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Using Jambi Local Wisdom of Lubuk Larangan as Theme for Development of Science Teaching Materials to Improve Students' Environmental Literacy

Arizaldy, Sjaeful Anwar, Siti Sriyati

Departement of Science Education, Universitas Pendidikan Indonesia, Indonesia

Abstract: This research aims to produce teaching materials on the theme of *lubuk larangan* using 4S-TMD method to improve students' environmental literacy. The research method used was developmental Research, covering three stages, namely design, development, and evaluation. In the development stage, 4S-TMD method consists of selection, structuring, characterization, and didactic reduction. The instruments used are rubric for selection stage, rubric for structuring stage, rubric for characterization stage, rubric for didactic reduction, rubric for understanding and validation questionnaire for the feasibility of teaching materials. The results of the evaluation of the developed teaching material showed that it was self-instructional. It was easy to understand (85%). In terms of feasibility, the material was very feasible (88,88%). Student environmental literacy can be developed through the task at the end of the learning material in the form of assignments and questions posed on the teaching material which refers to the component of environmental literacy and the context of *lubuk larangan*.

Keywords: teaching material, local wisdom, environmental literacy, 4S-TMD.

Abstrak: Penelitian ini bertujuan untuk menghasilkan bahan ajar tema *lubuk larangan* menggunakan metode 4S TMD untuk meningkatkan literasi lingkungan siswa. Metode penelitian yang digunakan adalah *Developmental Research*, meliputi tiga tahap yaitu *design*, *development*, dan *evaluation*. Pada tahap *development* digunakan metode 4STMD yang terdiri dari tahap seleksi, strukturisasi, karakterisasi dan reduksi didaktik. Instrumen yang digunakan berupa rubrik tahap seleksi, rubrik tahap strujturisasi, rubrik tahap karakterisasi, rubrik reduksi didaktik, rubrik keterampilan dan angket validasi kelayakan bahan ajar. Hasil evaluasi terhadap bahan ajar yang dikembangkan menunjukkan bahwa bahan ajar bersifat *self instructional* dilihat dari keterampilan termasuk mudah dipahami (85%), selanjutnya dilihat dari kelayakan bahan ajar termasuk dalam kategori sangat layak (88,88%), pengembangan literasi lingkungan siswa mampu dikembangkan melalui tugas di akhir materi pembelajaran berupa tugas dan pertanyaan yang diajukan pada bahan ajar tersebut yang mengacu pada komponen literasi lingkungan serta konteks *lubuk larangan*.

Kata kunci: bahan ajar, kearifann lokal, literasi lingkungan, 4S TMD.

▪ INTRODUCTION

Since the beginning of the 21st century, we have been faced with the demands of the importance of quality human resources that can compete globally. Quality human resources are produced by quality education (Silva et al., 2020). Quality educational outcomes, on a micro basis, come from the quality main components in the teaching and learning process (teachers, students, and teaching materials). Learning is a process of gaining experience from the surrounding environment which refers to learning resources (Sund & Gericke, 2020). One good source of science learning is environmental observation as it can be studied contextually.

Teaching materials are one of the main components involved in the learning process which plays an important role in producing quality educational outcomes (Roure et al., 2018). The development of innovative teaching materials using local wisdom in learning is necessary so that these teaching materials meet the characteristics of students and can be used as a reference for schools. The development of teaching materials based on local wisdom is helpful for teachers and students in the learning process. The results of the analysis of science teaching materials in junior high schools today are not fully in accordance with the demands of the curriculum and scientific principles. Teaching materials published by the Ministry of Education and Culture in the form of teacher books and student books have not fully utilized the local potential of each region in Indonesia (Anwar et al., 2017).

Research on learning by promoting excellence and local wisdom shows that students' knowledge and attitudes are improved after studying science material related to their culture. In addition, the existed and developed textbooks in Indonesia still focus on the content dimension and rarely mention local wisdom (Nugraha & Binadja, 2013). The teaching materials rarely mention the regional potential to understand surrounding natural events or phenomena that can be presented in science learning as a means of learning and preserving local culture to the next generation (Anderson et al., 2001).

Another important thing related to the use of local wisdom in student teaching materials is that in integrated science learning, teachers are expected to be able to direct students to increase environmental literacy (Arizaldy et al., 2021). The teacher relates the science material being studied with phenomena in the environment and daily life so that students can have environmental literacy skills. Therefore, we should reconstruct the teaching materials with the *lubuk larangan* theme referring to the national curriculum, use international standard textbooks in drafting standard concepts, and develop environmental literacy through the integration of components based on the North American Association of Environmental Education (NAAEE) category (Sriyati et al., 2021). In addition, teaching materials are constructed through restructuring the presentation of teaching material and the use of didactic reduction to reduce the level of difficulty of each text that composes the teaching material.

In the preparation of teaching materials, several methods can be used, and this research used the Four Steps Teaching Material Development (4S-TMD) method developed by Sjaeful Anwar (Anwar, 2017). Each stage of this method has clear and detailed steps. The development of teaching materials of *lubuk larangan* is based on local wisdom values such as (1) respect, loving God's creatures, and being grateful, (2) harmony, (3) balance, (4) interaction, (5) environmental preservation, and (6) beauty. With this basis, it is hoped that students can understand the science material of *lubuk larangan* in everyday life comprehensively and increase their environmental literacy (Sari et al., 2020).

▪ METHOD

The research method used was the first type of developmental research proposed by Richey and Klein. This research procedure consists of three stages, namely design, development, and evaluation (Richey & Klein, 2005). The design stage began with a study of the current buffer solution teaching materials and preparing the design of the teaching materials to be developed.

In the development stage, 4S-TMD method was used to develop teaching material consisting of four steps, namely selection, structuring, characterization, and didactic reduction (Anwar, 2017). At the selection stage, learning indicators, concept labels, concept descriptions, and skills related to the buffer solution concept were developed. Then, concept maps, macrostructure, and multiple representations were developed in restructuring. Furthermore, the teaching material draft 1 was compiled and tested for its characteristics by students through the characterization stage. The last step was didactic reduction to reduce the level of difficulty of each text that is considered difficult for students.

The evaluation stage includes the feasibility test of teaching material in terms of content, presentation, language, graphics, and the environmental literacy base test developed. The feasibility test was carried out by 2 expert lecturers and 1 junior high school science teacher, as well as 45 students to test the level of understanding of the teaching material. The data collection technique used instruments in the form of a selection phase validation rubric, a structuring phase rubric, a characterization phase rubric, a didactic reduction rubric, a comprehension test rubric, and a feasibility test questionnaire that had been validated by experts before being used. Furthermore, the assessment instrument was revised according to the advice of the expert validator to produce an appropriate assessment tool. Then, the validation data is calculated using the formula:

$$\% X_{in} = \frac{\sum S}{S_{max}} \times 100\%$$

In which % Xin is the percentage of respondents' answers on the questionnaire, $\sum S$ is the number of answer scores, and S_{max} is the expected maximum score (Sudjana; 2005). Scoring on the results of filling out questionnaires for content suitability aspects used an assessment of four choices namely SS (strongly agree), ST (agree), KS (less disagree), and TS (disagree). Each choice has a different score. In SS = 4 statement, ST = 3, KS = 2 and TS = 1. In the construction aspect, use an assessment with "Yes" and "No" answer choices. Scores for statement "Yes" = 2 and "No" = 1. After knowing the answer score on the questionnaire, it calculates the average percentage of answers on each questionnaire using the formula of % Xi.

$$\% X_i = \frac{\sum \% X_{in}}{n}$$

In which, % Xi is the average percentage of answers to the statements on the questionnaire, $\sum \% X_{in}$ is the number of percentage answers to all statements on the questionnaire, and n is the number of statements on the questionnaire (Sudjana; 2005). The results of the calculation of each aspect are interpreted according to Arikunto based on "very low" to "very high" criteria. Then, it calculates the average percentage of content and construction aspects. The results of the calculation of the validity level of

performance assessment products are interpreted with criteria "valid/feasible" to "invalid/ inappropriate" (Arikunto, 2010). After being validated by experts, the next step is to conduct an initial field trial that aims to determine the teacher's response to the product being developed. Field trials were carried out at SMP Negeri 5 Rantau Pandan Kabupaten Muaro Bungo

▪ **RESULT AND DISCUSSION**

A. Development of Teaching Material

Selection Stage

The teaching material of *lubuk larangan* developed refers to several basic competencies (KD) for class VII, namely KD 3.3 (explaining the concept of mixtures and single substances (elements and compounds), physical and chemical properties, and physical and chemical changes in everyday life), KD 3.5 (analyzing the concept of energy, various energy sources, and changes in the form of energy in daily life including photosynthesis), KD 3.7 (analyzing the interactions between living things and their environment and population dynamics due to these interactions), and KD 3.8 (analyzing the occurrence of environmental pollution and its impact on ecosystems). At the selection stage, indicators, concept labels, concept descriptions, and values were developed related to *lubuk larangan*. The indicators developed must refer to the curriculum because teaching materials must be prepared under the applicable curriculum (Syamsuri et al., 2017). One of the indicators that have been developed and the labels of the concepts identified are shown in Table 1.

Table 1. Concept Indicators and Labels of Buffer Solution

Basic Competencies	Indicator	Concept label
Explaining the concept of mixtures and single substances (elements and compounds), physical and chemical properties, and physical and chemical changes in everyday life.	1. Explaining the basic concepts of mixtures and single substances	
	2. Distinguishing between physical and chemical properties of matter	1. Homogeneous Mix 2. Heterogeneous Mix
	3. Explaining the different types of physical and chemical changes	3. Compound 4. Element 5. Molecule
	4. Determining the elements and compounds that make up water	6. Atom 7. Chemical properties
	5. Explaining the role of elements and compounds that make up water for plants	8. Physical properties 9. Physical changes
	6. Writing down the chemical and physical properties of water	10. Chemical change 11. Plant
	7. Explaining the physical and chemical changes of water	

Table 1 shows 7 indicators developed from KD 3.3. on *lubuk larangan*. In this theme, a total of 30 indicators from 4 basic competencies were developed. Furthermore, the concept label was made to determine the core concepts of the material related to *lubuk larangan*. After the concept label was determined, a concept description was made. To guarantee the scientific truth of each concept, the description of the concept was taken from international standard textbooks that have been recognized as valid by

scientists (Anwar, 2017). A total of 11 textbooks were used as references in the development of this teaching material.

The material contains values related to environmental literacy. Environmental literacy is part of basic literacy that is needed so that everyone can understand and feel like part of the solution to environmental problems (Hasslöf et al., 2016). Environmental literacy that can be developed through this teaching material is influence, knowledge of ecology, socio-political knowledge, knowledge of environmental problems, cognitive skills, and environmentally responsible behavior. Environmental literacy is necessary to develop because it is useful for recognizing and solving problems related to the environment both in learning and in everyday life (Sari et al., 2020).

Structuring Stage

Structuring is compiling the structure and systematics of teaching materials where a set of materials is arranged in such a way so that the structure and systematics are following the theme (Anwar, 2017). The development of the structure of teaching materials can be done in three forms, namely concept maps, macrostructures, and multiple representations. Making concept maps aims to determine the relationship of one concept to another. Concept maps can help students develop knowledge and connect concepts in their minds to achieve better results (Asyhuri & Santosa, 2017; Saputro et al., 2019). The concept map created is shown in Figure 1.

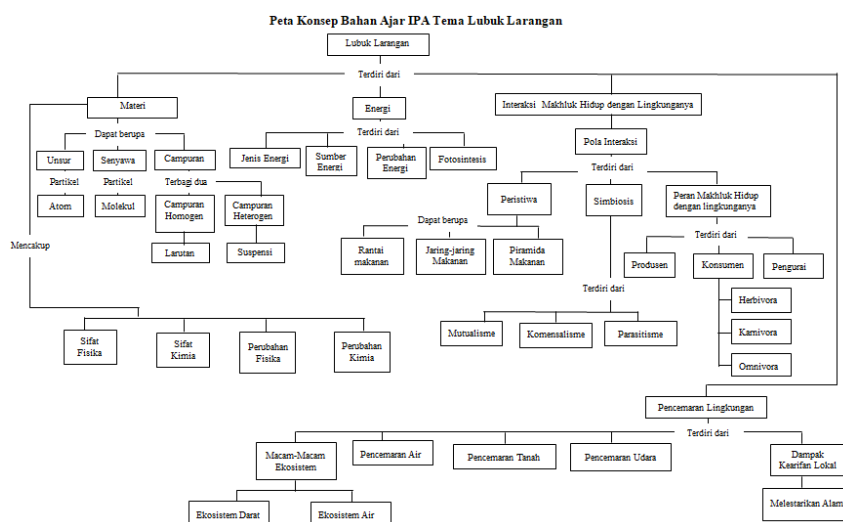


Figure 1. Concept Map of Lubuk Larangan Science Teaching Material

In addition to the concept map, a macrostructure was also made as a guide for the presentation of the concept of *lubuk larangan* teaching material. The macrostructure was used as a reference for writing the complete teaching material (Munawwarah et al., 2017; Redhana et al., 2021). Concepts related to *lubuk larangan* were mapped into two dimensions, namely vertical and horizontal. The vertical dimension in the form of a downward flow shows the macro concept while the horizontal dimension in the form of a path to the right shows the micro concept (subordinate). The macrostructure arranged is shown in Figure 2.

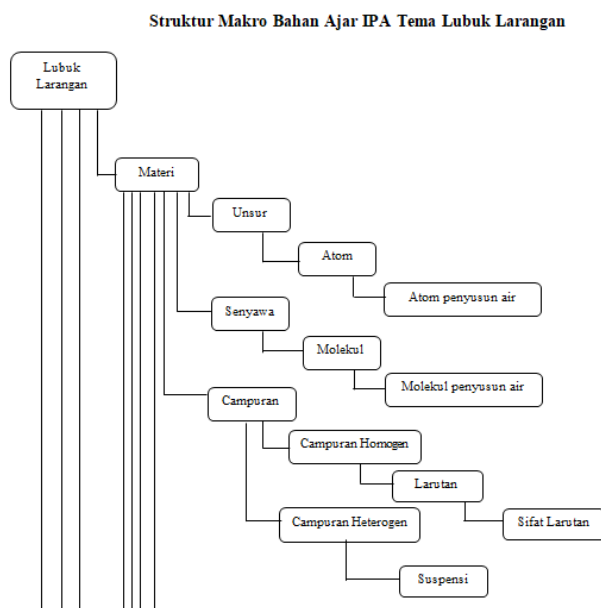


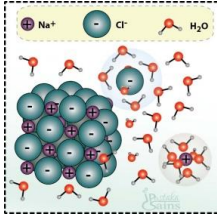


Figure 2. Macro Structure of *Lubuk Larangan* Science Teaching Material

Chemical representation has three levels, namely macroscopic, submicroscopic, and symbolic (Munawwarah et al., 2017). The macroscopic level is a phenomenon that can be observed directly; the submicroscopic level provides an explanation at the particulate level where the material described consists of atoms, molecules, and ions; the symbolic level involves the use of symbols, formulas, equations, pictures, and diagrams (Kamila et al., 2018; Yusria Izzatul Ulva, Santosa, 2014). The results of concept selection related to *lubuk larangan* from the textbooks are represented in these three levels. The macroscopic level is arranged based on everyday phenomena along *lubuk larangan* related to science learning. Table 2 shows an example of multiple representations. The teaching material was then compiled into draft 1.


Table 2. Multiple Representation of *Lubuk Larangan* Teaching Material

Concept Label	Multiple Representations		
	Macroscopic	Submicroscopic	Symbolic
Homogeneous mixture, solution	<p>In the purification process, the Local Water Supply Utility or the community often mixes several kinds of chemicals to purify river water such as adding alum as a coagulant in water and waste treatment as shown below.</p>  <p>Figure. Water Purification Process with Alum (Source: https://www.revapedia.com/)</p>	<p>Mixture is two or more pure substances that combine in arbitrary proportions. Mixtures consist of homogeneous and heterogeneous mixtures. A homogeneous mixture is also called a solution. Meanwhile, a heterogeneous mixture consists of colloids and suspensions.</p>  <p>Figure. a) Solution b) Colloid c) Suspension (Source: https://www.temukanpengertian.com)</p>	 <p>Figure Mixture of Sa (NaCl) with Water (H₂O) (Source: http://pustakasains.com)</p>

Characterization Stage

The characterization was carried out to find out the level of difficulty of a text of teaching material compiled in a draft of teaching material 1. At this stage, the instrument was developed, the draft was tested, and difficult concepts were identified. The development of the instrument was guided by the draft. The teaching material developed is divided into 68 main ideas. The characterization instrument is shown in Figure 3. The characterization instrument was tested on 45 students by filling in the main ideas and determining the difficulty level of the text.

1) Lubuk Larangan adalah salah satu kearifan lokal yang dikelola secara bersama- sama dan disepakati adanya aturan oleh pimpinan -pimpinan di suatu kenagarian meliputi Nimak Mamak pihak pemerintahan desa dan pihak organisasi pemuda Lubuk larangan sebuah lubuk yang dengan sengaja di larang, sedangkan yang disebut dengan lubuk adalah sebuah tempat yang mempunyai kedalaman kurang lebih dari 5 meter, lubuk tersebut sebagai tempat persembunyian dari ikan-ikan yang dilarang untuk diambil sebelum waktu yang sudah disepakati bersama oleh semua masyarakat yang ada dalam suatu kenagarian tersebut (Adnan Hasabtosia 2005).



Gambar. Lubuk larangan (Sumber: Dokumentasi Pribadi)

Bagaimanakah keterpahaman teks diatas?

Mudah Sulit

Ide Pokok diatas adalah . . .

Jawab :

Figure 3. Characterization Instrument

From the characterization stage, ten texts were in the difficult category, namely texts 13, 16, 17, 35, 42, 44, 48, 58, 63, and 66. These texts were then analyzed to determine whether they were classified as abstract, complex, or complicated. The results are shown in Table 3.

Table 3. Text Character Mapping

Text No.	Main Idea Answer (%)		Text Characters
	Correct	Incorrect	
13	66.67	33.33	Difficult
16	60	40	Difficult
17	66.67	33.33	Difficult
35	62.5	37.5	Difficult
42	68.75	31.25	Difficult
44	62.5	37.5	Difficult
48	50	50	Difficult
58	64.28	35.75	Difficult
63	57.14	42.86	Difficult
66	64.71	35.29	Difficult

Didactic Reduction Stage

This stage aims to reduce the level of difficulty in teaching materials to be more easily understood by students. At this stage, a didactic reduction was carried out on difficult texts contained in draft 1 based on the outlines obtained from the characterization stage. There were four texts to be reduced, namely texts 13,16, 17, 35, 42, 44, 48, 58, 63, and 66. Texts 13,16,63, and 66 were reduced using explanations in the form of images, text 17 was reduced using particularization, and texts 35, 42, 44, 48, and 58 were reduced using explanations in the form of symbols.

After being reduced, the teaching materials were arranged into draft 2. The teaching materials developed consist of five sub-chapters, namely (1) the definition of *lubuk larangan*, (2) material, (3) energy, (4) the interaction of living things with their environment, and (5) environmental pollution. *Lubuk larangan* teaching materials were developed based on environmental literacy so that, at the end of each sub-chapter, an exercise containing discourse related to *lubuk larangan* is presented, which refers to the components of environmental literacy. This task/exercise is presented at the end of each sub-chapter as an exercise and the end of the teaching materials as an evaluation. The tasks/exercises presented include observing, classifying, interpreting, communicating, proposing hypotheses, applying concepts, and using tools/materials/sources (Sriyati et al., 2021). Examples of phenomena presented in teaching materials can be seen in Figure 4. Additional information on *Tahukah Kamu* (Did You Know!) provides unique information about the local wisdom culture of *lubuk larangan* (Figure 5).

Ayo Kerjakan Latihan

Bacalah wacana berikut ini dan jawablah pertanyaan di bawahnya pada buku latihan :

Pembangunan Lubuk Larangan Di Kerinci Terus Meningkat

KBRN,Sungai Perahu: Antusias masyarakat Kabupaten Kerinci untuk melakukan budidaya ikan semah di lubuk larangan terus meningkat. Hal ini terbukti dengan adanya penambahan pemberstukan lubuk larangan di desa Betang Kuning Kecamatan Sitingau Laut yang dikelola langsung oleh Pemerintah Desa dan Lembaga Adat desa setempat.

Kepala Dinas Ketahanan Pangan dan Perikanan Kabupaten Kerinci Tito Rivano mengatakan, penambahan lubuk larangan ini, disamping sebagai upaya dalam meningkatkan produksi ikan di Kabupaten Kerinci, juga menunjukkan bahwa masyarakat memiliki komitmen yang tinggi untuk ikut serta menjaga lingkungan dari berbagai hal yang dapat merusak ekosistem alam.

"Keberadaan lubuk larangan ini bisa menjaga ekosistem lingkungan, diantaranya menghindari masyarakat membuang sampah sembarangan, menjaga dari ulah orang yang akan melakukan peracunan dan lain sebagainya," jelasnya.

Sebagai bentuk dukungan pemerintah dalam pengembangan budidaya ikan semah di lubuk larangan, Menurut Tito dalam waktu dekat akan dilakukan restocking sebanyak 10.000 benih ikan yang merupakan bantuan dari Dinas Kelautan dan Perikanan Provinsi Jambi.

" Alhamdulillah, kemarin sudah dilakukan restocking secara simbolis dilubuk larangan yang baru saja di rekonstruksi, dan nanti ada restocking besar-besaran yang merupakan bantuan dari DPKP Provinsi," tambahnya.

Diketahui sejauh ini jumlah lubuk larangan yang dikelola oleh masyarakat Kabupaten Kerinci, sebanyak 27 lubuk larangan yang tersebar di 18 kecamatan.

(Sumber: <https://jri.co.id/jambi/desaah/>)

1. Berdasarkan peristiwa dalam berita di atas, bagaimanakah dampak lubuk larangan terhadap kehidupan alam dan sosial ? (Subkomponen afektif tentang sikap terhadap lingkungan)
2. Berikanlah pendapat kalian mengenai kerjasama antara masyarakat desa Betang Kuning dan pemerintah dalam pengelolaan lubuk larangan? (Subkomponen afektif tentang penghargaan dan kepekaan terhadap lingkungan)
3. Berikanlah pendapat kalian tentang meningkatnya pengembangan lubuk larangan di Kabupaten Kerinci Provinsi Jambi? (Subkomponen pengetahuan sosial-politik nilai budaya dan kegiatannya)
4. Berikanlah pendapat kalian mengapa masyarakat sangat antusias terhadap budidaya ikan semah di lubuk larangan? (Subkomponen pengetahuan ekologi spesies dan populasi)

Figure 4. Components of Environmental Literacy

Tahukah Kamu !

Ikan semah di beberapa daerah yang memiliki kawasan lubuk larangan dipercaya sebagai penanda. Penanda adanya ikan semah dapat juga diartikan arah mata angin. Sebagaimana cerita di Sungai Batang Bungo, keberadaan ikan semah, ikan batok dan ikan gabus menunjukkan arah matahari mati. Istilah *matahari mati* menunjukkan matahari terbenam yang kemudian dapat diartikan sebagai Arah barat. Selanjutnya istilah *matahari hidup* juga dikenal sebagai matahari terbit yang kemudian diartikan sebagai Arah timur. Sehingga ikan semah bersama-sama dengan ikan batok dan ikan gabus menunjukkan aliran sungai yang mengarah ke *matahari mati*. Sedangkan arah *matahari hidup* ditandai dengan ikan lais, ikan baung dan ikan toman. Ikan semah sebagai biodiversity khas masyarakat hulu Jambi kemudian ditetapkan sebagai ikan yang sering ditempatkan di lubuk larangan. Sebuah tradisi yang ada dan masih berlangsung hingga kini.

Figure 5. Additional Information

Furthermore, to develop students' knowledge of skills, assignments/exercises are presented to support the development of student learning so that it is more contextual. This task/exercise is presented on material that requires knowledge of skills or practicum, for example, the concept of mixtures and single substances, activities to observe ecosystems, and environmental pollution. Figure 6 shows an example of a student worksheet in teaching materials aimed at developing students' knowledge of science process skills.

B. Understandability of Lubuk Larangan Teaching Material

The reduced text to didactics was then compiled into draft 2 and retested to determine the level of students' understandability of the teaching material. This understandability test was performed on 45 students. The method used was the same as that of the characterization test, namely by determining the main idea and level of difficulty of the text. The comparison of the results of the characterization and understandability tests is shown in Table 4.

Table 4. Comparison of Results of Characterization and Understandability Tests

Text No.	Characterization Test		Text No.	Understandability Test	
	Main Idea Answer (%)			Main Idea Answer (%)	
	Correct	Incorrect		Correct	Incorrect
13	66.67	33.33	7	93.33	6.67
16	60	40	16	86.67	13.33
17	66.67	33.33	17	93.33	6.67
35	62.5	37.5	35	87.5	12.5
42	68.75	31.25	42	93.75	6.25
44	62.5	37.5	44	87.5	12.5
48	50	50	48	75	25
58	64.28	35.75	58	85.71	14.29
63	57.14	42.86	63	78.57	21.43
66	64.71	35.29	66	85.71	14.29

The results of the characterization and understandability tests in Table 4 show a significant difference. The correct answer to the main idea in the difficult text increased.

Feasibility of Teaching Material

The feasibility test of teaching material aims to determine the feasibility of the teaching material which includes the feasibility of content, presentation, language, graphics, and aspects of environmental literacy. The feasibility was tested by distributing questionnaires to three expert lecturers and one science teacher. The results of the feasibility test are shown in Table 5.

Table 5. The Results of the Feasibility Test

Certificate	Aspect	Percentage (%)
1	Content	88.02
2	Presentation	80.55
3	Linguistic	86.81
4	Graphics	89.03
5	Environmental literacy	100
Avg. percentage (%)		88.88

▪ CONCLUSION

Jambi's local wisdom, lubuk larangan, can be a theme for developing teaching materials using the 4S-TMD method. This can be seen from the characteristics of the lubuk larangan teaching material that can be related to environmental problems and its usefulness in society by linking this phenomenon of the lubuk larangan environmental area. By developing teaching materials based on environmental literacy, this lubuk larangan theme is also a means of continuous development education to pass on this local wisdom culture to the next generation through science learning. The teaching material developed is very feasible with a high level of understandability. Furthermore, this research can be continued by increasing the population and research samples for understanding trials. It would be better if it was carried out in three schools with different clusters so that the resulting data would better represent students' understanding of each school cluster in the research city. so that the quality of teaching materials produced is better.

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