

# Development of Ethnoscience-Laden IPA Teaching Materials on Material on the Form of Substances and Their Changes to Improve Science Literacy Skills of Elementary School Students

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## ABSTRACT

Based on the problems that occur at SDN Pangkah 07, Pangkah sub-district, Tegal district, through observations and interviews, it was revealed that the learning resources used to implement the Merdeka Curriculum are still limited. The teaching materials currently used are LKS which have not been able to improve students' scientific literacy. This causes it to be less in accordance with the characteristics of the material studied with students. So that students find it difficult to understand the material. Based on these problems, it is necessary to develop teaching materials that are packaged into ethnoscience teaching materials.

This research is a Research and Development (R&D) research using development procedures with the research model from (Thiagarajan, Semmel & Semmel, 1974) using the stages of 4D development research consisting of 4 stages namely Define, Design, Development and Dissemination.

The results of this study indicate that ethnoscience-laden science teaching materials on the material of the form of substances and their changes to improve students' science literacy in elementary schools were successfully developed with average results on material experts 0.91 categorised as very valid, language experts 0.92 very valid and media experts 0.94 very

valid. Effectiveness obtained 80% of the effective category is used. The practicality of the results of the teacher response questionnaire averaged 100% very practical from three aspects and the results of the student questionnaire averaged 90% very practical.

So it can be concluded based on the data obtained, the characteristics of ethnoscience-loaded teaching materials are: a) in the form of printed teaching materials and links; b) ethnoscience-loaded teaching materials that take local wisdom. The ethnoscience teaching materials produced are in the very valid category, which is obtained from the assessment of validators or experts. The ethnoscience-loaded teaching materials produced with the n-gain value of the effective category, also obtained the results of teacher and student responses in the very practical category. Suggestions from the author of ethnoscience-loaded teaching materials need to be developed again on other science materials and aspects of science literacy attitudes and ethnoscience-loaded teaching materials that have been developed can be used as a reference by other researchers in carrying out similar research

**Keywords:** Social Sciences teaching materials, Ethnoscience, Scientific Literacy

## **INTRODUCTION**

Various types of literacy must be owned by everyone, including elementary school students, to live life in the current and future community environment and continue to higher school levels. In line with Fitriani's (2019) opinion, literacy is a person's ability to read and write so that the development of literacy is very important to pay attention to, because literacy is the initial ability that students need to have to live life in the future. According to Pertiwi (2018) literacy is a medium to increase knowledge in the community. According to Pamungkas (2017) Literacy is a skill that must be fertilised so that people can understand different types of problems depending on the situation.

Literacy is not only the ability to read and write, but there are many other types. Like the national literacy movement guidebook issued by the Ministry of Education and Culture in which it explains about literacy which is divided into six types, including literacy in reading and writing, numeracy, digital, financial, science, and culture and citizenship (Ulum & Haerudin, 2022). One of the literacies that should be implemented in science learning in schools is science literacy (Kristyowati & Purwanto, 2019). However, in reality there are still many schools that have not implemented science literacy. Because the results of Fitriani's (2018) observation in Sidoarjo stated that students' science literacy was still low. Azmy & Juniarso's (2020) research in Mojokerto concluded that science literacy applied by teachers in science learning in elementary schools is still low. According to Kartini (2019), teachers are only fixated on materials and books, so that learning is less meaningful and causes a lack of science literacy in students.

Science literacy is the ability to understand and utilise scientific knowledge as problem solving in everyday life, as well as acquiring new knowledge related to scientific phenomena (Sutrisna, 2021). Science literacy focuses on developing students 'knowledge in applying science concepts significantly, thoroughly, and being able to

make decisions to solve problems related to students' daily lives (Nurwidiyanti & Mutia, 2022). Based on data from the Programme for International Student Assessment (PISA), the science literacy skills of students in Indonesia are below average or at a low measurement stage compared to science literacy skills in several other countries (Ulfa, 2017). Reporting from The Organisation for Economic Co-operation and Development (OECD), in 2018 Indonesia was ranked 71 out of 79 countries with a score of 396 (Schleicher, 2019). With the survey results, the science literacy of Indonesian students is still far below the international standard score set by the OECD institution.

One of the causes of low science literacy skills is related to the availability of learning resources and science learning processes that have not provided opportunities for students to develop critical thinking skills and science learning is still characterised by the method of memorising material and the use of limited learning media (Febriani, 2022). Mastery of science literacy skills has benefits in developing students' cognitive abilities so that 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' science literacy skills (Narut & Supradi, 2019).

In addition, researchers conducted interviews with teachers and fourth grade students of SDN Pangkah 07, Pangkah Subdistrict, Tegal Regency, who concluded that the science learning conducted by these teachers used discovery learning with discussion and question and answer methods. The learning has also been linked to everyday life by taking contextual examples.

From the results of the interview, it was also found that the learning resources that have been used by teachers are from the teachers themselves, package books and LKS books that have been prepared by the government, and the surrounding environment. Only one school uses the internet for learning. In addition, the results of the analysis of books

used by teachers and students do not pay attention to ethnoscience. Thus, these teachers have never developed teaching materials used for the science learning process in their classes. The media used by teachers are objects at school and at home. Only one school uses PowerPoint, pictures and videos. So that the learning process carried out has not been integrated with local wisdom around. This is because local wisdom is also included in the structure of the independent learning curriculum in primary schools which can be included in subjects that can be added by each school flexibly (Rahmadayanti & Hartoyo, 2022). Referring to the results of interviews with teachers and students as well as observations at school, it was found that the need for learning resources in the form of teaching materials is needed to facilitate teachers in teaching and facilitate students in learning. This was conveyed directly by the teachers and the questions that the researchers had asked the students.

Teaching materials are learning tools that contain learning materials used by teachers in the learning process so that it runs smoothly and can be completed on time (Lubis & Ismaya., 2020). Teaching materials are materials that have been methodically arranged and can be used by students to learn and designed by teachers according to the current curriculum so that the process of teaching material to students is more coherent and the achievement of predetermined competencies (Nuryasana & Desiningrum, 2020). In addition to 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 IPAS 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 be more familiar with the culture and local wisdom of the region (Nurdeni, 2022). Local wisdom is closely related to IPAS learning, because daily life in the community is discussed and closely related to IPAS learning. Ethnoscience learning can instil positive values in students (Hadi, 2019). In ethnoscience learning, students will learn to connect the learning material discussed with the surrounding culture, so that learning will be more useful for life (Sudarmin, 2018).

Various studies have shown that the development of ethnoscience-based learning tools can train elementary school students' science literacy (Dwiyanti & Rosana, 2020). The implementation of learning has a very good tendency, activities during learning have been student-centred, the majority of students reach the completeness of science literacy scores, and learning gets positive responses from students. In addition, the development of high-class local wisdom-based science learning teaching materials in elementary schools. Making learning activities more practical and effective, it can be seen from the results of learning using teaching materials that students are very enthusiastic about being able to answer questions given by the teacher and make students learn more independently, care for the environment (Widiya, 2021). Research conducted by Dwiyanti & Rosana, (2020) raised the ethnoscience of processed rawon which characterises their area, while research conducted by Widiya (2021) examined local wisdom in Rejang Lebong Village.

## **LITERATURE REVIEW**

Teaching materials have an important role in learning activities. According to research conducted by Wildanasari (2022), Latifah & Rukmana (2022), Rasuanti (2022), Mella (2022), Nurdin, S. (2023), the results of the analysis of several articles that distinguish from the research conducted lie in learning materials, research will develop modules using IPAS material on the form of substances and their changes. Furthermore,

developing an ethnoscience-based module that will raise the culture in the Tegal area.

## MATERIALS & METHODS

This type of research is a study of a learning product developed and a research and development (RnD) model. RnD is a research method used to validate and develop products (Borgg & Gall, 2019). The RnD research and development method can be used to develop products in the form of media, materials, programs, service implementation plans or guidance and counselling research instruments (Nurmalasari & Erdiantoro, 2020). The development of ethnoscience-laden science learning teaching materials uses a development procedure with a research model from (Thiagarajan, Semmel & Semmel, 1974) using the stages of 4D development research consisting of 4 stages namely Define, Design, Development and Dissemination.

Stage 1, namely define, contains activities to determine what products will be developed, along with their specifications. This activity is a needs analysis conducted through research and literature studies. Stage 2, design, contains activities to make a design for the product that has been determined in stage 1. Stage 3, development, contains activities to make the design into a product and test the validity of the product repeatedly until the product is produced in accordance with the specifications set. Stage 4 is dissemination.

The validity test of the teaching module is obtained based on the results of a questionnaire that has been filled in by media experts and material experts. The validity of this teaching module media is obtained after linguists, media experts, and material experts fill out the questionnaire that has been prepared by giving a check mark (√) on the answer that matches the condition of the teaching module developed. The scores in this media validity test questionnaire are 1, 2, 3 and 4 with information 1 (not good enough), 2 (good enough), 3 (good) and 4 (very good). The data obtained from the

results of filling out this questionnaire is in the form of quantitative data which will calculate the average of the data with the following formula.

$$v = \frac{\sum S}{[n(c - 1)]}$$

**Table 1 Interpretation of Teaching Module Validity**

Correlation coefficient	Interpretation of Validity
$V > 0,80$	High
$0,60 \leq V < 0,80$	High enough
$0,40 \leq V < 0,60$	Enough
$0 \leq V < 0,40$	Bad

Analysis of the practicality of the teaching module is seen based on a questionnaire that will be answered by students totaling 10 questions as respondents. The questionnaire distributed to students has a score of 0 and 1 with a description of 0 (impractical) and 1 (practical) with alternative answers “Yes” and “No”. The data obtained in the form of quantitative data will be calculated to get the average score of the practicality of the teaching module from the total number of respondents. The data is calculated using the following formula.

$$P = \frac{f}{N} \times 100\%$$

P is the percentage number of student responses, f is the score obtained from the assessor, and N is the maximum number of scores.

**Table 2. Validity and Qualification Level Guidelines**

Achievement Level	Qualification	Decision
76 - 100	Very good	Very Practical
51 - 75	Good	Practical
25 - 50	Not enough	Not practical
0 - 25	Very less	Very Impractical

## RESULT

Assessment of the validity of stem-loaded teaching modules with PBL learning models by 1 material expert, 1 linguist, and media expert.

The material validity test was conducted by Mrs Anisa Yuni Pertiwi, M.Pd. This material validation was carried out with the aim of knowing the suitability of the material in ethnoscience-loaded teaching materials with material on the form of substances and their changes. The validation instrument used is divided into 15 with 4 alternative answers. The score obtained in the material validation test was 58. based on these results, the overall validity interpretation in the material validity test obtained a value of 0.91 with a high classification.

Prof. Dr Arief Yulianto, S. E, M.M lecturer at the Faculty of Economics and Business at Semarang State University, as a language validation test expert. The instrument used in the language validity test is a questionnaire which is divided into 14 questions with 4 alternative answers. This activity was carried out once. The language feasibility test was

carried out with the results of ethnoscience-loaded teaching materials with material on the form of substances and their changes developed can be used without revision. The score obtained from the language validity test is 53 with a high classification.

The third validity test was the validity of the media conducted by Prof. Dr. Tri Joko Raharjo, M. Pd as a lecturer at the Postgraduate Program at Semarang State University. The questionnaire filled in as an instrument of media validity test consists of 13 questions with 4 alternative answers. The score obtained from the media validity test was 50 with a high classification. The conclusion from the results of the validity test of ethnoscience-loaded teaching materials with material on the form of substances and their changes developed can be used without revision.

**Table 3 Media Validity Test Calculation Results**

Expert	Amount Question	The score Obtained	Aiken V	Category
Materials	15	56	0,91	High
Linguist	14	53	0,92	High
Media	13	50	0,94	High
Average			<b>0,92</b>	<b>High</b>

## DISCUSSION

There has been previous research on the development of ethnoscience-based teaching materials. Research conducted by Melawati & Farida (2022) on the development of ethnoscience teaching modules, which are both conducted at the elementary school level. The difference lies in the material taught in previous studies using ecosystem material for class IV in ethnoscience materials integrated with zoo tours in the surrounding environment, namely the Surabaya Zoo. Whereas in this study took material on the form of substances and their changes for grade IV in ethnoscience-charged teaching materials taken local wisdom.

In this teaching material, students are asked to seek their own knowledge through various activities in the teaching material. In accordance with the opinion of Harackiewicz et al. (2016) which states several efforts to

stimulate student involvement in learning activities, including; providing activities that use structural features (problems, challenges, and surprises) and providing academic content and tasks that facilitate the relationship of academic topics with student interests. The material on the form of substances and their changes applied in the Independent Curriculum IPAS subject is still difficult for students to understand the material, so there is a need for special teaching materials to make it easier for students.

In accordance with the opinion of Kustandi & Darmawab (2020), which states that there are characters that must be fulfilled by teaching materials, including self-instruction (independent learning) and self-contained (intact). The teaching module can be understood by students without or with the help of others and all learning materials have been packaged as a whole in the teaching

module, easy for students to learn. Teaching materials with ethnoscience material on the form of substances and their changes can be studied by students independently and can be accessed anytime and anywhere.

This ethnoscience-loaded teaching material aims to make students understand more about the local wisdom of their region, besides that it can also help students easily understand the material. This is in accordance with Syofyan et al (2019), which states that learning materials should contain material that is tied to the real world around the student's environment so that teachers can more easily provide examples in learning activities so that students can understand them.

The validity of ethnoscience-based teaching materials is obtained from the calculation of the questionnaire scores of material experts, linguists, and media experts. Material validation is carried out by one expert who has understood and experienced in the material of the form of substances and their changes. The score given by the material expert was 0.91 with a high classification (very valid). Teaching modules that have been valid in terms of material illustrate that the ethnoscience-based teaching materials developed are suitable for implementation in grade IV Elementary School and the existing material is suitable for use in learning to improve students' science literacy skills.

Language validation of ethnoscience-based teaching materials resulted in an average score of 0.92 with a high classification (very valid). Language validation of the teaching modules produced was carried out by lecturers who actively teach at Semarang State University. The stem-loaded teaching module with the PBL learning model developed uses Indonesian language adapted to EYD. Jannah (2021) stated that the use of Indonesian language based on EYD in designing learning media is very helpful to facilitate readers or the use of learning media developed.

Media validation conducted on ethnoscience-based teaching materials obtained a score of 0.94 with a high classification (very valid). Designing

learning media for students, especially elementary school students, should display many interesting images so that students are interested and focused on the learning process. Based on the results of Mahardika's research (2021) which obtained the results of images or illustrations should be in learning media to motivate students and foster students' curiosity about the material being taught.

Research conducted by Rahma & Azhar (2021) who developed a module using Aiken V to measure the level of feasibility. In previous studies, the average content feasibility component was 0.84 with a high validity category, the average module presentation component was 0.86 with a high validity category, the module language component was 0.85 with a high validity category, and the module graphic component was 0.90 with a very large validity category. In previous research, the development of inquiry-based modules by conducting 4 assessments (validators) there are content feasibility, presentation components, language components, and graphic components. Whereas in this study the development of teaching modules with ethnoscience content using 3 assessments (validators) there are media experts, linguists, and material experts.

In line with research conducted by Mulyono, Heri et al, (2021) who used learning media using Aiken V validity analysis. the validity test was carried out by 3 material expert validators and 3 media expert validators. The media expert validator obtained 0.944 in the valid category and the media expert validator was 0.895 in the valid category. The difference is that in previous studies the development of learning media using media and material expert validators only, while in this study the development of teaching materials using linguist validators.

The results of the posttest of 91 were influenced by learning that used teaching materials in the form of ethnoscience-laden teaching modules. Devi et al (2020) 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 listen less to the material taught by the teacher.

The development of ethnoscience-laden teaching materials for elementary school students that have been carried out in this study has proven feasible to use in learning IPAS material on the form of substances and their changes and proven effective in improving science literacy based on the results of pre-test and post-test scores obtained by students. Student creativity can be further developed through the integration of local wisdom or science phenomena that are close to everyday life Hastuti et al. (2023).

User responses, both from teachers and students to the ethnoscience teaching module on the material of the form of substances and their changes are in the 'Very Practical' category.

This research was conducted to prove the practicality of ethnoscience teaching modules on the material of the form of substances and their changes to improve students' science literacy. The material of the form of substances and its changes is suitable with the research objectives of improving students' science literacy. This is in accordance with the opinion of Muhammad, et al., (2022) which states that the material of substances and their changes can improve students' science literacy, while Situmorang, (2016) states that through the material of substances and their changes students will be in direct contact with their environment so that students can easily conclude problems found in everyday life and in the process of solving problems students need good science literacy skills.

Hikmawati et al (2020) stated that local wisdom-based teaching materials not only get positive responses from students, but also improve the quality of student learning outcomes, as well as student science literacy. Research conducted by making ethnoscience-based teaching materials related to local wisdom received a response

from teachers with a value of 100% which is in the very practical category and a response from students with a value of 90% in the very practical category so as to make student learning outcomes and science literacy increase. Students will be active in making the project.

## CONCLUSION

The conclusions of the research on the development of teaching modules with ethnoscience content are:

1. The characteristics of ethnoscience-loaded teaching materials are: a) in the form of link-based non-print teaching modules; b) ethnoscience-loaded teaching modules that take local wisdom.
2. The ethnoscience teaching materials produced are in the very valid category, which is obtained from the assessment of validators or experts (media, language, and material experts).
3. The resulting ethnoscience-loaded teaching materials are effective with the n-gain value obtained on average of 80.2 with the effective category.
4. The ethnoscience teaching materials produced are very practical, obtained from teacher responses with a value of 100% and student responses with a value of 90% with a very practical category.

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