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Development of An Ethnoscience Module on the Environmental Pollution Theme to Improve Community Early Literacy

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ABSTRACT

Early literacy skills are crucial foundational abilities necessary for a more meaningful life. The low levels of early literacy within society must be addressed to foster good literacy habits. Developing an ethnoscience module themed around environmental pollution can help improve community early literacy skills. This study aims to (1) assess the validity of the ethnoscience module on environmental pollution, (2) evaluate the practicality of the ethnoscience module on environmental pollution, and (3) determine the effectiveness of the ethnoscience module on environmental pollution. The research employs the ADDIE methodology: (analysis) problem analysis, (design) module design, (development) module development, (implementation) module implementation, and (evaluation) module evaluation. The study's findings indicate that (1) the ethnoscience module on environmental pollution is highly valid with a score of 87.81%, (2) the module is very practical with a score of 90,97%, and (3) the module is highly effective, achieving an N-Gain score of 0.8 and a community response rate of 86.25% in the very good category. The research and development results conclude that the ethnoscience module on environmental pollution can significantly enhance early literacy skills in the community.

***Keywords*:**

Early Literacy; Ethnoscience; Environmental Pollution.

ABSTRAK

Kemampuan literasi dini merupakan kemampuan dasar yang perlu dimiliki untuk menunjang kehidupan yang lebih berarti. Kemampuan literasi dini yang masih rendah dikalangan masyarakat perlu ditingkatkan untuk menanamkan kebiasaan literat yang baik. Pengembangan modul etnosains

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dengan tema pencemaran lingkungan dapat digunakan untuk meningkatkan kemampuan literasi dini masyarakat. Tujuan penelitian ini yaitu (1) mengetahui validitas modul etnosains tema pencemaran lingkungan, (2) mengetahui kepraktisan modul etnosains tema pencemaran lingkungan dan (3) keefektifan modul etnosains tema pencemaran lingkungan. Metode penelitian yang digunakan yaitu ADDIE (analysis) tahap analisis permasalahan, (design) tahap desain modul, (developmen) tahap pengembangan modul etnosains tema pencemaran lingkungant, (implementation) tahap implementasi modul, dan (evaluation) tahap evaluasi modul. Hasil penelitian ini menunjukkan bahwa (1) validasi modul etnosains tema pencemaran lingkungan mendapat hasil akhir sebesar 87,81% dalam kategori sangat valid, (2) kepraktisan modul etnosains tema pencemaran lingkungan mendapat hasil akhir 90,97% dalam kategori sangat praktis, dan (3) efektifitas modul etnosains tema pencemaran lingkungan mendapat hasil N-Gain sebesar 0,8 dengan kagori tinggi dan respon masyarakat sebesar 86,25% dengan kagori sangat baik. Berdasarkan hasil dari penelitian dan pengembangan modul yang dilakukan didapatkan kesimpulan bahwa modul etnosains pencemaran lingkungan dapat meningkatkan kemampuan literasi dini masyarakat.

***Kata kunci*:**

Literasi Dini; Etnosains; Polusi Lingkungan.

1. Introduction

Kemiri Village is one of the villages in the Panti District of Jember Regency. The village is situated on the slopes of Mount Argopuro, and it is known for several tourist areas and coffee processing factories. The head of Kemiri Village mentioned that the village's proximity to tourist spots negatively affects the local environment, with significant pollution, such as plastic trash scattered throughout residential areas and into waterways, and factory smoke polluting the surrounding air. Most of Kemiri Village's residents work as laborers on coffee plantations, facing difficult access due to the area's susceptibility to landslides. The distance to schools is also considerable, posing a challenge for the community, especially for children, in obtaining an education. The challenging accessibility restricts the community's mobility, impacting the overall quality of life for the village residents (Ceder, 2021).

Based on the conditions in Kemiri Village, one of the impacts is the low early literacy skills among the community due to difficult accessibility (Yoshikawa et al., 2020). This situation is exacerbated by the community prioritizing work over cultivating a literacy culture, resulting in a high illiteracy rate. The low early literacy skills are also due to several other factors, including inadequate reading facilities, an environment that does not support reading interest, and difficult access to literacy support facilities (Heikka, Pitkäniemi, Kettukangas, & Hyttinen, 2021).

Early literacy skills are essential for children's lives. Possessing early literacy skills helps cultivate and form a good literacy tradition. Parents, teachers, and the entire community must understand early literacy skills (Tatminingsih, 2022). Early literacy skills refer to what children know about reading and writing before they learn to read and write. Early literacy skills do not mean teaching reading but rather fostering a love for reading and building a reading foundation so that when children start to read, they are more prepared (Teale, Whittingham, & Hoffman, 2020). Early literacy skills consist of six interrelated indicators: Print Motivation, Phonological Awareness, Vocabulary, Narrative Skills, Print Awareness, and Letter Knowledge.

Early literacy skills in the community can improve with proper guidance. Building a reading foundation enhances early literacy skills, ensuring children are ready to learn when the time comes (López-Escribano, Valverde-Montesino, & García-Ortega, 2021). Instilling early literacy skills can be done by fostering reading habits from an early age. These habits can be developed through storytelling by parents or close relatives. Improving early literacy skills may include introducing the local environment through modules related to local potential and culture. A module serves as a tool for learning (Seruni, Munawaroh, Kurniadewi, & Nurjayadi, 2020). A module related to local culture can be referred to as an ethnoscience module. Local culture is closely related to local wisdom in an area. When learning is connected with ethnoscience, students are more interested in understanding the material as it directly relates to their surroundings. Ethnoscience-based learning helps students better understand their environment (Ardianti & Raida, 2022). Ethnoscience connects scientific and indigenous knowledge (Sotero, Alves, Arandas, & Medeiros, 2020).

An ethnoscience module serves as a learning medium with content related to local culture, providing readers with an understanding of the science around them. An example of an ethnoscience module for Kemiri Village, considering its environmental conditions and local culture, is a module on environmental pollution. This module would address the environmental conditions in Kemiri Village, including soil pollution due to scattered plastic waste, water pollution from factory waste and plastic waste in waterways, and air pollution from factory smoke. Incorporating an ethnoscience module into educational activities can enhance their effectiveness, thereby improving the community's early literacy skills (Jihannita, Fadly, Ekapti, Luthfiana, & Widowati, 2024).

Developing an ethnoscience module is essential for parents to instill a good literacy tradition. Using an ethnoscience module helps improve early literacy skills related to local culture. Previous research indicates that modules based on local culture can create an effective learning environment (Nambiar et al., 2020). The developed module will serve as an additional facility to support literacy and will be placed in a village literacy corner. Researchers have noted that having literacy support facilities enhances early literacy skills (Ardoin & Bowers, 2020).

Previous research suggests that developing modules based on local culture can support students' interest in understanding science concepts (Aminatun et al., 2022). A local culture-based module that connects science concepts with natural phenomena around students can improve their understanding, thus enhancing early literacy skills in the community. (Pela, Le, Kaboro, & Nurjamil, 2023). Given

the issue of low early literacy skills in the community, there is a need for the "Development of an Ethnoscience Module on Environmental Pollution to Improve Early Literacy Skills in the Community".

The development of this module aims to assess the validity of the ethnoscience module on environmental pollution in enhancing early literacy skills in Kemiri Village, the practicality of the module for this purpose, and its effectiveness in improving early literacy skills in the community.

2. Methods

This research uses the research and development (R&D) method as described by Safitri, Sari, & Gamayuni (2019), which involves a series of systematic steps to develop and validate educational products. The population of this study is the village of Kemiri, with a research sample of 10 people, selected through purposive sampling based on Salendab & Akmad's (2023) theory, which states that purposive sampling allows researchers to choose the sample that best supports the research objectives. The research design used is the ADDIE model (Analysis, Design, Development, Implementation, and Evaluation) (Adri, Ganefri, Sri Wahyuni, Zakir, & Jama, 2020). The ADDIE model is employed in this study and consists of five stages: analysis, design, development, implementation, and evaluation (Sahaat, Nasri, & Abu Bakar, 2020). The research and development procedure using the ADDIE model is outlined as follows: 1) Analyze the issues faced by the community in Kemiri Village regarding their low early literacy skills through interviews with the village head and community leaders. 2) Design the ethnoscience module on the theme of environmental pollution, incorporating material components from the local environment and culture of Kemiri Village using Microsoft Word with Canva design assistance (Zakiyah & Sudarmin, 2022). 3) Develop the ethnoscience module on the theme of environmental pollution to facilitate the community in enhancing their early literacy skills. 4) Implement the ethnoscience module on environmental pollution, specifically targeting women in the community, particularly mothers, to be used as a medium to improve early literacy skills in children (Novitasari, Prahani, & Suryanti, 2023). 5) Process data based on responses from community questionnaires to determine the validity and effectiveness of the ethnoscience module as well as the early literacy skills of the community. The data analysis is conducted according to the criteria of each aspect to assess validity, practicality, and effectiveness.

2.1 Validity

The validity of the module is assessed by three validators using the following formula:

$$P = \frac{\sum X}{\sum Xi} \times 100\%$$

Table 1. Criteria for Module Validity

Percentage	Validity criteria
81%-100%	Very valid
61%-80%	Valid
41%-60%	Fairly valid
21%-40%	Less valid

0%-20%	Not valid

(Komikesari et al., 2020)

2.2 Practicality

The practicality of the module is determined based on observations during the learning process. The ethnoscience module is considered practical if it meets the criteria of practical or very practical, using the following formula:

$$P = \frac{Score\ obtained\ for\ an\ item}{Maximum\ score} \times 100\%$$

Table 2. Criteria for Module Practically

Percentage (%)	Practicality Criteria
80,01-100,00	Very practical
60,01-80,00	Practical
40,01-60,00	Fairly practical
20,01-40,00	Less practical
00,00-20,00	Not practical

(Hasmawaty, Syam, & Saman, 2020).

2.3 Effectiveness

The module's effectiveness is assessed through test analysis to measure students' abilities. This study uses the N-Gain to determine the improvement in students' science literacy skills using the formula:

$$< g >= \frac{(Sf) - (Si)}{(100) - (Si)}$$

Table 3. N-Gain Test Criteria

Normalized N-Gain Score	Interpretation
-1≤ g ≤ 0,00	Decrease
G = 0,00	No change
0,00 < g < 0,30	Low
0,30 < g < 0,70	Medium
0,70 < g < 1,00	Hight

(Puspitasari, Hidayat, & Pritasari, 2021).

Additionally, the effectiveness of the module is assessed through community response questionnaires using the formula:

$$Percentage\ of\ community\ response = \frac{Proportion\ of\ community\ choosing}{Total\ community} \times 100\%$$

Table 4. Community Response Criteria

Percentage (%)	Category

85≤Score≤100	Very good
70≤Score≤84	Good
60≤Score≤69	Fairly good
50≤Score≤59	Less good
Score<50	Not good

(Sprenger & Schwaninger, 2021)

3. Results and Discussion

3.1 Analyze

Several issues and urgent needs were identified based on the research results in Kemiri Village. The village struggles to manage waste from tourists and factory effluents, while poor road access limits community activities. The majority of the residents work as coffee laborers and industrial factory employees. Low early literacy skills among the community hinder their ability to guide their children toward better education. The community needs practical literacy guidance to improve their skills. Currently, there are no available learning modules, and existing literacy training programs are ineffective. Therefore, an ethnoscience module addressing environmental pollution in Kemiri Village is needed. This module is expected to enhance early literacy and raise awareness of the importance of environmental preservation. With this module, the community is anticipated to better understand the importance of education and be able to guide their lives and their children's lives in a better direction while addressing existing environmental issues.

3.2 Design

The ethnoscience module design stage was carried out using the Canva Premium application. At this stage, the researcher designs from the cover, table of contents, concept map, and materials by indicators of early literacy abilities.

Figure 1. Cover

The module cover is designed with bright colors and bright ornaments to attract people's reading interest. On the cover, the author's title and name are displayed. The module includes six points that

detail indicators of early literacy skills. The first indicator is Print Motivation. Each discussion material within the module includes the Print Motivation indicator, as shown in Figure 2.

Figure 2. Motivation

The Print Motivation indicator aims to motivate readers to engage in activities related to the goals of developing this ethnoscience module.

Figure 3. Phonological Awareness

The next indicator is Phonological Awareness. This indicator contains stories related to the material presented on water, soil, and air pollution. This indicator includes ethnoscience values such as community habits in making eco enzymes, neglecting piles of trash around the house, and still believing in the myth of cutting down banyan trees. This indicator aims to enhance early literacy skills by presenting engaging stories encouraging readers to understand them enthusiastically.

Figure 4. Vocabulary

The next indicator is vocabulary. The development of vocabulary is crucial for early literacy in Desa Kemiri. Teaching the meaning of words in the appropriate context helps them understand and use words correctly

Figure 5. Narrative Skill

The Narrative Skill indicator is an important ability for early literacy in Desa Kemiri. Readers are taught to develop this skill by using images as aids.

Figure 6. Print Awareness and Letter Knowledge

Print awareness and letter knowledge are important aspects of early literacy and can be taught to the community in Desa Kemiri through engaging puzzles.

Figure 7. Activity

The ethnoscience module developed is also designed according to the material and needs of the community. At the end of the module, a project phase for making eco-prints is provided.

3.3 Development

The module development stage involves validation and revision of the resulting module as follows:

Table 5. Module Validation Results

No	Aspect	Score(%)			Percentage (%)	Criteria
		1	2	3		
1	Isi	81,25	81,25	81,25	81,25	Very Valid
2	Kebahasaan	87,50	93,75	81,25	87,50	Very Valid
3	Penyajian	85,00	90,00	85,00	86,67	Very Valid
4	Kegrafikan	93,75	100,00	93,75	95,83	Very Valid
Average		86,88	91,25	85,31	87,81	Very Valid

The validation and revision of the module were carried out to ensure its quality and effectiveness. The module received an overall average validation score of 87.81%, placing it in the "Very Valid" category. Each aspect of the module was evaluated by three validators, with the scores and corresponding criteria summarized in the table above. Changes to the Module After Revisions:

Figure 8. Aspects of The Content in Parts of The Image Are Referenced by Adding Image Reference Sources

Figure 9. The content aspects of the material were revised to add reference sources

3.4 Implementation

The implementation stages are carried out to conduct module testing. The results of the implementation are as follows:

Table 5. Implementation Results of Ethnoscience Module

No	Activity	Meeting			Average	Category
		1	2	3		
1	Understanding	100%	100%	100%	100%	Very practical

2	Identifying	83,33%	83,33%	91,67%	86,11%	practical
3	Asking	91,67%	91,67%	91,67%	91,67%	Very practical
4	Answering	83,33%	83,33%	91,67%	86,11%	Very practical
	Rata-rata	89,58%	89,58%	93,75%	90,97%	Very practical

Overall, the practicality percentage is 90.97%. In the learning process, several challenges were identified, including the difficulty some communities needed help understanding the module through written text due to limited early literacy skills. Based on these issues, a solution has been formulated, which involves explaining the content using visual aids such as images provided in the module. This approach aims to enhance community understanding of the material being presented.

3.5 Evaluation

The final stage is the evaluation stage, where the researcher evaluates by collecting data to determine the improvement in early literacy skills and the community's response to the module in the learning process. The data for the N-Gain criteria can be found in Table 7.

Table 6. N-Gain Results

Component	Pre-Test	Post-Test	N-Gain	Criteria
Number of students	10	10	0,8	Hight
Lowest score	50	83,33		
Highest score	83,33	100		
Average	3,8	5,5		

Based on Table 7, it is known that the N-Gain value is 0.8, which falls under the high classification. This indicates that improving early literacy skills using the ethnoscience module is effective. Further analysis of each indicator of early literacy skills can be seen in Table 8.

Table 7. N-Gain Results by Indicator

Element	Average Score		N-Gain	Description
	Pre-Test	Post-Test		
Print Motivation	70	100	1	Hight
Phonological Awareness	60	90	0,75	Hight
Vocabulary	50	100	1	Hight
Narrative Skill	80	90	0,50	Medium
Print Awareness	50	80	0,60	Medium
Letter Knowledge	70	90	0,67	Medium

The results of the community response analysis were obtained from ten community members who used the ethnoscience module to improve their early literacy skills. The results of the community response analysis can be seen in Table 8.

Table 8. Community Response Results

No	Aspect Observed	Percentage	Category

1	Language	87,50%	Very Good
2	Material	87,50%	Very Good
3	Interest	83,75%	Very Good
Average		86,25%	Very Good

Based on Table 9, the average community response indicates that the ethnoscience module is effective and has received a positive response from the community.

3.6 Validity

Module validity conducted by three validators aims, as stated by Irman & Waskito (2020), to ascertain the validity status of the module intended for research. Based on Table 4.1, the ethnoscience module validation results yielded an average validation score of 87.81%, categorized as valid. According to Agustina (2020), A module is considered valid when the average validation rating meets the criteria for validity. The content feasibility aspect of this module is highly valid, with a score of 81.25%, aligning with community needs and fostering moral development. Melawati & Istianah (2022) assert that module content is valid if it meets learning objectives and needs. Fadieny & Fauzi (2021) define module validity as factual accuracy, conceptual alignment, and relevance to student development. Rajabalee & Santally (2021) emphasize that good modules encompass easily understandable and factually accurate content. The language appropriateness aspect scored 87.50%, categorized as very valid, indicating that the language used in the module is clear and straightforward for the community to understand. Irmawati, Syahmani, & Yulinda (2021) stress the importance of using language that adheres to grammatical rules and is effectively comprehensible. The presentation aspect scored 86.67%, categorized as very valid, demonstrating clear objectives, logical presentation sequence, and engaging information and interactions. Hananingsih & Imran (2020) advocate for modules that present instructions and information simply yet aligned with learning objectives and core content. The aesthetic appeal aspect scored 95.83%, categorized as very valid, due to the effective use of fonts, layout, and visual design elements that attract readers. Fadieny & Fauzi (2021) emphasize that good graphic components of a module include well-chosen fonts, layouts, and neat and visually appealing illustrations. This viewpoint is echoed by Yulia (2021), highlighting that visually appealing design elements, including colors and additional graphics or photos, can motivate students. Overall, these findings affirm the module's effectiveness across various aspects of validity, ensuring its suitability for enhancing community literacy and environmental awareness in Kemiri Village.

3.7 Practically

Module practicality is assessed by aligning the learning process with the instructional design. The practicality of the module can be observed based on its usability and ease of use in the learning process, as noted by Alwi, Ernalida, & Lidyawati (2020). In the learning process, three observers evaluated the practicality of the ethnoscience module on environmental pollution to enhance early literacy skills. Practicality sheets were tailored to the instructional design related to learning activities. When the learning process aligns with the instructional design, overall implementation can be

considered practical. Arslan (2020) State that a module is deemed practical if it can be effectively used in the learning process according to the prepared instructional design. The practicality analysis results based on the implementation of the learning process indicate alignment with the instructional design. According to Table 4.3, the implementation percentage of the ethnoscience module on environmental pollution falls under the category of very practical, with an average practicality score of 86.30%. Nurvitasari, Suyoto, & Ngazizah (2022) Mention that a module is practical when it can address and resolve emerging issues in learning. This assertion is supported by Noveridha Utama & Zulyusri (2022), who suggest that a module is practical if applied in the field according to the instructional design, engages interaction with the target audience, and presents easily understandable content.

3.8 Effectivenes

The effectiveness of the ethnoscience module on environmental pollution in enhancing early literacy skills among the community is demonstrated through the results of pretest and posttest scores and student responses. Based on the N-Gain calculation in Table 4.4, an N-Gain score of 0.8 was obtained, classified as high, indicating that the ethnoscience module on environmental pollution significantly enhances early literacy skills. This finding is consistent with Dewi, Erna, Martini, Haris, & Kundera (2021), suggesting that using ethnoscience modules can improve activities' effectiveness and thus enhance the community's early literacy skills. Akmal (2021) asserts that ethnoscience modules enhance scientific literacy by integrating local culture into learning. According to Hasasiyah et al. (2019), ethnoscience modules link scientific concepts with natural phenomena, thereby supporting the improvement of early literacy skills. Lestari, Faelasofi, & Suminto (2021) this module effectively enhances early literacy skills when learning outcomes are high, and students are actively engaged and interact well with instructors. Meanwhile, Nihwan & Widodo (2020) mention that ethnoscience modules result in high N-Gain improvements in early literacy skills and positive student responses. This is supported by previous research indicating that ethnoscience modules effectively enhance early literacy skills when test results aligned with indicators yield high scores (Abdul Muizz, Suryanti, & Binar Kurnia Prahani, 2023).

Student response analysis was used to assess the effectiveness of the ethnoscience module on environmental pollution based on a survey administered to the community. The survey included ten questions. According to Table 4.6, community responses to the developed ethnoscience module on environmental pollution were highly positive. This indicates that the community responded positively and enthusiastically to the literacy enhancement learning using the ethnoscience module on environmental pollution. Sintiya, Astuti, & Purwoko (2021) Suggests that the practicality of a module can be assessed based on the responses received, where positive survey responses indicate effectiveness. Based on the survey responses and N-Gain scores obtained, this aligns with Kurniasari & Arfa (2020), who argue that modules as learning media supplements can enhance early literacy skills in the community.

4. Conclusion

The ethnoscience module on the theme of environmental pollution has proven to be highly valid, highly practical, and effective in enhancing early literacy skills within the community. This module can be implemented in various community activities and educational settings to strengthen awareness and knowledge about environmental pollution issues and ways to address them.

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