Development of Teaching Modules Containing Ethnoscience Material on Forms of Substances and Their Changes to Improve the Scientific Literacy of Elementary School Students

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ABSTRACT

This research was carried out based on the results of observations, teacher interviews in the process of teaching and learning activities, it was found that teachers had not used teaching modules containing ethnoscience, which had an impact on low scientific literacy and student learning outcomes. This research aimed to design a teaching module containing ethnoscience regarding the form of matter and its changes in class V of elementary school. The research method used is the research and Development (R&D) method with the 4D Development model (Define, Design, Develop and Disseminate). This research was carried out at the Jebus 15 State Elementary School with small-scale tests in class VI with a total of 17 students and large-scale tests in class V with a total of 30 students. In addition to Developing teaching modules containing ethnoscience on material on the form of substances and their changes, this research purpose also to analyze the increase in effectiveness of using teaching modules containing ethnoscience on material on the forms of substances and their changes in increasing the scientific literacy of students being Developed. Data and collection techniques in this research include questionnaires, tests and documentation. This research instrument was carried out by first analyzing the results of trials on a small-scale including validity, reliability, level of difficulty and differentiability of questions. The data analysis technique used a prerequisite test and then an N-Gain test is carried out to determine the increase in students' scientific literacy abilities.

The results of research on large-scale tests can be concluded that there was a significant increase in scientific literacy abilities from the application of teaching modules containing ethnoscience regarding the forms of substances and their changes. The results of the pre-test classical completeness test data analysis gained a score of 10% after implementing the teaching module containing ethnoscience material on the form of substances and the change increased to 90% in the Post-test score. The results of the increased N-Gain test gained an average N-Gain value of 0.71 in the high category.

Keywords: Teaching modules, Ethnoscience, Science Learning, Scientific literacy.

INTRODUCTION

Education is an effort made to educate students so that they can adapt to circumstances well (Melawati & Istianah, 2022). Education is also *Defined* as a process of humanizing humans then they can actualize themselves in life, where good education is education that not only prepares students for a profession or position, but is able to solve the problems they face in everyday life (Dewi & Primayana, 2019). Education is one of the most important factors in determining the quality of human resources and the progress of a nation (Rahayu et al., 2022). Education is carried out with every effort to prepare students through learning and guidance. If the teacher

provides learning well, then learning objectives can be achieved optimally. Learning will be carried out well if teachers provide learning facilities that are innovative, interesting and integrated with the culture of the community (Nuralita, 2020).

The policy that has been established by the government to improve the quality of education is the curriculum. The curriculum has an important role in the form of learning tools which contain planning of learning activities in the form of a process of acquiring knowledge and experience gained through a series of learning activities (Ardianti & Amalia, 2022). The curriculum currently being implemented in Indonesia is the Independent Curriculum. The Independent Learning Curriculum is a learning curriculum that refers to a talent and interest approach. The Merdeka Curriculum itself has the concept of independence and freedom for education in Indonesia to determine for themselves the best way or method that can be used during the teaching and learning process (Sumarsih et al., 2022). Teaching and learning strategies, approaches and methods need to be emphasized and taken seriously in the implementation of the Merdeka Curriculum to achieve the desires of the newly introduced educational concept to produce students with knowledge, skills, creative thinking and innovation to face current and future challenges (Shanmugam et al., 2019).

Further, science learning directs students to have an awareness of scientific literacy, so that students could think critically, solve problems and have an awareness of protecting and preserving the natural surroundings and cultural traditions as learning materials or resources (Fiteriani et al., 2021). With scientific literacy, students' level of understanding in drawing conclusions from the information received becomes better. Helping students think critically and increase knowledge.

Scientific literacy is the ability to understand and utilize scientific knowledge to solve problems in everyday life, as well as gain new knowledge related to scientific phenomena (Sutrisna, 2021). Scientific literacy focuses on Developing students' knowledge in applying scientific concepts significantly, thoroughly, and being able to make decisions to overcome problems related to students' daily lives.

Based on PISA (Program for International Student Assessment) data, the scientific literacy abilities of students in Indonesia are below average or at a low measurement stage compared to scientific literacy abilities in several other countries (Ulfa et al., 2017). Reporting from The Organization for Economic Co-operation and Development (OEDC), in 2018 Indonesia was ranked 71st out of 79 countries with a score of 396 (Nurwidiyanti & Sari, 2022). With the results of this survey, the scientific literacy of Indonesian students is still far below the international standard score set by the OEDC institution.

One of the causes of low scientific literacy skills is related to the availability of learning resources and the science learning process which does not yet provide opportunities for students to Develop critical thinking skills and science learning is still characterized by the method of memorizing material and the use of limited learning media (Febriani et al. , 2022). Mastering scientific literacy skills has benefits in Developing students' cognitive abilities so they can process information effectively and efficiently. There is a need for new innovations in the science learning process by using learning media that can improve students' scientific literacy skills (Narut & Supradi, 2019). One action that can be taken is to utilize teaching materials in learning to increase scientific literacy (Nisa et al., 2021). Teaching materials should be *Design*ed and written according to learning rules, that is adapted to the learning materials, arranged based on learning needs, there are evaluation materials, and the teaching materials are interesting for students to learn (Zahro et al., 2016).

The solution to counter the problem of weak scientific literacy is to make students active in learning, using learning media. The use of teaching materials in learning activities is

very important for teachers and students, because by using teaching materials teachers can easily increase the effectiveness of learning and students will also have no difficulty in learning (Nihwan & Widodo, 2020). Teaching materials are a set of learning materials that refer to the curriculum used to achieve predetermined learning outcomes (CP) and learning objectives (Nugroho et al., 2019). Preparation of teaching materials is an important factor in determining the success of the learning process. Good teaching materials are *Develop*ed by considering the characteristics of students, the type of material, and the resources available in the surrounding environment. There are various forms of teaching materials, such as textbooks, modules, worksheets, models or mockups, audio teaching materials, and interactive teaching materials (Widiastuti, 2021). From various teaching materials, modules can be selected to be Developed to support learning activities (Sulistiyanti et al., 2021). Modules based on local wisdom are an alternative in this case (Setiawan et al., 2023).

A module is a type of teaching material that contains a learning implementation plan, to help direct the learning process to achieve learning outcomes (Septiani & Listiyani, 2021). Modules are Defined as teaching materials that are arranged systematically and packaged completely so that they can be studied easily and independently by students without or with teacher assistance (Setyawan & Wahyuni, 2019). Some of the advantages of learning using modules are that one of them is motivating students to be more enthusiastic about learning, because the material and tasks given are clearly presented according to their abilities (Ningsih et al., 2022). Apart from learning that can make students more active, learning also needs to contribute to the surrounding environment (local wisdom), so that students can also think scientifically about phenomena in the surrounding environment. One solution is to provide ethnoscience-based learning.

Ethnoscience learning is very necessary in providing science material to students. It is important for students to learn about their own culture and history to foster a sense of love and appreciation for their country. Ethnoscience-based learning will introduce students to the potential of a region, so that students will become more familiar with the culture and local wisdom of the region (Nurdeni et al., 2022). Local wisdom is closely related to science learning, because daily life in the community is discussed and closely related to science learning. Ethnoscience learning can instill positive values in students (Hadi et al., 2019). In ethnoscience learning, students will learn to connect the learning material discussed with the surrounding culture, so that learning will be more beneficial for life (Sudarmin et al., 2018).

Various studies have shown that the Development of ethnoscience-based learning tools to train elementary school students' scientific literacy (Dwiyanti & Rosana, 2020) shows that the implementation of learning has a very good tendency, activities during learning are student-centered, the majority of students achieve complete scientific literacy scores, and learning received a positive response from students. Apart from that, the Development of high-class local wisdom-based science learning modules in elementary schools. Making learning activities more practical and effective, it can be seen from the results of learning using the module that students are very enthusiastic about being able to answer questions given by the teacher and make students learn more independently and care about the environment (Widiya et al., 2021).

It is hoped that the Development of an ethnoscience-based module by highlighting local wisdom of typical Bangka food culture can support students' knowledge during the learning process and increase students' insight into local culture which is related to material forms of substances and their changes. This can also make it easier for students to understand the material. Apart

from that, the modules Developed can attract students' attention in learning, motivate students because of the new things they can discover, increase students' enthusiasm, and increase their knowledge about local culture. This research Develops a learning module containing ethnoscience regarding the forms of substances and their changes which aims to increase students' scientific literacy.

MATERIALS & METHODS

This research used a Development research method with 4D Design (Define, Design, Develop, and Disseminate). Thiagarajan, S. et al (1974) The first stage, that is Define, is carried out by collecting initial data and defining the problems found from the research object. The second stage is Design, starting with Designing a teaching module containing ethnoscience regarding the form of substances and their changes. At this stage the teaching module is Designed to suit the Core Competencies, Basic Competencies, Competency Achievement Indicators, Learning Models used, and local wisdom taken from the local area. The third stage is the Develop stage, by carrying out trials of Development products in the form of teaching modules containing ethnoscience material regarding the form of substances and changes in them that have been produced to gain responses and evaluations so as to

produce teaching modules that were suitable for use and dissemination. The final stage is dissemination.

The research was conducted in class V of Jebus 15 State Elementary School with a total of 30 students. Data collection techniques in this research include test techniques and documentation. The test technique is a test instrument in the form of multiple choice questions to measure the achievement of students' scientific literacy abilities in science learning regarding the forms of substances and their changes. Documentation techniques are used as a source of supporting data to complement data gained from problem identification activities, data on student learning outcomes, photos of student activities and data on trial results of the teaching modules being Developed.

The data processing technique is by carrying out a prerequisite test, that is the normality test to determine whether the variables are normally distributed or not, then a data normality test is carried out with the help of SPSS using the Shapiro-Wilk test, it is known that the data is normally distributed if the significance value is ≥ 0.05 and vice versa the data is not normally distributed if significance value ≤ 0.05 (Fatimah et al., 2022). The following normality test output results are presented in Table 1.

Table 1. Normality Test Results

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Pre test	,152	30	,075	,933	30	,060
Post test	,127	30	,200*	,937	30	,076
*. This is a lower bound of the true significance.						
a. Lilliefors Significance Correction						

The data analysis technique used is by analyzing the increase in the results of students' scientific literacy skills from the pre-test and post-test results through analysis of the classical completeness test and the *N-Gain* test. To determine classical learning mastery by measuring the level of success of students' overall learning completeness. increasing classical mastery as a result of students' scientific literacy abilities is formulated:

$$p = \frac{\Sigma total\ student\ got\ score \geq 75}{\Sigma student\ followed\ test} \times 100$$

The increase in the results of scientific literacy skills can be seen after carrying out an *N-Gain* test to see the effectiveness of increasing each indicator. Calculations can be started by calculating the average value of the pre-test and post-test cognitive learning

outcomes. Pre test and post test scores are calculated using the *N-Gain* formula:

$$\text{N-gain (g)} = \frac{(post\ test\ score - pre\ test\ score)}{(\max\ ideal\ score - pre\ test\ score)}$$

(Yany et al., 2022)

The percentage data gained is then categorized to determine the level of effectiveness which can be seen in table 2.

Table 2. Effectiveness of *N-Gain*

Normality Gain (g)	Remark
$g \geq 0,7$	High
$0,3 \leq g < 0,7$	Medium
$g < 0,3$	Low

(Wanahari et al., 2022)

RESULT & DISCUSSION

The increasing of the results of elementary school students' scientific literacy abilities after learning using teaching modules containing ethnoscience material on the forms of substances and changes can be seen from the instruments for measuring the effectiveness of the results of students' scientific literacy abilities, those were the pre-test and post-test question instruments. The pre-test questions are given before carrying out the learning, while the post-test questions are given after the learning has been carried out by implementing the teaching module Developed with ethnoscience content regarding the forms of substances and their changes.

Students' classical completeness can be declared complete if the pre-test and post-test scores have reached the Minimum Completeness Criteria (KKM). The KKM that has been determined for class V science learning at Jebus 15 State Elementary School is 75. The results of classical completion are presented in Table 3.

Table 3. Summary of Classical Completion Results

Category	Average Score	Completed Students	Completed Percentage	Criteria
Pre test	61,87	3	10%	Not Completed
Post test	88,13	27	90%	Completed

Based on Table 3, it is known that the percentage of classical completeness in the pre-test score was 10% in the incomplete category compared to the percentage of classical completeness in the post-test learning results of 90% with the complete criteria. It can be concluded that the results of students' scientific literacy abilities can improve after using teaching modules containing ethnoscience material on the forms of substances and their changes that have been Developed. This is aligned with research by Rikizaputra et al., (2023) explaining that teaching modules containing ethnoscience are suitable for use and can improve the scientific literacy abilities of elementary school students. Apart from that, research conducted by Sari et al., (2021) explains that teaching modules containing ethnoscience are very effective to use and can help improve students' scientific literacy skills.

Increasing the effectiveness of students' scientific literacy skills can be determined using the N-Gain test. The average N-Gain score is to prove that there is an increase in the average pre-test and post-test scores when learning using teaching modules containing ethnoscience regarding the forms of substances and their changes. A summary of the calculations for increasing the results of students' scientific literacy skills is presented in Table 4.

Table 4. *N-Gain* Results of Increasing Learning Outcomes

Categori	Average	*N-Gain*	
		Average	Criteria
Pre test	61,87	0,71	High
Post test	88,13		

The results of the N-Gain calculation are presented in Table 4. It is known that the average N-Gain is 0.71 in the high category and the level of effectiveness in using teaching modules containing ethnoscience material in the form of substances and their changes is 71% in the high category. This is

in line with Retno & Marlina, (2018) who stated that the use of integrated ethnoscience teaching modules has a positive influence on students' scientific literacy. The role of cultural enculturation in science learning, that is the reconstruction of societal science into scientific science, can improve students' knowledge and skills (Sudarmin & Pujiastuti, 2013). This is in line with Sumarni et al., (2016) who found that ethnoscience learning can Develop generic science skills and scientific literacy.

However, it is hoped that teaching modules containing ethnoscience can become one of the supporting elements for learning to create effective learning that combines cultural values so that students do not forget the cultures that apply in a particular area. Rusilowati & Widiyatmoko, (2015) stated that the Development of teaching materials where local wisdom is seen through educational research is an effort to ensure the preservation and transmission of local wisdom to future generations.

The results of increasing students' scientific literacy skills are influenced by learning that uses teaching materials in the form of teaching modules containing ethnoscience. Ariningtyas et al., (2017) stated that the lack of innovation in using teaching materials and learning models is one of the causes of the teaching and learning process not attracting students' attention, so that students do not focus and play a lot which makes students less likely to listen to the material taught by the teacher. Aligned with Masfufah & Ellianawati, (2020) stated that the low achievement of student learning outcomes is due to the lack of students understanding a concept of the material being studied. Supported by research conducted by Pertiwi et al., (2019) which stated that the problem with low scientific literacy among students is that the learning process does not present interactive and innovative strategies, media and learning models to students.

The Development of teaching modules containing ethnoscience for elementary school students which has been carried out in this research has been proven to be suitable for use in science learning regarding the forms of substances and their changes and has been proven to be effective in increasing scientific literacy based on the results of the pre-test and post-test scores gained by the students.

Students' creativity can be further Developed through the integration of local wisdom or scientific phenomena that are close to everyday life (Imansari et al., 2018). In this research, the material on the forms of substances and their changes is packaged into a teaching module containing ethnoscience in the form of a flipbook. The teaching module contains material that has been combined with local wisdom in the students' area, so that it is easier for students to understand it and can increase scientific literacy.

One of the factors that influence scientific literacy in this research is the teaching module that has been Developed with an ethnoscience content that is used in the learning process. A community life-based learning approach can create scientific literacy with teaching modules (Sofiana & Wibowo, 2019). One learning model that is suitable for science learning is integrated ethnoscience learning (Afriana et al., 2016). Apart from scientific knowledge, attitudes towards science also improve with ethnoscience-based learning (Tseng et al., 2013).

CONCLUSION
The quality of learning greatly influences student learning outcomes. Teachers play a very important role in learning. In an effort to improve the quality of learning, one of the efforts taken is the use of teaching modules containing ethnoscience material regarding the forms of substances and their changes which are Designed according to learning needs and are able to provide increased results in students' scientific literacy abilities. This is proven by the students' learning results during the pre-test assessment before using the teaching module containing ethnoscience material on the form of substances and its changes, which gained an

average of 61.87, while the post-test assessment after using the teaching module containing ethnoscience on material on the form of substances and its changes gained an average of 61.87. amounting to 88.13. The classical completion results of the post test were 90% and the pre test was 10%. The average N-Gain calculation is 0.71 in the high category, for the percentage effectiveness of N-Gain the score is 0.71 in the very effective category. This proves that the use of teaching modules containing ethnoscience material regarding the form of substances and its changes is able to provide an increase in the results of the scientific literacy abilities of class V students at Jebus 15 State Elementary School, West Bangka Regency, Bangka Belitung Islands.

Declaration by Authors

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