidants beneficial for health (Andari et al., 2024).

Corn silk tea is one of the local potentials that can be utilized in Natural Science learning at junior high schools, particularly in the topics of Ecology and Biodiversity in Indonesia (Andila et al., 2023). In Natural Science learning at junior high schools, particularly in the topics of Ecology and Biodiversity in Indonesia, corn silk tea can be used as a material to study the diversity of living organisms, especially plants. By utilizing corn silk tea in Natural Science learning on biodiversity, students can gain a more concrete and relevant understanding of plant diversity and develop awareness of the potential utilization of local natural resources in their environment.

Although there has been much research on science literacy and the development of teaching materials, there remains a gap in the application of relevant local contexts in Natural Science learning in Indonesia (Putri et al., 2023). Most of the

existing textbooks do not pay attention to local potential and do not connect the material with students' daily experiences. This research addresses that gap by developing a Natural Science textbook based on the local potential of Grenden Village, which is expected to encourage students' reading interest and understanding of science concepts (Anggraena et al., 2022).

The novelty of this research lies in the use of teaching materials that are not only innovative but also relevant to students' lives and local wisdom (Fitriani et al., 2024). By utilizing local products such as corn silk tea as learning materials, students are expected to more easily understand ecological concepts and biodiversity (Wahditiya et al., 2024). The urgency of this research is also very high, considering the low levels of science literacy among students, which can impact their ability to face challenges in today's information era. The development of creative textbooks based on local potential is expected to enhance science literacy and the quality of education at the junior high school level (Budianti et al., 2024).

The purpose of the study was to determine the effectiveness of a science textbook based on the local potential of Grenden Village in improving the science literacy of junior high school students. This research aims to create learning materials that are more relevant and engaging for students. Thus, it is hoped that students can better understand science concepts through contexts that are familiar and close to their lives. This development is expected to encourage teachers' creativity in applying innovative teaching methods (Febriansyah et al., 2023).

METHOD

Research Design

This study utilizes a quantitative research method to evaluate the effectiveness of a science textbook based on the local wisdom of Grenden Village in enhancing the science literacy of junior high school students. Data will be collected through surveys and standardized tests to assess students' pre- and post-intervention literacy levels

Research Subjects

The subjects of this study are the 31 students of class VII D at State Junior High School 1 Puger, who will use the locally-based textbook from Grenden Village to enhance their science literacy.

Data Analysis Methods

The effectiveness analysis of the locally-based textbook from Grenden Village to enhance science literacy among junior high school students is divided into two parts, namely:

Analysis of Student Responses

The analysis of student responses can be calculated using the formula below:

$$RS = \frac{A}{B} \ x \ 100\%$$

Explanation:
RS   = Student response
A   = Total score obtained
B   = Total maximum score

The criteria for student responses can be seen in Table 1.

Table 1. Student Response Criteria

Score (%)	Criteria
86-100	Very Good
66-85	Good
46-65	Fairly Good
25-45	Not Good

(Novanda et al., 2024)

The development of the locally-based Natural Science textbook from Grenden Village to enhance science literacy among junior high school students can be considered good if it falls within the student response criteria category of 66%-85%.

Analysis of Science Literacy

The analysis of science literacy can be calculated using the formula below.

$$<\text{N-gain}> = \frac{Spost - Spre}{Smax - Spre}$$

Explanation:
<N-gain>   = Improvement of Science Literacy Values
S_{pre} = Pre-test Score
S_{post} = Post-test Score
S_{max} = Maximum Score

The level of science literacy skills can be seen in Table 2.

Table 2. Level of Science Literacy Ability

Score	Criteria
$0.7 \leq g \leq 1$	High
$0.3 \ g \ 0.7$	Medium
$0 < g \ 0.3$	Low

(Amalia et al., 2022)

The development of the Natural Science textbook based on the local potential of Grenden

Village to enhance science literacy among junior high school students can be considered effective if there is an improvement in students' science literacy, indicated by an N-gain score of $0.3 \leq g < 0.7$, which falls within the moderate criteria.

RESULT AND DISCUSSION

The effectiveness of the textbook is assessed through pretests and posttests. The results of both tests will be calculated using N-gain to evaluate the improvement in each student's science literacy. This method allows for an assessment of how effective the textbook is in enhancing students' science literacy before and after the learning process (Limiansih et al., 2024). The assessment results from the pretest and posttest will be analyzed according to the established assessment rubric. The aim of this analysis is to determine the extent of improvement in students' science literacy after using the local potential-based textbook from Grenden Village (Suhayati & Watini, 2024). The pretest and posttest scores can be seen in the Table 7.

Table 7. Results of Pre-test and Post-test

Component	Grade VII D		N-gain	Category
	Pretest	Posttest		
Number of Student	32		0.58	Medium
Lowest Score	0	32		
Highest Score	77	95		

Based on the pretest and posttest scores, an analysis can be made regarding the improvement in science literacy among grade VII D students after using the local potential-based Natural Science textbook from Grenden Village, with N-gain 0.58, which is categorized as moderate.

Table 3. N-gain Science Literacy Indicator

Science Literacy Indicator	Question Number	Activities	Mean	N-gain	Category
Knowledge	1	Pre-test	8	0.57	Medium
		Post test	18		
Competencies	2	Pre-test	9	0.42	Medium
		Post test	14		
Context	3	Pre-test	9	0.45	Medium
		Post test	16		
Attitude	4	Pre-test	5	0.75	High
		Post test	24		

Based on the student response questionnaire, the use of the local potential-based Natural Science textbook from Grenden Village received a very positive response from grade VII D students (Table 9). The questionnaire results yielded an average score of 82%, categorized as 'Very Good.' This result demonstrates that the local potential-based Natural Science textbook from Grenden Village is well accepted by students and is scored as practical and suitable for use. The use of this textbook has proven effective in enhancing the science literacy of grade VII students at Junior High School, as indicated by the pretest and posttest analysis showing significant improvement. The science literacy test encompasses knowledge, science processes, the context of science applications, and attitudes, with results showing the effectiveness of the textbook across all these indicators (Pratama et al., 2024).

Table 9. Student Response Questionnaire

Assessment Indicator	Percentage	Category
Interest	81	Very Good
Learning motivation	84	Very Good
Satisfaction	80	Good
Average Score	82	Very Good

This book is designed according to students' needs and integrates local material, facilitating understanding through real-life experiences. It is also equipped with tasks and activities that encourage active interaction, creating a diverse learning experience that enhances student engagement in the learning process. Student responses through tests and questionnaires indicate their satisfaction with this textbook due to its engaging and easy-to-understand presentation methods.
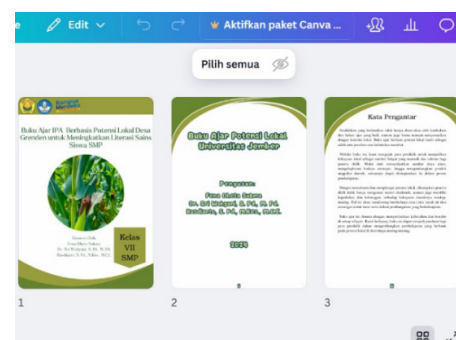

Figure 1. Science textbook based on the local potential of Grenden Village

The analysis conducted shows that the N-gain scores from the pretest and posttest have increased. This aligns with the statement by Fata-

hillah & Amorie (2022) that selecting appropriate textbooks is expected to enhance students' science understanding, which can subsequently improve their science literacy. To choose quality textbooks, an analysis considering various aspects related to science literacy, such as content, processes, and context, is necessary. Students develop their knowledge through direct experiences and social interactions (Kustiarini et al., 2024).

According to Masithah et al. (2022), students build their knowledge through direct experiences and social interactions. The effectiveness of a textbook can be assessed through various interconnected aspects. One of these is the improvement in student understanding, which can be measured through the results of pretests and posttests after using the book. Active student engagement in learning enhances material comprehension, while feedback from students and teachers regarding the ease, appeal, and relevance of the material indicates how well the textbook is received. Additionally, ease of access and use of the textbook in the context of daily learning, as well as the relevance of the material to local student needs, are crucial (Purwati & Erawati, 2021).

The results from the N-gain table of science literacy indicators show a significant increase in student scores from pretest to posttest across all indicators of science literacy. This indicates progress in students' understanding and mastery of science literacy after using the developed textbook. For instance, for the indicator "Knowledge," the average score increased from 7.94 in the pretest to 17.63 in the posttest. Similarly, other indicators, such as "Science Processes" and "Context of Science Applications," also showed substantial increases. Even for the indicator "Attitudes," the posttest scores nearly reached 24, much higher than their pretest scores. Overall, this data indicates that the developed textbook is effective in improving students' science literacy across various measured aspects. This statement underscores the challenges faced by learners in Indonesia, namely the tendency to memorize material without relating it to everyday life (Marwah & Pertiwi, 2024).

The results from the N-gain table of science literacy indicators show a significant improvement in student scores from the pretest to the posttest across all science literacy indicators. This indicates progress in students' understanding and mastery of science literacy after using the developed textbook. For instance, in the "Knowledge" indicator, the average student score increased from 7.94 in the pretest to 17.63 in the posttest.

Similarly, other indicators, such as "Science Processes" and "Science Application Context," also demonstrated substantial increases. Notably, for the "Attitudes" indicator, the posttest scores approached 24, significantly higher than their pretest scores. Overall, this data suggests that the developed textbook is effective in enhancing students' science literacy across various measured aspects (Laksono and Wibowo, 2022).

The improvement in student scores from pretest to posttest may be attributed to several factors, one of which is the teaching method employed. If the textbook is designed to encourage active student participation, they are likely to understand the material more easily. For example, activities involving discussions or experiments can make learning feel more tangible and engaging. Additionally, if the content of the textbook is relevant to students' daily lives, they are more likely to be interested in learning. When students feel that the material taught relates to their experiences, they tend to be more motivated and find it easier to grasp scientific concepts (Laksono and Wibowo, 2022).

The statement underscores the challenges faced by students in Indonesia, particularly the tendency to memorize material without relating it to everyday life. According to Laksono and Wibowo (2022), this leads to difficulties for students in applying their knowledge in real-world situations. Additionally, the low ability of students to solve environmental problems highlights the importance of critical thinking and problem-solving skills, which are essential to master in this century. These skills not only assist students in their studies but also in facing challenges in the real world. Therefore, there is a need for more interactive and relevant learning approaches to enhance students' ability to connect lessons with their daily experiences.

The improvement in the knowledge indicator from the pretest to the posttest is attributed to a better understanding of biotic and abiotic environmental concepts after using supportive teaching materials. Students have become more adept at identifying relevant examples, such as plants and animals. However, they still face challenges in distinguishing between biotic and abiotic factors, finding appropriate examples, and relating environmental factors like water availability and sunlight to plant growth. An interactive and relevant learning approach is expected to help students overcome these challenges (Octaviani et al., 2021).

The improvement in the science process competencies indicator from pretest to posttest

occurred because students became more skilled at observing and analyzing interactions among ecosystem components after using a textbook focused on the scientific method. However, students still face difficulties in explaining the complex interactions between various ecosystem components. Even though they are trained in observation, explaining the relationship between maize plants and environmental factors requires a deep understanding of the interconnected concepts (Octaviani et al., 2021).

The improvement in the science application context indicator from pretest to posttest shows that students are better able to connect their science knowledge with their everyday environment. This is likely due to the use of relevant textbooks that encourage students to see the relationships between the subject matter and the phenomena around them. However, students still face some difficulties, such as identifying endemic species and understanding the importance of biodiversity. They may be less familiar with the species present in their environment or may not fully comprehend the impacts of biodiversity loss (Octaviani et al., 2021).

Students find it easier to answer questions related to the attitudes indicator because the material taught is relevant to daily life, such as the health benefits of corn silk. Methods that encourage students to design the preparation of corn silk tea while considering ecosystem balance help develop their critical and creative thinking skills. The sense of responsibility toward the environment that is fostered also boosts students' confidence and commitment, making them feel more capable of completing tasks. This positive attitude improvement is evident in the comparison of pretest and posttest scores, which show progress (Octaviani et al., 2021).

The science textbook based on the local potential of Grenden Village can enhance the science literacy of junior high school students by connecting the subject matter with real-world contexts that are relevant to them. By utilizing natural resources, such as making tea from corn silk, students can better understand scientific concepts through direct experience. As noted by Nurmalasari et al. (2024), learning is more effective when students are actively engaged in the learning process and relate new knowledge to their experiences and contexts. By leveraging local potential, this textbook not only improves science understanding but also builds environmental awareness (Nurmalasari et al., 2024).

Based on the results of the student response survey, 81% of students expressed interest in the content and presentation of the textbook. Furthermore, 84% of students felt motivated to study the material presented, indicating a high level of motivation. In terms of satisfaction, 80% of students were pleased with the use of this textbook. Overall, students rated the textbook positively, with an average score of 82%. The high percentages across all aspects indicate a positive response from students toward the science textbook based on the local potential of Grenden Village. This suggests that the textbook is effective in attracting interest, motivating students, and providing satisfaction in the learning process.

Students responded positively to the science textbook because the material is relevant to everyday life and drawn from local potential, making learning more applicable and engaging. This enhances student involvement and motivation. Additionally, the interactive textbook includes practical activities, such as experiments and observations, which make learning more enjoyable and enable students to learn actively, boosting their confidence in the learning process. Sadiyyah & Samsudin (2023) state that practice and observation increase student interest because they can directly experience and apply scientific concepts in real-world contexts, making learning more engaging and relevant.

In the development of the science textbook, researchers faced challenges in providing tools and materials for practical activities, aligning the content with the curriculum, and ensuring accessibility of the material for all students. To address these challenges, researchers can collaborate with educational institutions and local communities to obtain support for practical tools and to develop relevant materials that meet students' needs.

CONCLUSION

The conclusion of this research indicates that the science textbook, which is based on the local potential of Grenden Village, is highly effective in improving the science literacy of junior high school students. Additionally, the textbook demonstrated effectiveness with an N-gain score of 0.58, which is considered moderate, and student responses were very positive, scoring 82%. Therefore, this textbook is deemed suitable for use in science education at junior high schools. This can be used as a supplementary resource for teaching natural science in schools to enhance students' science literacy. Students are expected to actively engage in learning by relating the material to local potential. Textbooks based on local potential are hoped to serve as additional referen-

ces for teachers to create contextual learning, and can be used to improve science literacy among junior high school students.

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