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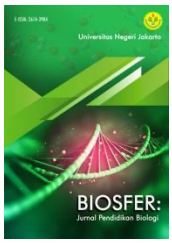

Euphorbia heterophylla leaves as herbal tea: An ethno-scientific approach to boosting scientific literacy

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ABSTRACT

The urgency of the research is to produce a poster product of Patik Sir leaf tea (*Euphorbia heterophylla*) on the diffusion material to improve scientific literacy skills. The phenomenon that occurs in class IX students is the lack of student involvement in practical science activities so that scientific literacy abilities also decrease. The main objective of this research is to produce posters as supporting media for practical science learning. The development of this poster took an ethnoscience approach using the object of Patik Sir (*Euphorbia heterophylla*) leaf tea. The research method uses Research and Development (R&D) based on the Borg & Gall. The research subjects were 28 class IX students of SMAN 1 Lenteng, Indonesia. Research instruments include validation sheets, scientific literacy description tests, and questionnaires. The data analysis technique uses a percentage formula to analyze validity and response data. Scientific literacy data was analyzed using n-gain score and paired sample *t test*. The results of the study showed that poster products were very effective for application in science learning so that science literacy increased. The results of this research provide a contribution that the potential of the wild plant Patik Sir (*Euphorbia heterophylla*) can be used as a reference for science learning materials.

INTRODUCTION

Science education is currently directed at preparing students to be successful in life in the 21st Century. One of the sustainable future-oriented learning can be implemented by involving students in finding solutions to everyday problems that are appropriate to their learning stages (Daryanto & Karim, 2017); . To support children's growth and development in accordance with the educational needs of the 21st century, stimulation through scientific literacy activities is needed (Imaduddin & Khafidin, 2018). Scientific literacy describes the level of understanding in science. (Fuadi et al., 2020) there are three main dimensions in measuring scientific literacy including scientific processes, scientific knowledge, and implementation in real life. Supporting research (Bogar et al., 2024) shows that scientific literacy abilities in science subjects are demonstrated from the context aspect, content aspect and competency aspect. The results of research (Marwah & Pertiwi, 2024) show that students have adequate scientific literacy skills, this is supported by science learning based on product innovation.

Based on observations in July 2024, the movement to strengthen scientific literacy through science practicum has not been carried out optimally at SMAN 1 Lenteng. In science learning, students tend to act as listeners and note takers and observe the teacher's explanations. The results (Nurcahyani et al., 2021) of the ethnoscience learning research have a significant influence on increasing students' scientific literacy in developing science education for students in the 21st century. Research results (Yusmar & Fadilah, 2023) show that one of the factors causing low scientific literacy is the lack of student involvement in practical activities so that students are weak in linking scientific knowledge with phenomena in their daily lives. The research (Junita & Yuliani, 2022) results show that e-LKPD teaching materials on ethnoscience-based membrane transport material are very effective at 100% for training students' scientific literacy skills. The results of previous studies (Lubis et al., 2021) stated that the scientific literacy skills of junior high school students can be supported by the existence of ethnoscience-based science module teaching materials on global warming material which is categorized as very suitable for use in the learning process.

Scientific literacy is one component of learning outcomes that must be achieved in 21st century learning (Nurcahyani et al., 2021). Scientific literacy views the importance of mastering thinking and using scientific thinking in recognizing and responding to social issues (DeBoer, 2000). These thinking and acting skills make students active learners so that students' character and competence develop further. (Dewi et al., 2019) The problem-solving approach that will be raised in this research uses an ethnoscience approach. Active involvement of students in the teaching and learning process through the use of the ethnoscience paradigm can be a solution to overcome the problem of low scientific literacy skills in students. By applying the concept of ethnoscience in science learning, students are expected to be able to solve real-life problems in the 21st-century era. Learning is designed and implemented to build capacity to become lifelong learners. Learning that combines scientific knowledge and the community's original scientific knowledge is able to improve students' scientific concepts so that learning becomes meaningful. The results of research (Andini et al., 2022) found that scientific literacy abilities increased because they were supported by accurate selection of ethnoscience-based learning resources.

The results of research (Dewi et al., 2019) on improving scientific literacy can be done using an ethnoscience approach so that it can develop students' scientific literacy in terms of content, competence, context, and attitude. Research results (Hidayanti & Wulandari, 2023) show that the implementation of the ethnoscience-based Problem-Based Learning (PBL) model is able to improve science literacy skills because students gain direct experience and play an active role in learning. The difference in this research lies in the use of Patik Sir leaf (*Euphorbia heterophylla*) as an object to support the science practicum activity on diffusion material. The ethnoscience approach is a system of knowledge and cognition (ideas/thoughts) typical of a society (Sudarmin et al., 2014). The novelty of this research is that it uses Patik Sir leaf objects in practical activities. In line with research results (Hariyanto et al., 2023) that *patik mas* leaves can be consumed as tea, which is an innovation from a type of wild plant that is often considered a pest. The urgency of this research will produce a poster product of Patik Mas leaf (*Euphorbia heterophylla*) on the material of diffusion to improve scientific literacy skills. The selection of the Patik leaf object was based on research results (Destryana et al., 2023) that the potential of wild plants in Patik Sir supports the sustainability of human life, food security, and as a natural resource for traditional medicinal plants in East Java. The research objectives were (1) to determine the validity of posters using an ethnoscience approach, (2) to determine the increase in scientific literacy after using posters containing *Patik Sir* leaf tea material in science practice activities, and (3) to determine the responses of students and teachers in implementing poster products in science

learning. The results of research (Fatmaryanti & Ramawati, 2024) show that students' scientific literacy skills increase after using digital posters on global warming.

METHODS

Research Design

The development method in research uses Research and Development (R&D). The development model used refers to the development model based on the Borg & Gall adaptation which consists of seven stages, namely: (1) potential and problems, (2) Data collection, (3) Product design, (4) Design validation, (5) Design improvements, (6) Usage trials, and (7) Product revision (Sugiyono, 2019). Briefly, the R&D steps are shown in Figure 1 below.

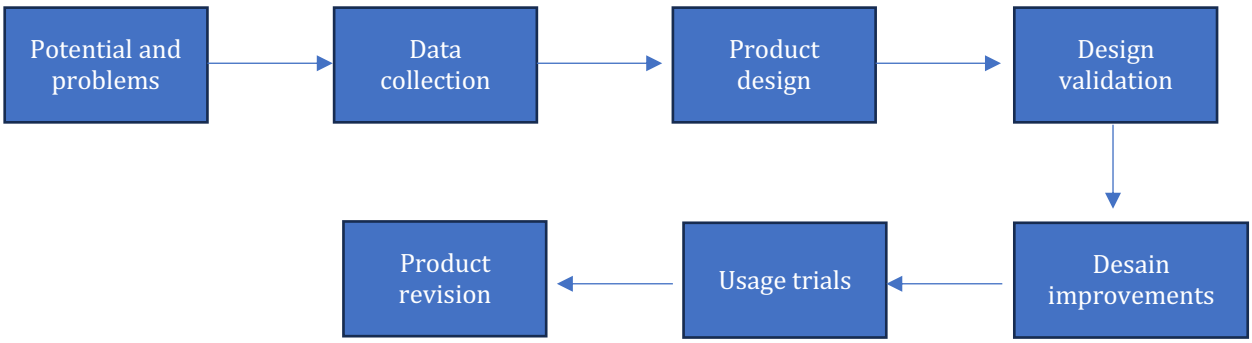

Figure 1. Development model on the Borg & Gall

Population and Samples

The research subjects used the population of class XI students at SMAN 1 Lenteng. The research period starts from July to December 2024. The research location is at SMAN 1 Lenteng. SMA Negeri 1 Lenteng is a senior high school located in the western part of Sumenep City, which is about 15 km from the centre of the Sumenep Regency government. As one of the reference schools for the people of the western part of Sumenep, SMA Negeri 1 Lenteng has been organizing education since 1998 and is required to always keep pace with changes in information technology.

Instrument

The type of data obtained consists of qualitative data and quantitative data. Qualitative data is the result of a questionnaire. Quantitative data is a scientific literacy test from pretest and posttest scores in the form of descriptions. The instruments used to collect research data and develop posters are tests and questionnaires. (a). Test: Scientific literacy is measured using an instrument in the form of a description test before and after using the Ethnoscience poster with the object Patik Mas (Euphorbia heterophylla). The trial design used in this research was a one-group Pretest-Posttest Design b). Questionnaires, validation data, poster readability, and student responses were obtained from the questionnaire sheet. The distribution of questionnaires was used to determine the responses of validators and students to the implementation of posters in science learning. The data analysis technique used is a quantitative descriptive analysis technique.

Procedure

This research uses the following stages: (1) Potential and Problem Stage: This stage starts from making observations to gather information. The potential and problems in this research are the identification of problems encountered in learning obtained from classroom observations; (2) Data Collection: Data collection is carried out after potential problems that can be used as material for planning. Data collection was carried out through distributing questionnaires to determine student responses and testing to determine scientific literacy abilities; (3) Product Design: The final result of this research is a product (draft 1). This stage of designing a poster requires planning, which includes analysis of the material and learning outcomes. (4) Design Validation: Design validation is an activity to assess the effectiveness of a product design. In this research, product validation was carried out by experts in the field of Science Education to assess the product based on rational thinking. The step taken after validation is a readability test; (5) Design Revision: At this stage, a poster (draft 2) is produced

after validation by experts. Weaknesses or deficiencies in the poster (draft 1) will be revised. The new product design is ready to be used for trial use; (6) Use Trial: This stage implements science learning using posters. The trial design used in this research is one-group Pretest-Posttest Design (*single group Pretest-Posttest*); (7) Product Revision: This stage carries out revisions to operational products based on suggestions from the results of product trials. The trial design of this research used a one-group pretest-posttest design (single group pretest-posttest).

Data Analysis Techniques

The data collection methods are questionnaires and test methods. The research instruments used a validity questionnaire for teaching materials, a readability questionnaire, and a student response questionnaire. Scientific literacy were assessed using pretest and posttest written tests as the essay questions. The data analysis technique for poster products using Patik Mas leaf objects development was obtained from calculating the validity of poster using the following formula in Table 1 (Akbar, 2013).

Table 1.
Poster validation.

Achievement level	Qualification	Categories
>80%	Very valid	No revision needed
70%-79%	Valid	No revision needed
60%-69%	Enough	Revised
50%-59%	Not valid	Revised
<50%	Less	Revised

This study measured the differences before and after using the ethnoscience poster with the object Patik Mas (*Euphorbia heterophylla*) that were tested using the Paired sample t-test assisted by SPSS v22. Moreover, an increase in scientific literacy was also measured and analyzed using the results of the N-gain score. These results can be interpreted based on Table 2 and Table 3 (Tucker & Stronge, 2005).

Table 2.
Division of N-Gain Score.

N-Gain Score	Category
$g > 0.7$	High
$0.3 \leq g \leq 0.7$	Medium
$g < 0.3$	Low

Table 3.
Interpretation Category of N-Gain Effectiveness.

Percentage (%)	Interpretation
< 40	Ineffective
40-55	Less effective
56-75	Quite effective
>76	Effective

RESULTS AND DISCUSSION

The potential and problem stage starts from making observations to gather information. The potential and problems in this research are the identification of problems encountered in learning, obtained from classroom observations and interview results. Based on observations and interviews in July 2024, it was found that the problem was focused on the movement to strengthen scientific literacy through science practicum, which had not been carried out optimally at SMAN 1 Lenteng. In science learning, they tend to act as listeners and note takers, and observe the teacher's explanations. Research results (Yusmar & Fadilah, 2023) show that one of the factors causing low scientific literacy is the lack of student involvement in practical activities, so that students are weak in linking scientific knowledge with phenomena in their daily lives. The school's potential is to actively implement the strengthening *Pancasila* student profile project activities, focusing on engineering and technology themes. Apart from that, the school's support for empowering the local potential of wild plants supports this research

activity. The selection of Patik Mas leaf plants (*Euphorbia heterophylla*) grows well in the Lenteng District school area.

The next stage is data collection; this stage is carried out after the potential and problems can be used as material for planning. Data collection was carried out through collecting information on science material and integrating Patik Mas (*Euphorbia heterophylla*) leaf tea in the form of posters to support science practicum activities towards scientific literacy skills. The benefits of these wild plants need to be studied by students to support sustainable food security. Apart from that, the formulation of scientific literacy questions is designed according to indicators of scientific knowledge, the nature of scientific inquiry, science as a way of thinking, and the interaction of science, technology, and society.

Product Design: The final result of this research is a product (draft 1). This stage of designing a poster requires planning, which includes analysis of the material obtained regarding cell membrane transport and the learning achievement objective, namely, to understand the process of diffusion using Patik Mas (*Euphorbia heterophylla*). The following is a display of the poster product design.

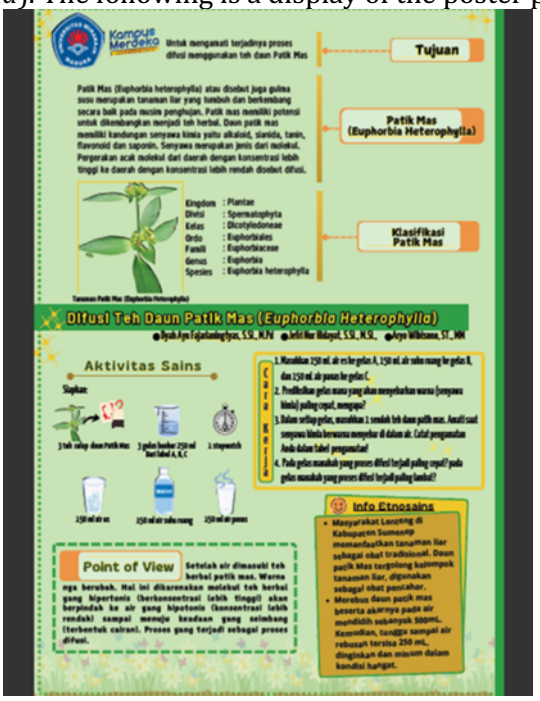

Figure 2. Ethnoscience poster with the object Patik Mas (Euphorbia heterophylla)

Design validation is an activity to assess the effectiveness of a product design. In this research, product validation was carried out by experts in the field of education to assess the product based on rational thinking. The validation results obtained 97% (very valid category) and can be implemented in the classroom to increase scientific literacy. The step taken after validation was a readability test which resulted in 99% of posters being read well by students. A summary of validation data and readability results can be seen in the following table.

Table 4.
Poster validation assessment results.

Components	Results (%)	Categories
Material	98	Very valid
Design	96	Very valid
Average	**97**	**Very valid**

Table 5.
Poster readability assessment results

Components	Results (%)	Categories
Diffusion Science Activities	99	Very good
Ethnoscience Info	100	Very good
Average	**99**	**Very good**

Design revision, at this stage, revisions are made to the science activities based on the validator's suggestions. Improvements to the poster design have been made to produce a poster that is ready to be implemented in class XI science learning about membrane transport. Use trials, at this stage, implement science learning using posters. The trial design used in this research was One-group Pretest-Posttest Design (*single-group Pretest-Posttest*). The trial was carried out on class XI students at SMAN 1 Lenteng. The research results showed that there was an increase in scientific literacy of 0.5 (medium category) as shown by the n-gain results. In each scientific literacy indicator, the average increase was 65% (quite effective). Based on descriptive statistics of the initial test and final test, it is proven that the final test is higher, so that the initial test can increase the final test seen from the significance value (2-tailed), which is 0.000 ($p < 0.05$). The following shows the summary results of data on increasing scientific literacy.

Table 6.
Results of Scientific literacy assessment for each indicator.

Indicators of Scientific Literacy	Percentage N-gain (%)	Categories
Science knowledge	81	Effective
The nature of scientific inquiry	58	Quite Effective
Science as a way of thinking	76	Effective
Interaction of science technology and society	44	Less Effective
Average	65	Quite Effective

Table 7.
Paired sample t-test results.

Components	Significance value	Decision
Pretest and Posttest	0.000 (p< 0.05)	(There is a difference between pretest and posttest)

Positive student responses stated 89% satisfaction with the implementation of ethnoscience posters in science learning; 85% said there was relevance between the poster material and everyday life; and 96% expressed confidence that the ethnoscience approach poster using Patik Mas (*Euphorbia heterophylla*) leaf tea as a support for science practicum activities could increase scientific literacy. The teache'sr response was 95% for posters with an ethnoscience approach that could be applied in class XI at SMAN 1 Lenteng. The final stage of this development is product revision based on the results of use trials. It was suggested that the indicators of interaction between science, technology, and society on posters should also be practiced at home as a form of sustainable integration of ethnoscience in everyday life. Revisions to this product have been carried out so that the poster product has been distributed widely for use in science learning in the following semester.

The development of poster products using Patik Mas leaf objects as a form of ethnoscience integration in science learning has proven to be very valid at 97% for use by class IX students to achieve scientific literacy. One of the supporting factors is the implementation of the independent learning curriculum, which is implemented at SMAN 1 Lenteng. This research is in line with research results (Bilad et al., 2024) that student-centered learning is a form of implementing the independent learning curriculum as a special strategy for achieving scientific literacy.

The development of posters using an ethnoscience approach can increase scientific literacy by 0.5 in the medium category. The highest indicator lies in the assessment of the science knowledge aspect at 81%. This aspect relates to students' reasoning competence obtained from an ethnoscience learning climate, which facilitates the development of personal potential in real life. This indicator measures the ability to understand scientific material (what people know), including explaining scientific phenomena based on evidence related to scientific issues. The results of this research are in the medium category. Research results (Sutrisna, 2021) show that low interest in reading is one of the factors causing students' low scientific literacy abilities. Scientific literacy is the ability to understand scientific concepts and processes to solve everyday life problems. There are four dimensions in measuring scientific literacy, including science competency or process, science knowledge about content, science application context, and science attitudes.

Science learning that takes place at the school uses poster media as a support for science activities in training scientific literacy. Research (Herlina & Abidin, 2024) shows that improvement efforts can be directed at developing interesting learning media to increase scientific literacy. The use of media has a role in determining the effectiveness of learning activities. Posters can encourage students to read more,

making it easier for students to understand the material because the presentation is more interesting and the discussion uses communicative language. Scientific literacy includes the ability to read, write and communicate as well as individual understanding in everyday life, which can be used in developing new knowledge in the fields of science and technology (Wahyu et al., 2020). In the science learning process carried out at SMAN 1 Lenteng, the science teacher asked students to analyze the concept of diffusion using the object of Patik Mas leaves and study the scientific phenomena of this wild plant, which has the potential to be used as a tea drink. In line with research (Washburn et al., 2023) that the need for scientific literacy skills plays an important role in educating scientifically literate students so they understand the scientific process and its implications as technology advances.

This research integrates the ethnoscience approach contained in the poster. This is based on research results (Fiteriani et al., 2021) that poster learning media containing ethnoscience content can be used as a reference for teachers as a science learning media. The learning process using an ethnoscience approach as a strategy for creating a learning environment that integrates learning materials with the local potential of the surrounding environment can increase students' science activities (Muizz & Prahani, 2023). In line with research (Pertiwi1b & Firdausi1a, 2019) that efforts to increase scientific literacy in science education are considered suitable if using ethnoscience-based learning. Ethnoscience-based learning will carry out direct observations so that students are able to explain scientific phenomena regarding natural conditions (Perwitasari et al., 2016). Research (Arianingrum et al., 2024) also supports that ethnoscience media with the theme of environmental pollution is very valid, very practical, and effective in increasing scientific literacy.

In this research, Patik Mas leaves were used so that students were directly involved in science activities on diffusion material. The results of research (Sari et al., 2023) in the science learning process, diffusion research activities provide an overview of the biological function of membranes in cell life, besides also to improving experiments. Class IX students have carried out an experiment that shows that *Patik m*as leaves, which have tea potential, will diffuse quickly under conditions of increased water temperature. This science activity is in accordance with research (Rustamsyah et al., 2024) that water temperature can be a factor in speeding up the diffusion process because heat can increase the kinetic energy of phenol molecules so they move faster. In research (Madliya et al., 2023), the diffusion method is widely used to determine the antimicrobial activity of plants such as tea leaves. Research (Sa'adah & Pertiwi, 2022) proves that students must be actively involved in the learning process, make observations, and solve problems independently through reading and writing. The results of research (Amalia et al., 2024) show that one of the efforts that can be made to increase scientific literacy is by integrating local wisdom in learning.

The Patik Mas plant grows abundantly in the Lenteng area of Sumenep. In line with research (Araldi de Castro et al., 2023) the presence of a species that is more adapted to the dominant ground cover is the wild poinsettia *E. heterophylla*. Research (Hariyanto et al., 2023) shows that people use wild plants as traditional medicine because they have therapeutic and health effects in treatment. This plant has the potential to act as a protease enzyme in its sap. This plant belongs to the Euphorbiaceae family, known as pati mas (Java); kate mas (Ternate); and pargesi (Sumenep). Local people in the Lenteng area consume these leaves as a traditional concoction, namely a laxative. Research results (Adjémé et al., 2023) E. heterophylla is widely used as a laxative and to expel worms because it contains anti-inflammatory, antioxidant, and vermifuge properties. The latex is used in making arrow poison and fish poison.

CONCLUSION

Posters with an ethnoscience approach were proven to be very valid for use in science learning, there was an increase in scientific literacy of 0.5 (medium category) after using posters using Patik Mas leaf tea objects in science practice activities, and there was a positive response from both students and teachers regarding the development of ethnoscience posters in increasing scientific literacy.

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