Preliminary Design: Development of Capillarity e-Module Based Ethnoscience to Promoting Students' Science Literacy

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Abstract *- Promoting character and affecting local culture can also be through ethnoscience approach. This study aims to develop a Capillarity e-module based ethnoscience and determine the effectiveness of the module to increase students' scientific literacy. The method of this study is Research and Development, it utilized 3D+1I model (Define, Design, Develop and Implementation) that used to produce certain products and test the effectiveness of these products. Subject of this research 15 pre-service Science Education teachers at Universitas Islam Lamongan who were studying Fluids and Thermodynamics courses. The results showed that the development of Capillarity e-module based ethnoscience with an average percentage of validation on the feasibility aspect of the content, language feasibility, and feasibility of presenting correspondingly for 95.3%, 86.1% and 82.3% and a very feasible criteria. The effect of the implementation of Capillarity e-module based ethnoscience can promote pre-service science education teachers' science literacy classical amounted to 93.75% Based on the results of this research concluded that the Capillarity e-module based ethnoscience effectively to increase pre-service science education teachers' science literacy.*

Keywords*: Capillarity E-Module; Ethnoscience; Science Literacy*

INTRODUCTION

In the 21st century, the development of science, technology and information is taking place rapidly with full competition which has triggered the rapid flow of globalization. This can erode cultural values and local wisdom so that students will lose their identity in the future (Rohmawati E, 2018). The decline in the quality of nationalism which is influenced by culture and gadgets is negative impact of globalization (Avikasari, 2018). Indonesia and global are challenged to design and develop various supporting competencies (Djatmiko, 2022). Related to this, character education is a priority in implementing the curriculum, especially the merdeka curriculum which instills several characters including mutual cooperation, individuality, integrity, religion and nationalism, which can be done by planting trees, throwing rubbish in its place, discipline and affection Indonesian culture (Sumarni, 2018). Cultivating character and affecting for local culture can also through ethnoscience approach (Zakiyah, 2022). A special challenge in implementing ethnoscience approach is that many students do not understand their local culture (Jumriani, 2021). In Merdeka curriculum, ethnoscience approach is also in line with the implementation of merdeka curriculum, it is profile of Pelajar Pancasila who have an understanding and affecting for local cultural wisdom.

Indonesia has a diverse culture that has not been widely used as a source of science learning information (Hadi, 2019). Local wisdom possessed by an area as culture, regional wisdom. To maintain it, it is necessary to preserve various noble values and regional wisdom through science education based on regional culture. Therefore, as a science teacher, you have a responsibility to uphold noble values and instill them in your students. By using

culture-based education, students can make direct observations so they can identify scientific problems, explain scientific phenomena, and draw conclusions about natural conditions and changes in nature through human activities (Sharifah, 2017).

Ethnoscience is an activity that utilizes science as an understanding of nature and culture that develops in society to transform society's original knowledge (Dewi, 2021). Local knowledge is reflected as local wisdom, namely an understanding of nature and culture that grows in an area. Ethnoscience is local wisdom in the form of language, customs and morals; as well as technology created by society or certain people which contains process knowledge; so that it can be used as a source of innovative and applied learning in science learning in the classroom (Atmojo, 2019). On the Fluid theme as part of science topics that are close to the surrounding environment and everyday life. The learning can implement ethnoscience approach, the concept of capillarity and the batik coloring process as a method and habit developed and adopted by some people and passed down to other generation.

The world of Indonesian education currently prioritizes the implementation of Merdeka curriculum that instills character, including independence, integrity, religiousness and nationalism, awareness of the cleanliness of the surrounding environment, discipline and love of Indonesian culture (Festiyed, 2022). Cultivating character and affecting for local culture through ethnoscience approach so that it is important to apply ethnoscience-based science learning (Handayani, 2018). In line with the independent curriculum by strengthening the profile of Pelajar Pancasila who have an understanding and affecting of local wisdom. Cultural diversity consists of social aspects and national traditions which contain scientific aspects that have not been properly explored and socialized.

Based on research and theoretical studies, the learning approach can be applied through ethnoscience approach to fluid concepts in science learning in Merdeka Curriculum. In learning fluid concepts, science teachers are expected to be able to apply innovative approaches through Ethnoscience with an emphasis on learning resources. Local crafts as life skills in certain regions in Indonesia to increase students' insight which can be implemented in learning. In this way, this innovative learning will be more effective than learning by means of lectures, discussions and questions and answers. So, students' understanding of ethnoscience is still weak, it can impact their concern for local cultural plurality (Putri et al., 2022). Ethnoscience can be integrated into learning in schools with various learning themes, to low level of awareness of local culture and also preserve it through learning based ethnoscience (Socrates et al., 2023). There are five things that can be raised in ethnoscience-based learning, namely historical thinking of society in managing nature, special terms from each community, holistic reasoning in various science and technology sectors, dynamic concepts (Mutmainah, Hakim, & Syam, 2022).

In the current global era and scientific literacy, students not only master scientific knowledge or theory, but also scientific literacy which can be applied solving natural phenomena in everyday life (Saraswati, 2021). Such education is directed at the formation of an entrepreneurial spirit, namely education that has the courage and willingness to face life's problems naturally and creatively find solutions, this needs to be developed to reduce unemployment. In this research, we designed an initial design for the development of an ethnoscience-based e-

module that discusses the concept of capillarity in the Sendang batik coloring process, Paciran, Lamongan, which is local wisdom.

Capillarity e-module courses integrated ethnoscience explore more of the concepts applied to the activity of making batik, so it requires more time to understand and be able to observe directly in the community. Therefore, the development of Capillarity e-module based ethnoscience can be an appropriate alternative module for integrating the concept of capillarity with local wisdom, because with these modules students can learn independently In learning activity is more efficient. Thus, this research as a form of module has been equipped with independent learning instructions so that students can carry out additional learning activities on themes without the direct presence of the teacher. Ethnoscience is a strategy for creating a learning environment and planning learning experiences that integrate culture as part of the science learning process (Afikah, 2022). Applying science learning with an ethnoscience approach requires the teacher's ability to combine indigenous knowledge with scientific knowledge. Therefore, this research is to determine the feasibility of a Capillarity e-module based ethnoscience to determine the effectiveness of the module to increase students' scientific literacy.

RESEARCH METHODS

The 3D+1I (Define, Design, Develop and Implementation) research and development method is a research design used to produce certain products and test the effectiveness of these products (Samsudin et al., 2023). This model was chosen to develop e-module Fluid. The product being developed is then tested for feasibility using validity and product trials to determine the feasibility of the module (Mahbubah, 2020). Research and development methods are research methods used to design new products and procedures that are tested in the field, evaluated, and refined some criteria. In this research, the product in question is an ethnoscience based e-Module on the Fluid concept. Participant were 15 pre-service Science Education teachers at Universitas Islam Lamongan who were studying Fluids and Thermodynamics courses. The research procedure was carried out in 5 stages, the first stage was the define, analyzing needs in the field, the design stage was designing module, the design stage was designing Capillarity e-module based ethnoscience, the develop stage was validation by experts which included language validation, construct validation and validation of content. Then the implementation stage is testing the Capillarity e-module by implementing it in learning and evaluation so that the product is said to be valid and reliable and can be developed and perfected. Data analysis techniques, average of each scientific literacy indicator obtained and the percentage to obtain the degree of validity, practicality and feasibility of the product. To determine effectiveness of e-module based ethnoscience in increasing pre-service science teachers' scientific literacy, the N-Gain score was used improving score criteria obtained from the pre-test and post-test (D.Wijaya et al., 2023).

RESULTS AND DISCUSSION

The development of Capillarity e-module was more significant on the thinking approach to promote pre-service science teachers more consider the concepts. The Capillarity e-module development has been applied by 3D+1I model which elaborates development phases, 1) Define, 2) Design, 3) Develop and 4) Implementation. In detail, Capillarity e-module development is discussed below.

1) Define

The definition stage discusses the results of the literature review. A literature study was carried out to collect data regarding local wisdom crafts that apply the fluid concept. In this research, we highlight the coloring process of Sendang batik crafts which applies the capillarity concept. The process of making Sendang batik consists of washing the cloth, designing, canting, dyeing, scraping and drying. The process of coloring Sendang batik uses dyes and dabs which use natural dyes which are usually used such as tall soga tree bark, indigo tree leaves, tegeran wood, turmeric, tea, noni root, soga jambal bark, kesumba, guava leaves, papaya leaves, sappan wood, and so on. These materials are extracted and become the main ingredients for coloring. In this process there is a physical concept, namely capillarity, when the dye extract is boiled it absorbs strongly into the batik cloth. The use of natural materials in traditional batik coloring, where traditional crafts are part of the local wisdom and culture in Lamongan.

The competency aspect of PISA scientific literacy prioritizes several competencies, namely: (1) identifying scientific issues; (2) explain scientific phenomena; and (3) use scientific evidence to draw conclusions. The science attitude aspect indicates interest in science, support for scientific inquiry, and motivation to act responsibly toward, for example, natural resources and the environment. Increasing pre-service science education teachers' scientific literacy in all four aspects has not been achieved optimally in learning. So one alternative that can be done is to develop a Capillarity e-module to raise the scientific literacy of prospective science teachers.

2) Design

This stage is used to design Capillarity e-module that will be created. The e-module that will be developed integrated ethnoscience capillarity.

3) Develop

The feasibility of an ethnoscience-based Capillarity e-module was validated by experts in content, language and layout module. The Capillarity e-module based ethnoscience is suitable for use in learning, if a percentage score of 62.50% <score≤81.25% is obtained, while it is said to be very feasible if a percentage score of 82.3 <score≤100% is obtained based on BSNP criteria (Sudarmin et al., 2016). The results of the expert assessment and validation of the first and second stages are presented in Table 1.

Table 1. Results of expert validation of the content, language and presentation of the module

	Validator	Average (%)	Citeria
1	Contents	95.3%	very feasible
2	Language	86.1%	very feasible
3	Presentation (layout)	82.3%	very feasible

The research results show that the ethnoscience-based Capillarity e-module assessment is very suitable for use in science learning because it meets the feasibility criteria. As for the integration of ethnoscience-based fluid concepts related to indigenous knowledge, the concept of capillarity in the dyeing process of Sendang batik crafts pattern, contextualizing and conceptualizing the independent curriculum with the culture prevailing in society.

The aspects of language validation that are assessed consist of students' cognitive development, communicative, interactive, logical, appropriateness of applying terms, symbols and formulas in science and correct Indonesian language rules. The average value for the overall feasibility of the

language component reached 3.43 and the average percentage was 86% which fell into the very appropriate criteria. Thus, the language feasibility component in the Capillarity e-module based ethnoscience is very good and can be implemented in science learning.

The components of media assessment or teaching module display are techniques for delivering material, supporting and presenting learning. The average value obtained was 92% and is a very feasible criterion. Several suggestions for improving the module in the sections suggested by experts until it reaches the criteria for being suitable for use.

4) Implementation

The effectiveness of the Capillarity e-module ethnoscience was obtained from the pretest, posttest scores, and the results of measuring student literacy during learning. The e-Module Fluid based ethnoscience was declared effective as a module supplement to increase pre-service science teachers' scientific literacy.

Before Capillarity e-module based ethnoscience has been implemented in the development stage, students are given some questions to measure pre-service science education teachers' literacy science, the results are analyzed as pre-test scores, and after implementing Capillarity e-module, students answer same questions but randomly which are used as post-test scores. The pre-test and post-test results were obtained, then analyzed further for normality test, homogeneity test, t test and N-Gain. The average post-test result is better than the pre-test average, meaning that the learning with ethnoscience approach and the modules developed is effective. In this research, N-Gain analysis was used to determine the increase in pre-service science education teachers' scientific literacy. The percentage is more than 85% so that the module can achieve mastery of classical knowledge. Developing Capillarity e-module based ethnoscience, 93.75% of students can achieve learning mastery.

CONCLUSION

Based on the results of research and discussion, it shows that the development of an ethnoscience-based Capillarity e-module is declared feasible with an average validation percentage in the aspects of appropriateness of content, appropriateness of language, and appropriateness of presentation of 94.3%, 86% and 92% respectively and entry criteria. The increase in scientific literacy of prospective teachers increased by 90.63%, after implementing Capillarity e-modules based ethnoscience. Therefore, it can be concluded that the development of Capillarity e-modules ethnoscience is effective in increasing pre-service science teachers' scientific literacy.

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