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DEVELOPMENT OF SCIENCE LITERACY-BASED TEACHING MATERIALS ON SOIL FORMATION PROCESS AND SOIL BUILDING COMPONENTS

Hayatun Nisa[1], Rizky Febriyani Putri[2], Ellyna Hafizah[3]
Universitas Lambung Mangkurat, Banjarmasin, Indonesia

hayatunnisa4416@gmail.com[1], feby.science.edu@ulm.ac.id[2], ellyna.science.edu@ulm.ac.id[3]

ABSTRACT
The learning process motivates the development of scientific literacy-based teaching materials on the material of soil formation processes and soil constituent components. So far, it has only used teaching materials in school textbooks. The purpose of the researchers in carrying out this development was to find out 1) the validity of scientific literacy-based teaching materials on the process of soil formation and soil constituents, (2) the practicality of teaching materials, and (3) the effectiveness of teaching materials. Development of teaching materials using the 4D model (define, design, develop and disseminate). The instruments implemented in the research include learning achievement tests, student response questionnaires, and teaching material validation sheets. The research validated scientific literacy-based teaching materials, showing very valid criteria by obtaining a score of 3.70. The learning outcomes test on this teaching material was also very valid, with a value of 3.51. The results of the practicality of teaching materials obtained a value of 70.85% which was indicated by practical criteria. Teaching materials based on scientific literacy were also declared effective by obtaining an n-gain of 0.91 with high criteria. From these results, the advanced scientific literacy-based teaching materials can be implemented as teaching materials because the test results are declared feasible and valid.

Keywords: teaching materials, scientific literacy, smp negeri 15 banjarmasin.

Corresponding Author: Hayatun Nisa
E-mail: hayatunnisa4416@gmail.com

INTRODUCTION

Natural Science is related to knowing about nature in a structured way so that natural science is not only an expert in sharing knowledge in forms, facts, principles, or concepts (Putra, 2017). In learning science, students in Indonesia can develop their ability to think critically (Anggraeni et al., 2023). Students' abilities to think creatively and actively, work with a good work ethic, be independent, solve problems, develop and research knowledge, and be honest, democratic, responsible, and moral are developed ways of learning and education (Towaf, 2014). The science learning course encourages students to provide direct experience and develop their potential so that they can scientifically understand and control the natural world around them (Istyadji & Putri, 2021). Not only that, students in science learning are also encouraged to be creative, active, and think critically.

Students are required to be creative, active, able to think critically, and only sometimes depend on the teacher (Akhan et al., 2022). The dependence of students and teachers can be resolved simultaneously by providing teaching materials appropriate to the context and sentences that students can understand so that they can independently study the material that will be delivered by the teacher. Teaching materials can help in the course of learning because they can help

teachers and students in learning activities so that teachers do not need to present much material; then, teaching materials can also take over the role of some teachers and support independent or individual learning.

Teaching materials are the most critical component in the course of learning, namely for the delivery of explanations and one of the critical factors in the functioning of a lesson. Of course, teaching materials must be presented orderly and ideal because they have an essential function in learning. However, teaching materials also have drawbacks. Based on a literature review related to several observations of the teaching materials, especially at the Junior High School (SMP) level that has been used so far, weaknesses or deficiencies have been found that must be refined and supplemented. Some of the gaps in the deficiencies that have been found so far in teaching materials, namely, students who need more space to be skilled in applying their knowledge to explain events around them (Listiana, 2013).

This happens due to the need for more contextual content in teaching materials, where the generally presented material and abstract concepts still dominate, so students are required to memorize without knowing what the lesson is related to every day (Risma et al., 2019). This teaching material utilizes the Problem-Based Learning (PBL) model. This model is a model in which learning focuses on problem-solving activities. It is intended that students can seek solutions to the problems presented actively. In this model, the role of the teacher acts more as an intermediary and helper in order to actively support students in the development of knowledge facilities and infrastructure (Sirega, 2016).

Problem-Based Learning (PBL) is also a way of learning in which students are challenged to "learn and to learn" They will be combined into groups and work together in order to be able to find solutions to the problems they face. This problem links students' curiosity and intelligence in analyzing and taking the initiative when learning occurs. Problem-Based Learning (PBL) prepares students to be analytical and think critically in finding and utilizing appropriate learning resources (Yulianti & Gunawan, 2019). Some student skills, such as finding answers to concrete problems and critical and analytical thinking, are part of the indicators of scientific literacy.

Scientific literacy is the understanding and knowledge about the design and course of science students need in everyday life. It is hoped that students can solve the problems they face every day scientifically by applying the knowledge needed to help humans make the right decisions. Science learning can be successful if students have good skills in scientific literacy (Rahmatullah et al., 2021).

In scientific literacy, the emphasis is not only on understanding and knowledge about the design and course of science but also on how individuals can make decisions and participate in culture, community life, and a growing economy. In this century's scientific literacy, the main thing that needs to be understood is the use of science and technology, not only to understand the universe (Narut & Supardi, 2019).

As for the purpose of this study, namely "The feasibility of scientific literacy-based teaching materials on the material Soil Formation Process and Soil Composition Components for class IX SMP?" From the formulation of the problem, the derivative questions are formulated as follows: 1). Knowing the validity of developing teaching materials based on scientific literacy material on the Process of Soil Formation and Components of Soil Composition for class IX in junior high school 2). Knowing the effectiveness of developing teaching materials based on scientific literacy material on Soil Formation Processes and Soil Composing Components for class IX SMP 3).Knowing the

practicality of developing teaching materials based on scientific literacy material on Soil Formation Process and Soil Composing Components for class IX SMP.

And the research benefits that can be expected are as follows: 1). For students, teaching materials based on scientific literacy material on the Process of Soil Formation and Soil Composition Components for grade IX SMP can be used as a learning resource. 2).For teachers, teaching materials based on scientific literacy material on the Process of Soil Formation and Soil Composition Components for grade IX SMP can be used as an alternative teaching material for teachers in the learning process. 3).For schools, teaching materials based on scientific literacy material on the Process of Soil Formation and Soil Composition Components for grade IX SMP can be used as information and contributions in improving science learning.

According to the explanation above, scientific literacy-based teaching materials will be developed using the Problem-Based Learning (PBL) learning model in the material Soil Formation Process and Soil Composition Components for grade IX Junior High School

METHODS

This literacy-based teaching material utilizes the concept of research and development, which is a method that functions to validate and develop products (Sugiyono, 2017). In addition, research on the development of scientific literacy-based teaching materials also utilizes the 4D model. The 4D model according to (Listianthy et al., 2021) ; (Narut & Supardi, 2019), there are four steps in development using the 4D model, namely: the defined stage is the initial analysis stage, where the level of development is regarding the situation and work environment activities so that it is necessary to obtain the initial problems underlying the existence of a product that must be developed as well as issued. The second stage, designs (design), is the designer of a scientific literacy-based teaching material product; the third stage is developing (development), is an activity to validate or assess the feasibility of the product design that researchers will develop; the fourth stage is dissemination (dissemination) is the stage of disseminating literacy-based teaching materials science. However, in this study, it was sufficient until the third phase, namely development, while the fourth phase, namely disseminating the teaching materials, was not distributed in print but only through PDF files.

Data analysis techniques used in developing scientific literacy-based teaching materials are as follows.

1. Teaching Material Validity

The development research was carried out by validating three proficient people, namely, 2 Science Education Lecturers at FKIP ULM (Lambung Mangkurat University) and 1 Science Teacher at SMP Negeri 15 Banjarmasin. Learning implementation plans, learning outcomes tests, and response questionnaires were identified as valid because of the results of verification by the validator with predetermined validity standards. Giving a value of validity utilizes the following formula.

$$K = \frac{\sum_{j=1}^{n} \bar{V}ij}{n}$$

Information:

$\bar{K}i$ = Standardized mean of the i

$\bar{V}ij$ = The value of the calculated results on the i-standard from the j-validator

n = Many validators

Table 1. The Validity of Teaching Materials

Mark	Standard
3.5 ≤ V ≤ 4	Very Valid
2.5 ≤ V < 3,5	Valid
1,2 ≤ V < 2,5	Enough Valid
0 ≤ V < 1.5	No Valid

Source: (Trianto, 2015)

Description:

V = The average validity score from all expert validators.

2. The Practicality of Teaching Materials

The practicality of teaching materials is measured according to the results of measurements from science subject teachers so that they can convey whether the developed teaching materials can be used or not by researchers. The data obtained in the practicality test is then averaged and converted according to the standard practicality level. Analysis of the practicality level of learning media in this practicality test questionnaire can be described as follows (Kumalasan, 2018) :

Information:

$$V_p = \frac{TSE_p}{S - Max} x100\%$$

Vp = value obtained by students

$TSEp$ = Number of questions correct

S – max = Many question items

Reasonable standards of student learning outcomes can be seen in the following table.

Table 2. Criteria for the Practicality of Teaching Materials

Standard	class	Information
75.01% – 100%	Very Practical	It can utilize without repair
50.01% – 75.00%	Practical	It can be used with little improvement
25.01% – 50.00%	Less Practical	Recommended so that not utilized
00.00% – 25.00%	Impractical	No can be utilized

3. The Effectiveness of Teaching Materials

The effectiveness of teaching materials is examined through data on assessing students' cognitive aspects of learning outcomes. Students can be called complete or successful if the value they get is greater than or equal to the Minimum Completeness Criteria (KKM) value with N I la I≥ KKM. Determination of students' cognitive aspects of learning outcomes according to the numbers obtained in the class with the standard class method applied by the Ministry of Education and Culture (KEMENDIKBUD) is as follows:

Table 3. Classification of Learning Outcomes

Level Mastery	Class
85 – 100	Very Tall
65 – 84	Tall
55 – 64	Currently
35 – 54	Low
9 – 34	Very low

Then the effectiveness of teaching materials is measured from a learning achievement found by completing the pretest and posttest to know the level of students' cognitive learning test results. Therefore it can be implemented by using an equation. Increasing the test of cognitive learning outcomes can take advantage of the normalized gain (N-gain) equation as follows

$$(g) = \frac{Posttest\ score - Pretest\ score}{Maximum\ score - Pretest\ score}$$

Standards of the effectiveness of student learning outcomes can be seen in the following table.

Table 4 . N-gain class

intervals	Standard
g < 0.3	Low
0.3 ≤ g < 0.7	Currently
g ≥ 0.7	Tall

RESULTS AND DISCUSSION

Validity

Teaching Material Validation Results

Presentation of data is one of the most critical aspects, where researchers vary scientific literacy-based teaching materials, and product visibility by experts is then measured whether the product in the form of scientific literacy-based teaching materials on soil formation processes and soil constituent components is appropriate or not for use. The team who are competent in their fields related to research are Ratna Yulinda, M. Pd and Sauqina, S. Pd, M. A where They are the lecturers in the Science Education Study Program and researchers also request Science Teachers at Public Middle Schools 15 Banjarmasin to become validators namely Risnawati, S.Pd as a science teacher at SMP Negeri 15 Banjarmasin. Following are the results of validating Science Literacy-based teaching materials on the material for soil formation processes and soil constituent components.

Table 5. Teaching Material Validation Results

Part Evaluation	Mark	Standard
Presentation	3.64	Very Valid
Appropriateness Fill	3.73	Very Valid
language	3.80	Very Valid
Literacy science	3.61	Very Valid
Average Validation Total	3.70	Very Valid

Based on the validation results of the three expert validators, it can be seen from Table 5. The result is a 3.70, so scientific literacy-based teaching materials on soil formation and soil constituents are categorized as very valid.

Learning Outcomes Test Validation Results

Validation by the three validators decided that the learning achievement test has a very reasonable standard. Validation calculations can be seen in Table 6.

Table. 6. Learning Outcomes Validation Results

Part Evaluation	Mark	Standard
Multiple choice	3.51	Very Valid
Description	3.50	Very Valid

Part Evaluation	Mark	Standard
Average Validation Total	3.51	Very Valid

According to the results of the validation of the three expert validators, validation of the learning outcomes test was obtained in the form of multiple choice and descriptions with an overall score of 3.51. The learning outcomes test on scientific literacy-based teaching materials on soil formation and soil constituent components is valid. So this is in accordance with the opinion of BSNP (2008), which states the validity of teaching materials and learning outcomes tests are stated to be Very Valid if the score is above 3.50 and is used invalid if you get a score below 1.50.

Product Revision Results

The experts provided validation results for scientific literacy-based teaching materials in the material on soil formation processes and soil constituent components. They found several aspects that were corrected or revised. Suggestions and comments from the validator are presented in Table 7.

Table 7. Module Repair Results

BEFORE REVISION	AFTER REVISION
	
Comments and Suggestions: Add Name Writer alongwith Name Lecturer Advisor	**Repair:** Add Name Writer AndName Lecturer Advisor
	
Comment And Suggestion : Add And adjust Indicator and Learning Objectives according to Kom- potential Base	**Repair :** Add and customize Indi- office da Objective learning following Competence Base.

Comment And Suggestion :
Fill the material too A little, And No, there is a supporting image

Repair :
Add content material And add-even picture

Comment And Suggestion :
Add a picture about Physical Weathering

Repair :
Added some picture examples of physical weathering

Comment And Suggestion :
Berries example explanation A little regarding the type of soil which exists in Borneo South

Repair :
Added an explanation of the type of peat soils in Kalimantan South As well as a QR code That contains an explanation of more details

	
Comment And Suggestion : The evaluation must choose Double	**Repair :** Change question Evaluation becomes choice Double

The Practicality of Teaching Materials

The trial was carried out after the product was in scientific literacy-based teaching materials through validation and improvement steps based on suggestions and comments from expert validators. Trials were carried out so that the suitability of scientific literacy-based teaching materials that had been created could be known. The trial was carried out with 31 students as respondents. Trials were carried out to determine the effectiveness and practicality of teaching materials based on scientific literacy, and data were taken together with the distribution of student questionnaires as respondents. Student responses can be seen in Table 8.

Table 8. The Practicality of Teaching Materials

Aspect Evaluation	Score	Standard
convenience use	70,39	Practical
Benefit	71,67	Practical
effectiveness	70,16	Practical

According to previous research, teaching materials that have been developed can be used by students with a total score of 70.85% in the experimental group (ULFA, 2018). This shows that the teaching materials that have been developed make it easier for students to understand because the language used is simple. The material contained in the teaching materials is more practical than in textbooks that students often use.

The Effectiveness of Teaching Materials

The teaching materials' effectiveness was measured by giving students 15 multiple-choice questions and two essays. The questions are designed according to the learning objectives guided by basic competencies. The learning outcomes of this researcher were measured by taking into account the pretest and posttest results. The pretest, distributed before learning, began with scientific literacy-based teaching materials. In contrast, the posttest was distributed using scientific literacy-based teaching materials after learning. Student learning outcomes test is obtained by calculating n-gain. The calculation results can be seen. The standard n-gain results obtained by class IX D can be seen in Table 9.

Table 9 . N-gain Calculation Results

Lots Participant	Mark N-gain	Standard N-gain
31 people	0.91	Tall

Based on the results of the N-gain calculation by obtaining a score of 0.91 with a high standard, it was declared effective based on the evaluation test.

Based on previous research, learning is said to be effective if the learning concepts conveyed by the teacher can be understood by students (Sumarni, 2013). This can be seen after learning by utilizing teaching materials. The results of learning before and after students use teaching materials look very different, as shown by the pretest and posttest scores.

CONCLUSION

The process of research and development of Teaching Materials based on Scientific Literacy The material for forming soil and soil components has been carried out and discussed following the research and development results. As a result, Teaching Materials based on Scientific Literacy The material for soil formation processes and soil constituent components is understood as Teaching Materials based on Scientific Literacy The material for soil formation processes and soil constituent components obtains a score of 3.70 with an excellent standard. Science Literacy-based Teaching Materials Materials on soil formation processes and soil formation processes were also declared practical with a score of 70.85% based on student response questionnaires, and Teaching materials based on Scientific Literacy Materials on soil formation processes and soil formation processes were declared effective with an n-gain score of 0, 91 with high standards based on evaluation test questions.

REFERENCES

Akhan, N. E., Çiçek, S., & Kocaağa, G. (2022). Critical and creative perspectives of gifted students on global problems: Global climate change. *Thinking Skills and Creativity*, *46*, 101131. https://doi.org/https://doi.org/10.1016/j.tsc.2022.101131

Anggraeni, D. M., Prahani, B. K., Suprapto, N., Shofiyah, N., & Jatmiko, B. (2023). Systematic review of problem based learning research in fostering critical thinking skills. *Thinking Skills and Creativity*, *49*, 101334. https://doi.org/https://doi.org/10.1016/j.tsc.2023.101334

Istyadji, M., & Putri, R. F. (2021). Pengembangan Bahan Ajar Ipa Berbasis Literasi Sains Pada Topik Kestabilan Suhu Tubuh Makhluk Hidup Dalam Kehidupan Sehari-Hari Kelas VII SMP. *Pahlawan: Jurnal Ilmu Pendidikan-Sosial-Budaya*, *17*(2), 111–122. https://doi.org/10.57216/pah.v17i2.1

Kumalasani, M. P. (2018). Kepraktisan penggunaan multimedia interaktif pada pembelajaran tematik kelas IV SD. *Jurnal Bidang Pendidikan Dasar*, *2*(1A), 1–11. https://doi.org/https://doi.org/10.21067/jbpd.v2i1A.2345

Listiana, L. (2013). Pemberdayaan keterampilan berpikir dalam pembelajaran biologi melalui model kooperatif tipe gi (group investigation) dan ttw (think, talk, write). *Proceeding Biology Education Conference: Biology, Science, Enviromental, and Learning*, *10*(1).

Listianthy, W. K., Sarwanto, S., & Indrowati, M. (n.d.). PENGEMBANGAN MODUL SETS PADA MATERI CAHAYA DAN ALAT OPTIK KELAS VIII SMP/MTS. *INKUIRI: Jurnal Pendidikan IPA*, *10*(2), 82–88. https://doi.org/10.20961/inkuiri.v11i1.50444

Narut, Y. F., & Supardi, K. (2019). Literasi sains peserta didik dalam pembelajaran ipa di indonesia. *JIPD (Jurnal Inovasi Pendidikan Dasar)*, *3*(1), 61–69.

Putra, P. (2017). Pendekatan etnopedagogi dalam pembelajaran IPA SD/MI. *Primary Education*

Journal (PEJ), *1*(1), 17–23.

Rahmatullah, M. F., Pasani, C. F., & Yulinda, R. (2021). Pengembangan Bahan Ajar Berbasis Literasi Sains Bermuatan Karakter Toleransi Untuk Siswa SMP Pada Materi Pewarisan Sifat. *Pahlawan: Jurnal Ilmu Pendidikan-Sosial-Budaya*, *17*(2), 1–10. https://doi.org/10.57216/pah.v17i2.149

Risma, M., Rahmayani, R., & Handayani, F. (2019). Analisis konten buku teks IPA terpadu kelas VIII semester 1 ditinjau dari aspek literasi saintifik. *Jurnal Eksakta Pendidikan (Jep)*, *3*(2), 200–208. https://doi.org/https://doi.org/10.24036/jep/vol3-iss2/396

Seri (2016). Pengaruh model pembelajaran problem based learning (PBL) terhadap belajar siswa pada materi pokok suhu dan kalor di kelas X semester II sma negeri 11 medan tp 2014/2015. *Jurnal Ikatan Alumni Fisika Universitas Negeri Malang*, *2*(1), 26. ttps://doi.org/10.24114/jiaf.v5i2.12554

Sugiyono. (2017). *Model Penelitian dan Pengembangan*. Alfabeta.

Sumarni, W. (2013). Penerapan learning cycle sebagai upaya meningkatkan keterampilan generik sains inferensia logika mahasiswa melalui perkuliahan praktikum kimia dasar. *Jurnal Inovasi Pendidikan Kimia*, *4*(1).

Towaf, S. M. (2014). Pendidikan karakter pada matapelajaran ilmu pengetahuan sosial. *Jurnal Ilmu Pendidikan*, *20*(1).

ULFA, R. K. (2018). *Pengembangan Modul Sistem Pencernaan Makanan Berbasis Literasi Sains Untuk Kelas VIII MTsN Padang Japang*.

Yulianti, E., & Gunawan, I. (2019). Model pembelajaran problem based learning (PBL): Efeknya terhadap pemahaman konsep dan berpikir kritis. *Indonesian Journal of Science and Mathematics Education*, *2*(3), 399–408. https://doi.org/10.24042/ijsme.v2i3.4366