Effectiveness of an Ecosystem E-Booklet Containing Local Wisdom of Lake Rawa Pening to Improve Students' Understanding of Environmental Care Concepts and Character

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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

Semarang Regency, Central Java Province has one of the largest lakes which is a natural resource and is a mainstay in several fields. With the existence of natural resources in the form of Rawa Pening Lake, it is widely used and utilized by the surrounding community, one of which is in the world of education. Basically, media is an unavoidable reality as well as a tool to achieve learning goals in the educational process. In an effort to meet the required learning objectives, teachers can at least utilize affordable and effective instruments (Amzaludin et al., 2023). Electronic media has a major impact on many areas of life, including education. Examples of electronic media include the internet, mobile phones, videos, and E-Booklets. The use of electronic media in the classroom has grown rapidly as a result of technical developments to increase the efficiency of the teaching and learning process (Afrida et al., 2023).

E-Booklet is a media used to convey material in the form of a summary equipped with attractive images. This E-Booklet is designed using a special application to produce learning media that can attract students' interest in using it (Hendrianti et al., 2021). E-Booklets have a number of benefits, including: 1) content that is easy to understand and digest; 2) interesting and informative content that can inspire students to read the booklet; 3) lots of text illustrations to break up the boredom of the content; and 4) compact size so that the booklet is easy to carry (Yusuf et al., 2023)

Local wisdom is one of the valuable assets owned by the Indonesian nation. One of the local wisdoms in Rawa Pening Lake is the swamp cleaning activity, which is very appropriate and has a major impact on the ecosystem in Rawa Pening Lake. The use of booklets is one of the learning media needed in the implementation of the teaching and learning process that combines local wisdom (Maulina & Razak, 2024). The purpose of utilizing the surrounding environment is to make learning interesting and improve student understanding through completing learning tasks (Nurhasanah et al., 2022). In addition, to help students build character and introduce local culture, both teachers and students can benefit from using local wisdom as a learning tool. so that they learn about civilizations that they have never learned before.

Conceptual understanding is an important component in learning because it allows students to develop their skills in all subject areas.

The terms "understanding" and "concept" form conceptual understanding. The process of understanding a particular concept or meaning and having the capacity to apply it in different contexts is known as understanding. (Siahaan & Sihotang, 2023). Character is characterized as a person's morality and personality that develops from the internalization of various values that form the basis of perspectives in acting, thinking, and behaving (Mudaningrat et al., 2023).

In junior high school/MTs, the science subject that often causes misconceptions in students is ecosystem material. This is in accordance with Rogers' research (2021) which shows that some children have misunderstandings about the concept of ecosystems at the junior high school level. According to data on students' general understanding of the idea of ecosystems, students who do not understand the concept are the students with the lowest number (23%). The percentage of students who have the largest misunderstanding is 45%, while 32% of students understand the concept.

Trianggono's research (2017) Seven indicators of conceptual understanding including Interpreting, Exemplifying, Classifying, Summarizing, Inferring, Comparing, Explaining are listed in the updated Bloom's taxonomy. Interpretation Ability is the ability to interpret where it is able to change information from one form to another. Ability to Give Examples or can be said the ability to demonstrate is the ability of students to provide examples of broad ideas or principles. Classification Ability is the ability to recognize that an item for example belongs to a certain category concept/principle. Summarizing Ability or the ability to summarize where the ability to summarize knowledge into one sentence that summarizes what is learned or abstracts a concept. The Ability to Conclude is the ability to abstract an idea or principle by identifying patterns in several examples and drawing conclusions from those patterns. The Ability to Compare is the ability to draw comparisons and contrasts between two or more things, events, concepts, issues, or circumstances. The Ability to Explain is the ability to develop and apply cause and effect models within a system.

Research by Nugroho et al. (2023) entitled "The Relationship between Understanding Environmental Character Values and Biology Learning Outcomes" found that the large amount of garbage seen everywhere is evidence that students are still not aware and do not care about the environment. One of them is that in the school environment there is still a lot of garbage scatte-

red around so that it affects biology learning outcomes. This is also in accordance with research by Marpaung et al., (2023) which explains that schools always maintain cleanliness as long as teachers invite students and give them examples. This is one component of school character development. Unfortunately, children still lack the awareness needed to keep the school tidy both inside and outside the classroom when they are not under the guidance and supervision of teachers. This can happen because of the influence of the environment outside the school.

Research by Tyas et al., (2022) states that students can be taught the following indicators of environmental: 1) preserving the environment; 2) cleaning hands after activities; 3) getting used to saving energy; 4) grouping waste by category; 5) organizing cleaning equipment. The relationship between the Ecosystem E-Booklet containing local wisdom and conceptual understanding. Basically, the E-Booklet that we developed is different from E-Booklets in general, because we utilize the potential or local wisdom that exists so that it will increase children's conceptual understanding related to ecosystem material. The relationship between the E-Booklet containing local wisdom and increasing the character of caring for the environment, namely by linking it to the learning material that is carried out, will foster students' caring character for the environment. This can happen because the existence of an ecosystem containing local wisdom is mutually sustainable and has an impact on the environment itself.

In another study conducted by Pamenang (2021), it was stated that based on the analysis of student questionnaires and interviews with biology subject teachers at SMA Adabiah 2 Padang, it showed that 90% of students stated that there was a lack of variation in learning media at SMA Adabiah 2 Padang, 100% of students wanted the development of electronic learning media in the form of E-Booklets, and 85% of students chose reproductive system material as material that was difficult to understand in learning. This also happened at SMP N 1 Banyubiru when we asked directly with the subject teachers so that the background to the development of E-Booklets containing local wisdom would be a very relevant object and novelty by utilizing local wisdom in the surrounding environment.

The urgency of this research focuses on improving students' understanding of the concept and character of caring for the environment. Based on the results of interviews and pre-tests, it still shows little results so that it is necessary to have the help of supporting media to improve the understanding of the concept and character of caring for the environment.

METHOD

This research is a development research or commonly called Research and Development R&D with analysis quantitative statistic to displays details of data collection and analysis to measure the effectiveness of E-Booklet in improving students' conceptual understanding and environmental care character. this research using experiment and control class. Data will be collected through standardized tests to assess students' pre and post-intervention conceptual understanding level. Environmental care character is measured by a questionnaire distributed to students.

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
81-100	Very Good
61-80	Good
41-60	Enough
21-40	Not Good
0-20	Very Not Good

The analysis of conceptual understanding can be calculated using the formula below.

$$\langle N\text{-gain}\rangle = \frac{S_{post} - S_{pre}}{S_{max} - S_{pre}}$$

Explanation:
$\langle N\text{-gain}\rangle$ = Improvement of conceptual understanding values
S_{pre} = Pre-test Score
S_{post} = Post-test Score
S_{max} = Maximum Score

RESULT AND DISCUSSION

This E-Booklet is divided into 5 main parts that make it effective in improving the understanding of the concept and character of caring for the environment, including the cover page showing and describing the local wisdom of Rawa

Pening Lake. Here are displayed the best photos of Rawa Pening Lake from various angles, so that people who first see it are amazed by the local wisdom that exists and are interested in reading and seeing the inside of the E-Booklet. The second characteristic is that there are instructions for use that are easy to understand and applicable. The instructions here are typed and made in such a simple way that they are easy for readers to understand, making it easier for readers to use them.

The third characteristic section contains CP and TP based on the independent curriculum. This is done to adjust the curriculum currently being implemented. CP in this E-Booklet is divided into 2 meetings where each meeting contains 3 CP. The next characteristic is a material diagram that is integrated with the local wisdom of Rawa Pening Lake, this is related to the geographical location, content or core material, form and appearance of the E-Booklet using the flipbooks application. The last characteristic is that there is exploration and assignment to develop an environmentally friendly character. What is different here is that with this assignment students are asked to visit and explore Rawa Pening Lake directly and then make a report.

Table 1. Differences between pretest and posttest in the experimental class and control class

Group	Class	Pretest	Treatment	Posttest
Experiment	VII A	46.93	X1	80.40
	VII B	44		87.87
Control	VII E	45.6	X2	77.33
	VII F	46.66		77.2

The difference in the results of the Pretest and Posttest between the experimental class and the control class in class VII A, VII B, VII E, and VII F is very visible, indicating a significant difference between the various classes. Based on the data, it shows that the average posttest score is higher than the pretest score, this is caused by several factors including the learning time, and students have not understood the basic material given by the teacher so that students work on questions with the limited knowledge they have had so far and are based on material that they still remember when they were in elementary school/MI.

To compare and strengthen the results that the effectiveness of the E-Booklet Ecosystem containing local wisdom of Rawa Pening Lake can improve conceptual understanding, here we compare it with the control class that only uses textbooks and LKS media used in daily learning and the results are indeed very significant differences. This statement is in accordance with the opinion of Amzaludin et al., (2023) who stated that media is an unavoidable reality as well as a tool to achieve learning goals in the educational process. Therefore, teachers must be able to utilize the resources provided by the school, and it is not impossible that these resources reflect the latest technological advances.

Therefore, the treatment of providing the E-Booklet Ecosystem Containing Local Wisdom of Rawa Pening Lake is considered very effective. There is a difference of 14.32% between the experimental class and the control class. Both classes obtained quite effective results, but with different averages, namely the experimental class outperformed the control class.

Table 2. Difference in N-gain in the experimental class and the control class

Class	Treatment	N-gain	N-gain (%)	Average (%)	Category
VII A	X1	0.64	63.95	71.55	Quite effective
VII B		0.79	79.15		
VII E	X2	0.57	57.18	57.23	Quite Effective
VII F		0.57	57.29		

The difference in the results of N-gain and N-gain scores in the experimental class and control class both in class VII A, VII B, VII E and VII F, where the difference in the results of N-gain and N-gain scores is very clearly visible, the difference is very significant from the various classes. Based on the results of the N-gain analysis in Table 2 in the experimental class, it can be seen that the N-gain value is 0.71 with the criteria of "moderate" and the N-gain score is 71.55 with the criteria of "quite effective" with this indicating that the E-Booklet Ecosystem containing the local wisdom of Lake Rawa Pening used by students is able to improve students' understanding of the concept. While for the control class, it can be seen that the N-gain value is 0.57 with the criteria of "moderate" and the N-gain score is 57.23 with the criteria of "quite effective". Although in the control class there was also an increase in N-gain and N-gain scores, the results were still small, so there were still many N-gain and N-gain scores for the experimental class. It was proven that there was a difference in N-gain of 0.14 and a difference in N-gain score of 14.32.

The results of this difference are said to be quite large between the experimental class and the control class and provide additional evi-

dence that the E-Booklet Ecosystem containing local wisdom of Rawa Pening Lake can effectively improve students' conceptual understanding. This is in line with research by Rahma et al., (2022) who stated that one of the benefits of using electronic books or E-Booklets is that the content is presented with images to help students understand the information better. The use of E-Booklets also improves students' conceptual understanding because during the learning process, students can use their sense of sight to help them visualize. Using imagination can help you remember things better. E-Booklets have the advantage of being accessible via electronic devices such as computers and mobile phones, making them more practical to use and store.

So that the treatment of providing the E-Booklet Ecosystem containing local wisdom of Rawa Pening Lake is considered very effective to use. There is a difference of 14.32% between the experimental class and the control class. Both get quite effective results but with different averages, more experimental classes than control classes.

Table 3. Results of T-Test Between Experimental and Control Classes

No	Information	Group	
		E	C
1	Number of students	60	60
2	Pretest average	45.46	46.13
3	T-test results	0.00027	
4	Posttest average	84.13	77.26
5	T-test results	0.00055	

The t-test results obtained a result of $0.00055 \leq 0.05$, which indicates a very significant difference between the experimental class and the control class. High criteria indicate that E-Booklet is effective in improving students' conceptual understanding, especially in Ecosystem material.

Students' conceptual understanding skills need to be trained and accustomed to from an early age so that students are accustomed to the ideal conceptual understanding system that will affect student achievement/learning outcomes. The material in the E-Booklet is arranged by adjusting the local wisdom in the environment around the students so that students can easily understand the material presented in the E-Booklet so that they can easily understand the concept of Ecosystem material containing local wisdom which will become a provision of knowledge for them. This is in accordance with other research

by Kubota (2022) who explained that in order to help students build character and introduce local regional culture, educators and students can utilize the stages of making booklet media based on local wisdom as a learning tool. Students who use booklet media based on local wisdom may better understand cultures that they have never studied, both at home and abroad. outside the classroom due to lack of expertise and resources for it. With this, conceptual understanding will also emerge and be integrated based on existing local wisdom.

Based on the results of direct classroom observations, students have high enthusiasm in learning, indicated by students actively asking questions to both teachers and their peers, this shows that students have a high curiosity during learning using the E-Booklet Ecosystem containing local wisdom of Lake Rawa Pening. This is because the learning supplements used are quite interesting, increase students' curiosity, increase knowledge and insight because the E-Booklet Ecosystem containing local wisdom of Lake Rawa Pening includes various real descriptions of the Ecosystem in the environment around students.

The emergence of more enthusiastic and active student responses in learning is the result of the stimulus given by the teacher. This is in line with the behaviorist learning theory presented in the research of Jelita et al., (2023) who stated that human behavior is studied by behaviorist learning theory. According to the behavioral perspective, learning is a process that occurs as a result of stimuli that produce reactive behavioral interactions (responses) based on mechanical rules.

Meaningful learning activities will make it easier for students to gain new knowledge and insights. This is in line with the research of Maulina & Razak (2024) who stated that to foster noble qualities for future generations, local wisdom is needed. The use of booklets is one of the learning media needed in implementing learning that combines local wisdom. To help students build character and introduce local culture, both teachers and students can benefit from using local wisdom as a learning tool. so that they learn about civilizations they have never learned before.

class VII, consisting of 4 classes where 2 classes are experimental classes, namely class VII A and VII B, then control classes VII E and VII F. Furthermore, the data was analyzed to obtain the average value of the student assessment. Data on the environmental care character of students before and after using the E-Booklet Ecosystem containing Rawa Pening Lake can be seen in Table 4 and Table 5.

Table 4. Results of the Questionnaire on Environmental Care Character in the Experimental Class

	Pre	Average	%	Inf	Post	Average	%	Inf
VII A	3.60	36.80	61.33	Good	50.9	51.45	85.75	Very Good
VII B	37				52			

Table 5. Results of the Questionnaire on Environmental Care Character in the Control Class

	Pre	Average	%	Inf	Post	Average	%	Inf
VII E	36.9	36.78	61.30	Good	45.17	45.42	75.7	Good
VII F	36.67				45.67			

The environmental care character of students in the experimental class before using the E-Booklet achieved a percentage of 61.33% in the good category, while after using the E-Booklet, it reached a percentage of 85.75% in the very good category. The environmental care character of students in the control class before the learning process obtained a percentage of 61.30% in the sufficient category, while after the learning process using the LKS Book and the package book utilized in the learning, it achieved a percentage of 75.7% in the good category.

Based on the data obtained, it is known that the level of environmental care character of students in experimental class before using the E-Booklet was 61.33% with a good category. While in the control class before learning the results of the environmental care character questionnaire were obtained at 61.30% with a good category. This is because many students do not yet understand the importance of environmental care characters that need to be applied each of them.

In general, after using the Ecosystem E-Booklet containing the local wisdom of Rawa Pening Lake, the experimental class got an average increase of 85.75 with the criteria of "Very Good". While the control class got an average increase of 75.7% with the criteria of "Good". The difference in the results of the increase between the experimental class and the control class that was obtained and was very significant is evidence of the effectiveness of the E-Booklet. So in this case, the Ecosystem E-Booklet containing the local wisdom of Rawa Pening Lake is very effective in increasing awareness of environmental care characters for students, especially class VII students of SMP N 1 Banyubiru during science learning on Ecosystem material. This is in line with (Mudaningrat et al., 2023) which states that the quality of an environment is determined by the nature of its inhabitants. However, the quality of human existence itself will be influenced by how humans handle the environment.

CONCLUSION

Based on the results of the research and discussion, it can be conclude that the Ecosystem E-Booklet containing the local wisdom of Rawa Pening Lake consists of 5 characteristics including, a cover page that displays and describes the local wisdom of Rawa Pening Lake, there are instructions for use that are easy to understand and applicable, there are CP and TP based on the independent curriculum, material diagrams that are integrated with the local wisdom of Rawa Pening Lake and there is exploration and assignment to develop students' environmental care character. The E-Booklet is very effective in increasing conceptual understanding as seen from the n-gain value of 0.715 with high criteria with effective criteria. In addition, compared to the control class, the T test was used which got a result of $0.00055 \leq 0.05$. E-Booklet is effective towards environmental care character seen from the average percentage which shows an increase from before use getting results of 61.33% with a good category to 85.75% with a very good category. Compared to the control class getting results of 61.30% with a sufficient category to 75.7% with a good category, it is proven to be very significant different.

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