Development of Science Learning Teaching Materials Based on Ethnoscience

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Abstract. This research aims to develop products and perform feasibility testing of Science Learning Teaching Materials based on Ethnoscience to enhance the scientific literacy skills of PGSD students at FIP UNIMED. This research employs the 4D Model, which comprises four stages: Define, Design, Develop, and Disseminate. In addition to creating educational resources, it also offers experience to students and instructors in delivering lectures using ethnoscience-based learning to enhance the scientific literacy competencies of PGSD students. The evaluation of the feasibility components of the content material yielded a percentage of 86.61% (Valid/Feasible for use), the feasibility component of design and technology attained a percentage of 81.50% (Valid/Feasible for usage), and the practicality aspect recorded a percentage of 86.30% (Valid/Feasible for use). The effectiveness findings from the pre-test and post-test indicated a percentage of 82.55%.

Keywords: Development, Teaching Materials, Ethnoscience, Scientific Literacy.

1 Introduction

Ethnoscience-based learning can attract and provide meaningful experiences for students. Students can understand a science or new material through the local cultural wisdom of the area. Teachers must possess the capability to create diverse and modern instructional resources to ensure that the learning experience remains engaging and dynamic for pupils. The development of ethnoscience-based courses can enhance students' scientific literacy. The development of ethnoscience-based science learning modules has been conducted by several previous researchers. First, evelopment (R&D) study aimed at determining the effectiveness and feasibility of using motion material modules integrated into science learning to improve students' science literacy (E.S., Dian, 2022). Second, research by Alfiansyah,aims to determine the feasibility and practicality of developing ethnoscience-based science learning modules in training students' science literacy (E.P. Alfiansyah, 2022). Third, Ramadani's research seeks to assess the feasibility and efficacy of ethnoscience-based modules in science education for third-grade students (H.Ramadani, 2022). The goal of ethnoscience learning can impact the improvement of skills Students, research from states that the role related to the determination of

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skills is seen from several findings of ethnoscience learning research, among them: 1) positive results, namely regional cultural appreciation will emerge if science learning in the classroom is in line with the cultural knowledge of students in their daily lives, this learning process is known as the term inculturation learning, 2) active and student-centered learning activities will make learning effective, so that the processes of assimilation and accommodation of learning from students occur. This is in accordance with the 2013 Curriculum which aligns with literacy that learning needs to emphasize the achievement of integrated understanding, not just superficial understanding (A. Khoiri and W. Sunarno, 2018).

According to the PISA 2018 Result, students in Indonesia scored lower than the OECD average in reading, mathematics, and science, this means that the scores of students in Indonesia related to reading, mathematics, and science are lower than the OECD average (OECD, 2018). The World Economic Forum identifies 16 essential skills, among which scientific literacy is crucial for the 21st century. one key to successfully facing the challenges of the 21st century in the era of globalization is "science literacy." Science literacy can be trained through teaching materials that include competitive learning activities to build students' connections in scientific concepts with everyday life problems. Science literacy is important for students so that they not only understand science as a concept but also apply science in everyday life. Treating literacy as a developing concept also allows teachers to see cultural and linguistic diversity as valuable resources for students to engage with new media, not as consumers, but as critical and creative producers. Based on the results of initial observations, it was found that the science learning lectures in elementary schools are directed to master the material, mastering the CPMK based on literacy skills in order to create varied science learning, then the science literacy skills of students, especially PGSD students, are still low. Furthermore, the lecture activities are still dominated by the mastery of concepts and theories onlyThe PGSD study program is the most preferred curriculum at the State University of Medan for enhancing lecture quality. The program has conducted an analysis of the development of the PGSD curriculum and has a vision to produce excellent elementary school educators in the use of communication and information technology as well as local wisdom nationally by 2030. The researcher aims to investigate the "Development of Ethnoscience-Based Science Learning Teaching Materials to Enhance the Scientific Literacy Skills of PGSD Students at FIP UNIMED."

Lecturers' carefully crafted information or materials meant to aid students' learning are known as "teaching materials". Teaching materials may be created in either printed or non-printed formats, and they may be auditory, visual, or both. The educator's teaching book may include textbooks, modules, handouts, and LKS, as well as other instructional materials (M. . Soegiranto,2010)..

The utilization of instructional resources is essential in the educational process. This role, as defined by Tian Belawati, encompasses the responsibilities of students and lecturers in classical, individual, and group learning environments. The creation of instructional materials entails the methodical generation of modules through structured activities adhering to the prescribed protocols for material development (T. Belawati, 2003). The development of educational materials aims to produce resources that enable a student-centered learning process, enabling students to engage in independent learning activities, either with or without the direction of instructors. Three techniques can be selected for the preparation of teaching materials. According to Sungkono et al., the three strategies are self-writing, information repackaging, and information organization (S. Sungkono, 2003).. According to Khairul et al., the process of

preparing teaching materials is as follows: a) formulating competency standards, b) conducting competency standard analysis, c) determining students' initial behaviors/abilities, d) formulating basic competencies, e) compiling Plan of KBM.i) used. Based on several expert opinions above, teaching materials are the materials prepared by lecturers/teachers systematically that are used by participants (students) in the learning process that have been adjusted to certain learning (Khairul Anwar, 2018).

The word ethnoscience comes from the word ethnos (Greek) which means nation, and scientia (Latin) which means knowledge. Therefore, ethnoscience is the knowledge possessed by a cultural community (A. Ariningtyas, et al, 2017).. This science studies or examines the knowledge systems and cognitive types of certain cultures. The focus is on the unique and original knowledge of a cultural community. Maria Ulfah asserts that ethnoscience constitutes the unique knowledge inherent to a nation (A. R. Harefa, 2017).. The objective of ethnoscience is to represent the environment as perceived by the research community. The objective of incorporating ethnoscience into educational activities is to facilitate the acquisition of knowledge by students by integrating local culture with the material that is scientifically studied and in close proximity to them. This approach enhances the learning process. Learning with an ethnoscience approach emphasizes achieving an integrated understanding rather than just a deep understanding. Students learn to connect the material studied in class with the context of their lives and the relationship between science and technology so that learning in school is not only informative but also practical and beneficial in life. One dimension in studying science is that science learning is intended to obtain a relationship between science and technology and society.

The term "Science Literacy" was first used by Paul DeH Hurd in 1958 at Stanford University in California, United States, according to De Boer. Hurd defined it as the ability to comprehend science and adapt it to the demands of society. Literacy encompasses the capacity to read, evaluate, verify the correctness of material and written information, and effectively utilize and convey it across many situations (G. E. DeBoer, 2000). The terminology of literacy is also used to express the level of knowledge and understanding of a person as a provision to achieve personal growth and to be able to play an active role in the development of the surrounding community. Literacy includes the recognition of numerical problems and mathematical symbols, integration of speaking, listening, and critical thinking skills related to the material in reading texts (W. Jufri, 2017).

According to Desi, N, the ability of science literacy is one of the skills that must be mastered by students through education in the 21st century (D. Nugraheni, et al, 2017). Students who are science literate are able to identify key ideas, develop their understanding of the subject, articulate those ideas clearly, and use what they've learned in real-world contexts—whether that's in the classroom, at home, or in the madrasah—to address practical issues and promote positive self- and social-perception (M. F. Sya`ban and I. Wilujeng, 2016). Identifying scientific issues. The context of science application is one of the dimensions of science literacy that contains the understanding of situations related to the application of science in everyday life, which becomes a field for the application of processes and understanding of scientific concepts (E. S. Bahriah, 2015). According to the aforementioned expert definitions, scientific literacy skills encompass the ability to utilize scientific knowledge, formulate inquiries, and derive conclusions from evidence, facilitating comprehension and decision-making about the natural world and its alterations due to human activities.

1. Ilda Rahmi Siagian, Robenhart Tamba. (2023) Development of Science Modules. Ethnoscience-Based Learning on Energy Source Material to Improve Science Literacy of Elementary School Students, Journal of Physics and Science Learning, Vol. 07 No. 2, December 2023. The research findings indicate that ethnoscience-based science education on energy sources has been effectively developed for enhancing student literacy in elementary schools, with material expert evaluations scoring 93%, classified as highly feasible, and media expert evaluations scoring 91.17%, categorized as very valid; trial results yielded an 82% rating, classified as very practical. Then, to see the effectiveness, a test was conducted resulting in 86.95%, it is encompassed within the very effective criteria. Consequently, it can be inferred from the acquired data that the enhancement of literacy among fourth-grade pupils at SDN 106162 Medan Estate attained a score of 86.95%, categorizing it as extremely effective.
2. Imelda F.U. Manurung, et al. (2021) conducted research with the title Development of Electronic Publication (EPUB) Based on Multi-Representation Science to Improve Science Literacy of Students (Proceeding Atlantis Press, Vol. 591 AISTEEL 2021, pp. 812-816). The research results indicate that the media is said to be valid and can improve the science literacy skills of students.
3. Nurhairani, Fahrur Rozi, Septian Prawijaya. (2019). Development of Problem-Based Learning Models with a Science Literacy Approach in Elementary Schools. Proceeding 1st ICSSIS Atlantis Press Volume 208, pp. 230-233. The results of this research suggest that the learning aids that were developed are highly feasible and have the potential to enhance the science literacy abilities of PGSD students. Based on several studies above, the Development of Science Learning Teaching Materials Based on Ethnoscience can Improve Scientific Literacy Skills in PGSD Students at FIP UNIMED.

2 Research Method

This research is a development project that incorporates modifications from the 4D (Four D Models) development framework that Thiagarajan, Semmel, and Semmel established (T. Trianto, 2008). The objective of development study is to evaluate alterations that transpire over a specified duration (P. Setyosari, 2013). This investigation was implemented in the Department of Elementary School Teacher Education at State University of Medan during the Even Semester of 2023/2024. The participants in this study were 35 second-semester PGSD FIP UNIMED students from the 2023 cohort enrolled in the Science Learning course.

The 4D model is comprised of four developmental stages: the define, design, develop, and disseminate stages. The development in the creation of ethnoscience-oriented instructional resources are delineated as follows:

Stage I: Define

The define step establishes and clarifies the learning needs. The define stage comprises five essential steps: front-end analysis, learner analysis, task analysis, concept analysis, and the establishment of unambiguous instructional goals.

Stage II: Design

The design phase focuses on creating educational materials. Four actions must be undertaken at this stage: a) construction of criterion tests, b) selection of media. c) Format selection, specifically evaluating existing forms of ethnoscience-based teaching materials and identifying the format to be developed, d) creating an initial design in accordance with the chosen format.

Stage III: Develop

Two processes are undertaken in the development stage of new products: a) expert evaluation followed by modification, and b) testing throughout the development phase. At this developmental stage, the goal is to complete the learning tools following revisions informed by expert feedback and test results.

Stage IV: Disseminate

The dissemination process is the final stage of development. The dissemination phase is executed to advance the development product for acceptance by users, whether individuals, groups, or systems. Producers and distributors must demonstrate judgment and cooperate to package materials effectively; the last stages of packaging, distribution, and acceptance are vital yet sometimes overlooked. Media dissemination is carried out by publishing through international proceedings and journals, Intellectual Property Rights (HaKI) and ethnoscience-based teaching materials into books with ISBN.

Data Collection Technique

In research, there are several commonly used data collection methods. Interviews, questionnaires, observations, and documentation studies comprise the data collection methodologies. The data collection instrument in this development is an assessment instrument to assess the products that have been developed. The main instruments used by researchers to collect data in this development are interview and questionnaire techniques.

This data collection instrument is used by researchers to collect data on the results of the development of ethnoscience-based teaching materials. Sugiyono states that “a research instrument is a tool used to measure observed natural and social phenomena” (Sugiyono, 2016). This research data is obtained from research instruments which include:

a. Interview Sheet

This instrument is utilized for student feedback on the creation of ethnoscience-oriented educational resources.

b. Questionnaire

Data collection instruments used in the development of ethnoscience-based teaching materials. The following is a grid of validation instruments for media experts, material experts.

c. Test

This instrument is used to determine the level of science literacy skills of students.

This study's data analysis will be categorized into two types: (1) Assessment of the efficacy of ethnoscience-oriented instructional resources for primary science education, and (2) Evaluation of experimental results in collaboration with students. The procedural flow for applying research

on the creation of ethnoscience-based instructional materials for elementary science education is illustrated in the fishbone diagram below:

3 Result and Discussion

The study and development of elementary science teaching materials based on ethnoscience aimed at enhancing scientific literacy skills among PGSD FIP UNIMED students was undertaken in Class J PGSD FIP UNIMED in 2021, following the protocols of the Research and Development methodology.

Following the outcomes of the conducted research and development, the researcher gives many findings as follows: The researcher creates educational resources for elementary science instruction, grounded in ethnoscience, to enhance scientific literacy skills among students. Selecting the category of research known as Research and Development (R&D). The development methodology employs the 4D paradigm, which includes definition, design, development, and implementation. The material includes instructions for the production and application of the product, facilitating its integration into the learning process and minimizing errors in its development and utilization.

The materials used to teach science in elementary school, grounded in ethnoscience to enhance scientific literacy skills, have been deemed feasible. The developed e-module received validation from design and technology experts, specifically Mrs. Imelda Free Unita Manurung, S.Pd., M.Pd., achieving a final percentage of 81.50%, categorizing it as "very feasible." Validation conducted by material specialist Mr. Suyit Ratno, M.Pd yielded a final percentage of 86.61%, categorizing it as "very feasible." The validation results indicate that the Teaching Materials for Science Learning in Elementary School Based on Ethnoscience are deemed appropriate for utilization by students and lecturers in the educational process. Simultaneously, the practicality assessment of the instructional materials for Science Education in Elementary Schools conducted by the lecturer.

The data analysis of the practicality test questionnaire yielded an average percentage of 86.30%. This percentage signifies that the ethnoscience-based teaching resources for Science Learning in Elementary Schools are "practical" for usage by elementary school pupils. Meanwhile, the efficacy findings from the pre-test and post-test yielded a percentage of 82.55%.

4 Conclusion

The 4D Model will be employed in this development research, which comprises four stages of development: the definition stage (Define), planning stage (Design), development stage (develop), and dissemination stage (Disseminate). Alongside the creation of teaching materials, it also offers experiential opportunities for students and lecturers in delivering lectures using ethnoscience-based learning to enhance the scientific literacy abilities of PGSD students. The results of this study will be used to create ethnoscientific instructional materials, which will thereafter be published as accepted or published articles in Indexed International Proceedings, also registered as Intellectual Property Rights (HaKI), published in National Accredited Journals

Sinta (published), and books with ISBN. This research is at the Technology Readiness Level (TRL) type of Social Humanities and Education level 3.

The evaluation of the material content's feasibility yielded a percentage of 86.61% (Valid/Feasible for use), the design and technology display feasibility achieved a percentage of 81.50% (Valid/Feasible for use), and the practicality aspect garnered a percentage of 86.30% (Valid/Feasible for use). Meanwhile, for the effectiveness results from the pre-test and post-test with a percentage of 82.55%. The findings of the feasibility, practicality, and effectiveness assessments indicate that the Teaching Materials for Science Learning in Elementary School Based on Ethnoscience are highly feasible, practicable, and effective for usage. Recommendations for the subsequent plan include creating analogous publications for additional elementary school grades to enhance the quality of mathematics education at the elementary level.

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