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Development of Ethnoscience Based Science Learning Module and Science Literacy for Junior High School Students

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Abstract:
This research aims to develop ethnoscience-based science learning module and science literacy for grade VIII students. This module development uses the Research and Development (R&D) model by adapting the steps of the 4D model, which includes (Define, Design, Develop, Dessimination). In this study, data were collected through observation, interviews, questionnaires, and documentation. The developed module was validated by material experts, media experts, LKPD experts, and readability experts who each provided an assessment of the relevant aspects. The results of validation by material experts, media experts, LKPD experts and readability experts showed 100% feasibility. The results of student responses showed very good results of 88.10%. Students who use this module are better able to connect scientific knowledge with the context of science which is an important indicator in the ability to think critically, analytically, and creatively. The results of this study indicate that ethnoscience and science literacy-based modules are not only effective in improving understanding of material concepts, but also strengthening higher-order thinking skills that are needed in facing the challenges of today.

Keywords: *Etnosains, Science Literacy, Grade VIII Students, Module Development, Science*

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Introduction

Natural science is a branch of science that studies natural phenomena through facts, concepts, and laws through a series of scientific method activities (Maulina et al, 2021). In the implementation of learning activities cannot be separated from the use of teaching materials, teaching materials are all materials in the form of information, text or tools that are systematically arranged to achieve learning objectives. Teaching materials can be in the form of teaching modules, the use of modules as teaching materials is an effective learning resource to instil independence in students, because modules are arranged systematically so that they allow students to learn at any time with little guidance from the teacher (Prastowo, 2016).

Science learning needs to integrate an approach that is able to connect scientific concepts with students' daily lives. The ethnoscience approach is a learning strategy that combines learning experiences with cultural elements. Every culture has knowledge embedded in it, which is often referred to as indigenous science. Through the ethnoscience approach, students can develop an appreciation for nature and culture in society as well as apply science knowledge in accordance with the technology they master. This will improve their ability to use scientific knowledge to overcome various challenges in everyday life (Arifatun, 2015). Through ethnoscience learning, students are guided to connect subject matter with everyday life, integrating science and technology. Thus, learning at school not only provides benefits in the field of science, but also in practical life. This opens up the possibility to better understand the relationship between science, technology and society (Agnes, 2017).

Science literacy is the ability to understand scientific concepts and processes needed to make evidence-based decisions in everyday life. In science learning, science literacy is very important because it helps learners develop critical, logical, and analytical thinking towards natural phenomena that occur around them. Ethnoscience-based modules and science literacy are very suitable to be applied in learning, because this approach combines traditional knowledge with modern science (Sudarmin, 2015). By using modules, students can learn independently and repeat lessons at any time. Modules will be more interesting for students if the material is relevant to their daily lives and the surrounding environment.

The use of modules is very appropriate to use in the learning process because it can improve students' understanding of concepts, well-designed modules can help students understand scientific concepts better, through the presentation of structured information and clear learning steps, modules can help students gain a deeper understanding of science concepts. Modules can develop students' critical thinking skills and provide opportunities for students to learn independently. By accessing the module independently, students can manage their own study time, repeat difficult material, and overcome their own difficulties, this can build students' independence in learning and improve their science literacy. Modules can help students experience science concepts first-hand. Through this practical experience, students can gain a stronger understanding of science concepts and relate them to the real world.

Based on the results of interviews conducted by researchers with science teachers in one of the schools in the Kediri area, it shows that there are several problems in the learning process, namely, teachers are too fixated on textbooks provided by schools and LKS from publishers, which are often thick and less innovative. The textbooks used in learning are purchased from publishers, not the result of direct innovation from teachers, which can lead to imbalances in the learning process. This results in limited development of students' science literacy and reliance on limited resources. In addition, the lack of innovation in learning can hinder students' science

literacy development, as innovative and diverse learning can help students to actively engage, apply critical thinking and better develop science literacy skills.

Previous research has also shown that the integration of ethnoscience and science literacy in learning can significantly improve literacy, understanding of scientific concepts, and critical thinking skills. Studies such as those conducted by (Mardianti et al., 2020), (Lubis et al., 2021), and (Muizz et al., 2023) show that ethnoscience-based approaches are effective in improving science literacy, making them relevant and important in the context of developing science education in the 21st century. These findings support the need for the development of science learning modules that integrate ethnoscience and science literacy, particularly in additive and addictive substances, to address shortcomings in existing teaching materials and effectively improve students' science literacy.

In this context, it is important to encourage teachers to involve themselves in the development of innovative and relevant learning materials and provide students with greater access to diverse sources of information. Thus, students' science literacy can be improved through teachers' literacy development and a more holistic learning approach. Based on the above description, researchers need to conduct a study on science learning modules. Modules are teaching materials that are arranged in simple language so that students can easily understand them according to their level of knowledge. This module is an alternative for students to learn independently without direct guidance from the teacher. With innovations such as ethnoscience-based modules and science literacy in science learning, it is expected to increase students' interest in learning.

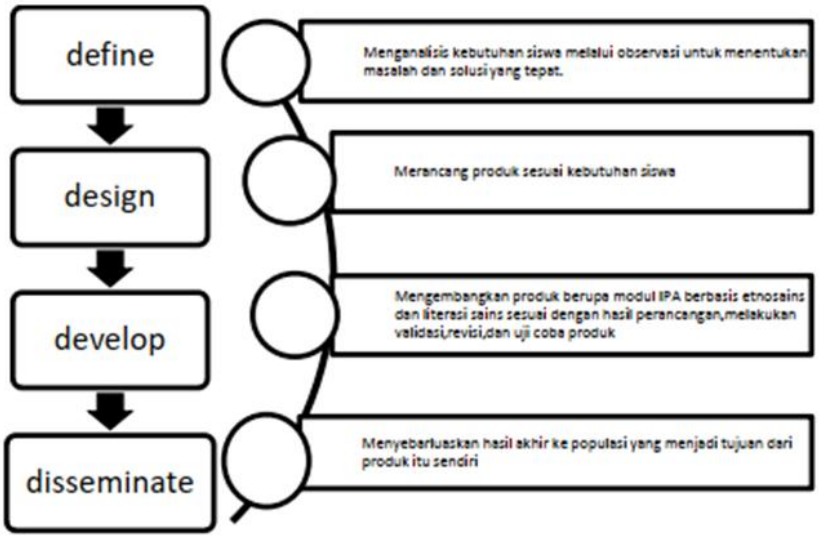
Unbalanced learning can result in injustice in the education process. When learning is unbalanced, some important aspects of education may not be given enough attention while others dominate. For example, if the focus is only on mastering knowledge and information, critical thinking, creativity and practical skills may be neglected. Similarly, if learning is only centred on academic intelligence, emotional, social and physical aspects may be neglected. Therefore, by using an ethnoscience and science literacy-based science learning module, the unbalanced approach can be overcome and students can develop their full potential according to their individual diversity. This module allows students to learn with their cultural context, encourages active engagement, and develops their intelligence and skills in science.

Based on previous studies, the researcher decided to develop an ethnoscience and science literacy-based module that is expected to provide solutions to the above problems. This ethnoscience and science literacy-based module is expected to serve as a tool to support effective learning activities in the classroom, and can provide variety and innovation in the development of learning media.

Methods

This study uses a research and development method, known as Research and Development (R&D), by applying the 4D development model proposed by Thiagaraja in 1974. Research and Development (R&D) is a research approach used to develop specific products and test their effectiveness in an educational context (Haryati, 2013). This research procedure applies the 4D development model, which involves steps to realise product design, particularly teaching materials. The development steps in this study include the creation and modification of teaching materials in accordance with the

guidelines presented by Cahyadi (2025). The following are the stages of activity contained in the 4D model consisting of:



Data is collected through observation, interviews, questionnaires, and documentation. Teaching materials that have been developed must be validated and tested. Teaching materials are validated by lecturers and science teachers who have competence in their fields, which include material experts, media experts, LKPD experts, and readability experts. This stage shows the connection they learn with their daily situation when answering (Atika, 2024). The purpose of the validity test by this team of experts is to determine whether the module that has been made is feasible and suitable for use. If there are deficiencies or discrepancies based on the theory and input from the validators, the module will be revised. The following formula calculates the total number of validation scores and student responses, the answers from respondents are calculated using the method described by Sugiyono (2014) as follows:

$$\text{Score (\%)} = \frac{Total\ score\ obtained}{Maaximum\ score} \times 100\%$$

Clculating the average score :

$X = \frac{\sum_1^n 1xi}{n}$

X = Average

$\sum_1^n 1xi$ = Total number of scores

n = The number of scores

The calculation is used for each question in the questionnaire and validation in calculating the percentage of all aspects of the indicator on the assessment for learning media.

Results and Discussion

Table 1. Validation Creteria

Description	Score
Yes	1
No	0

Researchers compiled a validation sheet with statements which were then assessed by validators using a Guttman scale-based questionnaire consisting of 2 yes and no assessment scores. The percentage of evaluation results was then converted into the criteria value listed in the following table:

Table 2. Creteria for module validity (Akbar, 2013)

Eligibility Creteria	Level of Feasibility
80,01% - 100%	Very valid, or can be used without revision
70,01% - 80%	Moderately valid, or can be used but needs minor revisions
50,01% - 70%	Less valid, recommended not to be used because it is not feasible
1% - 50%	Not valid or should not be used

After being validated and revised, the module was tested in the field involving 29 class VIII students as samples to test the effectiveness of the product. The assessment instrument applied is a questionnaire that will be filled in by students after using the module. This process is part of the evaluation to assess the effectiveness of the module based on feedback from users. The percentage of student response results is then converted into the criteria value listed in the following table:

Table 3 Module eligibility creteria

Eligibility Criteria	Feasibility Level
70,01% - 100%	Very feasible, or can be used without revision
50,01% - 70%	Feasible, or can be used but needs minor revisions
30,01% - 50%	Fairly feasible, or can be used but needs some/partial revision
20,1% - 30%	Less feasible, recommended not to be used because it is not feasible
1% - 20%	Not feasible or should not be used

Presentation of Trail Data

This research focuses on the results of the development of ethnoscience-based science learning modules and science literacy for grade VIII students. The development of this module refers to the 4D model which consists of defining, designing, developing, and disseminating stages.

1. Define

   Based on the results of the initial analysis at the define stage, it was found that class VIII students in one of the schools in Kediri have a rich and diverse cultural background that can be integrated in learning through an ethnoscience approach. This is in line with the theory of contextual learning which emphasises the importance of linking the subject matter with students' daily experiences (Johnson, 2002). The main purpose of this stage is to understand the problem that needs to be solved and set the objectives to be achieved through the module as teaching material. The results of this analysis will be the basis for developing modules for learning. To obtain information about the problems that occur, researchers conducted observations in the school environment. The results of the observation showed several problems encountered during the teaching and

learning process, namely: Obstacles in understanding and mastering subject matter, especially in science subjects, teaching materials used by teachers in the form of LKS are less interesting, students are less aware of the surrounding environment, and student learning outcomes are lacking.

2. Design

In the design stage, the module structure was prepared by combining scientific concepts with local wisdom and science literacy. the goal is to develop a product that is suitable for overcoming problems that arise during the teaching and learning process. Researchers designed the product to be developed, the final result of which was a learning module. The material in the module is designed so that students can understand concepts through a cultural context that is familiar to them, such as the use of additives in traditional foods. Research by Aikenhead (1996) supports this approach by stating that cultural integration in science learning can increase relevance and student engagement. The design stage includes: Media selection, format selection, and initial design.

3. Develop

At the develop stage, the designed module was validated by experts and trialled on a small group of students. The validation results showed that the module had good quality in terms of content, language, and presentation. The limited trial also showed that students understood the material more easily and were more interested in learning. This finding is supported by Tytler's (2007) research, which states that the use of relevant contexts in science learning can improve students' concept understanding and learning motivation. Validation of material experts, media experts, LKPD experts, and readability experts conducted by lecturers from the science department, After going through the validation process by material experts, media experts, and LKPD experts, the Ethnoscience-based science module and scientific literacy developed has received strong recognition of the structure and accuracy of the material, media, and LKPD presented. A decent product must be valid from the aspects of title, examples or illustrations, images/photos/videos, language, activities 1, 2, and 3 on the aspects of depth/ breadth of material, correctness of material concepts, currency of material, contextuality of each material (Atika, 2022).

Material experts, media experts, and LKPD experts gave positive responses to the clarity of learning objectives for each chapter, as well as the systematic organisation of complex scientific concepts. They highlighted the need to consider variations in students' learning styles in the presentation of the material, as well as emphasising the importance of using relevant examples and illustrations to support understanding. In addition, the validators provided suggestions to improve the interactivity of the module, such as through the addition of problem-based tasks and simple experiments. With this feedback, we have adopted the necessary changes to ensure that the developed science module can provide a more meaningful and in-depth learning experience for students.

After undergoing the validation process by readability experts on the Ethnoscience and Science Literacy-based Science module, the readability expert validators provided feedback and comments, particularly in terms of emphasis on readability, clarity of material and feasibility of module design where validators responded to the need to clarify some complex scientific concepts and suggested presenting data in a more visual format. In addition, they also provided feedback on how to construct a more engaging and relevant narrative. With this feedback, we

have made the necessary adjustments and are confident that our materials are ready to be published with better quality and comprehensible to readers.

4. Disseminate

   The final stage, disseminate, involved distributing the module to all grade VIII students and training teachers on how to implement the module in learning. Implementation in the classroom showed that students showed significant improvement in concept understanding, as well as positive attitudes towards science learning. These results are consistent with Hurd's (1998) findings which emphasise that science literacy developed through contextualised and relevant approaches can improve students' overall scientific competence. The dissemination process involves a series of stages starting with the introduction of the concepts and module content to learners through a group of students gathered to study, discuss, and work together in developing skills or knowledge on a particular topic.

The development of this ethnoscience and science literacy-based science learning module succeeded in improving the quality of learning in a more meaningful and contextual way for students. This shows that the integration of local wisdom in science learning not only enriches the subject matter, but also increases students' engagement and understanding, which ultimately contributes to better learning outcomes.

Analysis

The development of Ethnoscience and Science Literacy-based science modules on additives and addictive substances begins with observations in one of the schools in Kediri where the problems faced by schools in improving students' understanding of learning are often related to the lack of effective approaches in teaching, especially in the field of science. Learning resources available in schools are often inadequate, where students only rely on handbooks provided by teachers. These books are often considered less interesting and difficult to understand by students, thus hampering the learning process. This is where the application of Ethnoscience and Science Literacy-based modules is important. Existing teaching modules in schools usually focus on delivering scientific facts and concepts in a linear and less contextualised manner. In contrast, Ethnoscience-based modules are designed to connect the subject matter with relevant and real science issues. This approach not only makes learning more interesting and meaningful for students, but also encourages them to develop critical, analytical and creative thinking skills.

The Ethnoscience module facilitates discussion and collaboration, helps students relate scientific knowledge to the context of science, and strengthens communication and teamwork skills. Therefore, the Ethnoscience and Science Literacy-based module is more effective in improving students' understanding and engagement compared to the conventional teaching module currently used in schools.

Based on the analysis of the data obtained, the module is designed to facilitate students in identifying, analysing, and evaluating additives and addictive substances that are complex and relevant to daily life. The data showed that the use of the Ethnoscience and Science Literacy module significantly improved students' engagement and motivation, which was reflected by an increase in their Literacy test scores. Students using this module were better able to connect scientific knowledge with the

context of science, which is an important indicator of critical, analytical, and creative thinking skills. In addition, the Ethnoscience-based learning method encourages discussion and collaboration in class, so that students can develop good communication and teamwork skills. The results of this study indicate that the Ethnoscience and Science Literacy-based module is not only effective in improving the understanding of material concepts, but also strengthening the higher-order thinking skills that are needed in facing the challenges of today.

Material, media, LKPD, and readability expert validation results.

Tabel 4. Result of expert validation of material, media, LKPD, and readability

Validator	Percentage of Feasibility	Category
Material expert	100%	Very Valid
Media expert	100%	Very Valid
Expert of LKPD	100%	Very Valid
Readability expert	100%	Very Valid

Based on table 1, the results of validation by material experts, media experts, LKPD experts, and experts have a feasibility percentage of 100% with a very feasible category. The percentage of module feasibility from the material expert's point of view can be calculated by adding up the values given by the material expert for each aspect assessed. This total value is then divided by the maximum number of values that can be achieved for all points evaluated in the table. From this calculation, a percentage of feasibility is obtained which reflects the level of acceptance or validity of the module in terms of material, indicating how well the module is assessed by the material experts involved in the validation.

The development test conducted was a module trial in class VIII which was selected as the trial sample. Data collection was conducted through observations, interviews, and questionnaires to evaluate students' responses to this ethnoscience and science literacy-based teaching module. The results of this evaluation were then analysed to determine the success of the module. The results of student responses showed excellent results of 88.10%. Students who use this module are better able to connect scientific knowledge with the context of science which is an important indicator in the ability to think critically, analytically, and creatively. This is in accordance with research (Ahmadi et al., 2019) which emphasises that modules that combine traditional knowledge with modern science not only improve cognitive learning outcomes but also the affective aspects of students. In addition, (Rahman et al., 2023) underlined that ethnoscience-based learning can improve problem solving and critical thinking skills. The results of this study indicate that ethnoscience-based modules and science literacy are not only effective in improving the understanding of material concepts, but also strengthening higher-order thinking skills that are needed in facing the challenges of today.

Conclusion

The development of science learning modules based on ethnoscience and science literacy has proven to be very valid and effective for use in the learning process. This module successfully integrates scientific concepts with local cultural contexts, thus increasing relevance and student engagement. Based on expert validation (material, media, LKPD, and readability), all aspects of the module obtained a 100% feasibility percentage with a very valid category. The field trial also showed positive responses from students, with a response percentage of 88.10%, reflecting increased interest and understanding. This module not only strengthens the understanding of material

concepts, but also encourages the development of students' critical, analytical, and creative thinking skills. Thus, this module can be an innovative solution in contextualised science learning and support the improvement of science literacy for junior high school students.

References

Ariningtyas, A., Wardani, S., & Mahatmanti, W. (2017). Efektivitas lembar kerja siswa bermuatan etnosains materi hidrolisis garam untuk meningkatkan literasi sains siswa sma. Journal of Innovative Science Education, 6(2), 186-196.

Anggraini, A., Rahmawati, L., & Adiwibowo, D. (2024). Pengaruh Metode Pembelajaran Kooperatif Tipe Think Pair Share (TPS) Berbasis ICT terhadap Hasil Belajar Siswa pada Materi Sistem Reproduksi Tumbuhan. *International Conference on Education,* Institut Agama Islam Negeri Kediri.

Anggraini, A., Rahayu, S., & Sapta, M. Pengembangan E-modul Berbasis Problem Based Learning pada Materi Kadar Hormon Leptin pada Tikus Hiperglikemik. *Jurnal Pendidikan Sains Indonesia* 10(2):202-217

Nisaâ, A., Sudarmin, S., & Samini, S. (2015). Efektivitas penggunaan modul terintegrasi etnosains dalam pembelajaran berbasis masalah untuk meningkatkan literasi sains siswa. Unnes Science Education Journal, 4(3). Prastowo, A. 2016. Pengembangan Bahan Ajar Tematik. Jakarta: Kencana

Maulina, I., Kusuma, H. H., & Faqih, M. I. (2021). Pengembangan ensiklopedia alat ukur fisika sebagai sumber belajar untuk siswa SMP/MTs. Physics Education Research Journal, 3(1), 53-64.

Sudarmin, S., Si, M., & Pd, M. (2014). Pendidikan karakter, etnosains dan kearifan lokal. Semarang. CV. Swadaya Manunggal.

Muizz, A. M. A., & Prahani, B. K. (2023). Literature Review: Penggunaan Modul IPA Berbasis Etnosains untuk Meningkatkan Literasi Sains Pada Siswa SD. Jurnal Elementaria Edukasia, 6(4), 1905-1914.

Lubis, M. F. (2021). Pengembangan Modul Pembelajaran IPA Berbasis Etnosains Untuk Melatih Kemampuan Literasi Sains Siswa SMP (Doctoral dissertation, UIN Fatmawati Sukarno).

Mardianti, I., Kasmantoni, K., & Walid, A. (2020). Pengembangan modul pembelajaran IPA berbasis etnosains materi pencemaran lingkungan untuk melatih literasi sains siswa kelas VII di SMP. Bio-Edu, 5(2), 97-106.

Ahmadi, Y., Astuti, B., & Linuwih, S. (2019). Bahan ajar IPA berbasis etnosains tema pemanasan global untuk peserta didik SMP Kelas VII. UPEJ Unnes Physics Education Journal, 8(1), 53-59.

Rahman, A., Suharyat, Y., Ilwandri, I., Santosa, T. A., Sofianora, A., Gunawan, R. G., & Putra, R. (2023). Meta-Analisis: Pengaruh pendekatan STEM berbasis etnosains terhadap kemampuan pemecahan masalah dan berpikir kreatif siswa. Innovative: Journal of social science research, 3(2), 2111-2125.

Haryati, S. (2012). Research and Development (R&D) sebagai salah satu model penelitian dalam bidang pendidikan. Majalah Ilmiah Dinamika, 37(1), 15.

Cahyadi, F., Zainuddin, M., & Arifin, S. (2025). Pengembangan E-Modul Etnomatematika Batik Berbasis PjBL untuk Meningkatkan Kemampuan Berpikir Kritis Siswa Sekolah Dasar. Briliant: Jurnal Riset Dan Konseptual, 10(1), 59-68.

Akbar, S. (2013). Instrumen Perangkat Pembelajaran (Vol. 53, Issue 9). PT Remaja Rosdakarya.

Sugiono. (2017). Metode Penelitian dan Pengembangan Research and Development.

Bandung : Alfabeta Bandung.

Johnson, M. J. (2002). The Medication Adherence Model: a guide for assessing medication taking. Research and theory for nursing practice, 16(3), 179.

Aikenhead, G. S. (1996). Science education: Border crossing into the subculture of science.

Tytler, R. (2007). Re-imagining science education: Engaging students in science for Australia's future. Teaching Science, 53(4), 14-17.

Hurd, P. D. (1998). Scientific literacy: New minds for a changing world. Science education, 82(3), 407-416.