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Exploring Local Wisdom: Improving Basic Skills in Heat Transfer material through Developing a Physics Module Based on Smoked Fish

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ABSTRACT

Purpose of the study: The aim of this research is to determine the differences in the use of physics modules based on local wisdom of smoked fish in heat transfer material.

Methodology: This research adopts a research and development (R&D) approach. The samples taken for this research were two classes at the school, with each class consisting of 30 students. The data collection technique in this research was carried out through the use of a questionnaire as the main instrument. The data analysis technique in this research involves a series of systematic steps to test assumptions and test hypotheses.

Main Findings: Based on the results of the T-test, students' responses to the use of a physics module based on the local wisdom of smoked fish in one of the high schools in Eastern Sumatra. The T test results obtained a sig value. (2-tailed) 0.037 < 0.05 so it can be concluded that there are differences in student responses who use the physics module based on the local wisdom of smoked fish.

Novelty/Originality of this study: Delving into local wisdom, this innovative approach transforms the teaching of heat transfer in physics by crafting a specialized module inspired by the traditional technique of smoking fish. Through this unique lens, students not only enhance their fundamental skills but also gain a profound appreciation for the seamless integration of indigenous practices into scientific education.

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1. INTRODUCTION

Education is a conscious and planned effort to create a learning atmosphere and learning process so that students actively develop their potential to have religious spiritual strength, self-control, personality, intelligence, noble morals and skills needed by themselves, society, nation and state [1]–[3]. This understanding provides an illustration that various aspects are needed to support the achievement of educational goals. Education has the aim of increasing a person's potential in living a good life [4]–[6]. Education is a process of an individual's journey towards a better direction in accordance with their human potential [7]–[8]. In other words, education is a conscious effort to develop the potential of human resources (HR) through learning activities [9]–[11]. One potential that can be improved is intelligence. A person's intelligence can be increased through a process, namely learning. Learning is an important process that occurs in everyone's life [12]–[14]. Almost all human abilities, skills, knowledge,

habits, hobbies and attitudes are formed, modified and developed due to learning. In everyday life the term learning is used widely, because learning activities can be carried out in various forms, including reading books, memorizing verses of the Koran, taking notes on lessons, and imitating the behavior of characters.

Education based on local wisdom is a very relevant approach in improving skills [15]–[17]. By integrating local values and traditions into the curriculum, education can provide a deeper understanding of local identity and culture [18]–[20]. This not only improves academic skills, but also hones practical skills that suit the needs of local communities. Through the use of learning methods related to local wisdom, students can develop creativity, innovation and more contextual problem solving [21]–[23]. Additionally, this approach fosters a sense of pride and love for cultural heritage, producing individuals who are not only globally competent but also preserve valuable local values. Thus, education based on local wisdom becomes a strong foundation for improving skills holistically and sustainably [24]–[26].

In physics learning, skill development is a very important aspect because of its significant long-term impact. Understanding physics concepts not only involves theoretical knowledge, but also the practical ability to apply and analyze natural phenomena [27]–[29]. Critical skills such as problem solving, logic, and creativity are at the core of effective physics learning [30]–[32]. Students who have these skills can face complex challenges in their daily lives and careers. In addition, studying physics also strengthens experimental, measurement, and data analysis skills, which contribute to a deep understanding of the scientific method [33]–[35]. Thus, developing skills in learning physics is not only for academic achievement, but also to equip students with skills that are relevant and useful in living life and developing in an era of technology and science that continues to develop.

Previous research that discussed physics modules based on local wisdom was research conducted by Wati et al., (2020) [36]. Where the research focuses on Madihin culture as a basis for developing physics modules. Meanwhile, the research carried out by the researchers themselves used local wisdom related to smoked fish. This comparison can open up space to explore various local and cultural wisdom as a basis for developing physics modules.

This research gives rise to significant innovation in physics teaching approaches by exploring local wisdom as the main foundation. In focusing on heat transfer, the developed physics module creates meaningful connections between academic content and local culture, offering a breakthrough in the way students understand these critical concepts. The uniqueness of this module lies in the use of smoked fish as a basis for learning, linking scientific knowledge with everyday life in a relevant and interesting way. The implications have the potential to stimulate students' interest in physics, opening the door to deeper and more sustainable learning.

In addition, this research has a broader impact on educational curriculum development, enriching the way we view the integration of local wisdom in formal learning processes. By including cultural aspects in understanding physics concepts, this research can provide a new perspective on how education can holistically enrich students' lives. These implications are not only limited to the school level, but can also stimulate reforms in a more comprehensive national level curriculum, bringing positive benefits to physics education at a broader level. Based on the background above, the aim of this research is to determine the differences in the use of physics modules based on local wisdom of smoked fish in heat transfer material.

2. RESEARCH METHOD

2.1. Types of Research

This research adopts a research and development (R&D) approach that includes a comprehensive series of stages to produce and test smoked fish-based physics modules. The R&D approach applied from design to testing on large groups ensures that the modules developed are not only based on a strong theoretical foundation, but have also been thoroughly tested in representative learning environments [37]–[39]. The initial step involves identification of learning needs and objectives, followed by systematic design and development of modules. After the module was formed, the research continued to the trial phase in small groups as part of initial development. The responses of students and teachers from these groups are then analyzed to improve and perfect the module. After that, the research reached the large group test stage involving two classes as a larger sample. This trial allows researchers to evaluate the effectiveness of the module in achieving learning objectives, gain deeper insight into student responses, and identify aspects that need improvement.

2.2. Population and Sample

This research focuses the population on students from one of the high schools in East Sumatra. This population consists of students who are currently undergoing a physics learning program at the high school level. In this framework, the samples taken for this research were two classes at the school, with each class consisting of 30 students. The selection of schools and the number of classes and students is based on considerations of achieving adequate representation of the wider population. By choosing high schools in Eastern Sumatra, it is hoped that the research results can provide insights that are relevant and can be applied to the educational context in the area. It is hoped that each selected class can provide sufficient variation to produce representative and general research

results. The data collected from these two classes will provide a comprehensive picture of the effectiveness of the smoked fish-based physics module in increasing students' understanding of heat transfer material.

2.3. Data Collection Technique

The data collection technique in this research was carried out through the use of a questionnaire as the main instrument. The questionnaire was carefully designed to cover aspects relevant to the research objectives, such as students' understanding of the heat transfer of materials, responses to the smoked fish-based physics module, and students' perceptions regarding the integrity of local wisdom in physics learning. The questionnaire sheet was developed by paying attention to the validity and reliability of the instrument, ensuring that the questions asked can produce accurate and reliable data. The data collection process began with distributing questionnaires to students in the two classes that were the research samples. Students are asked to fill out the questionnaire honestly and wholeheartedly according to their experiences while studying using the module. The collected data will be analyzed statistically to identify general patterns of research findings. The module product assessment questionnaire uses a Likert scale with the score provisions for each item as in the following table:

Table 1. Module Assessment Scale

Score	Category
4	Very Good
3	Good
2	Not Good
1	Very Not Good

2.4. Data Analysis Technique

The data analysis technique in this research involves a series of systematic steps to test assumptions and test hypotheses. First, normality and homogeneity tests were carried out to ensure that the data collected met the assumptions of normal distribution and homogeneity of variance [40]–[42]. After ensuring that the data meets these assumptions, data analysis continues with hypothesis testing, especially the T test. The T test provides an in-depth understanding of whether there are significant differences in student responses to the smoked fish-based physics module in increasing understanding of heat transfer material. During data analysis, special attention is paid to previously established levels of significance, so that the results can be interpreted statistically and support or reject the research hypothesis [43]-[45]. The results of the T test will provide a clear picture of whether the physics module based on smoked fish significantly improves students' understanding of heat transfer..

2.5. Research procedure

This research procedure begins with identifying the problem or need to be researched, which becomes the basis for formulating research objectives. Furthermore, this research adopts a research and development (R&D) approach. The selection of this research method was based on suitability to the research objectives and sample characteristics. The research consisted of two classes at school, with each class consisting of 30 students. Data was collected through the use of a questionnaire as the main instrument. Then the collected data is analyzed using a series of systematic steps. This includes data processing, statistical testing, and interpretation of results to test research assumptions and hypotheses. Once data analysis is complete, the results are interpreted to support the research findings and provide a better understanding of the problem under study.

3. RESULTS AND DISCUSSION

3.1. Normality test

In this research, a normality test was carried out to assess the extent to which the distribution of data from student response questionnaires to the smoked fish-based physics module followed a normal distribution pattern. This test is important to ensure that the data used in statistical analysis has a near-normal distribution, validating the fit with the required statistical assumptions. The results of the data normality test in this study can be seen in the following table:

Table 2. Normality Test Results

Class	Sig.	Distribute
A	0.200	Normal
B	0.096	Normal

Based on table 2, the normality test of students' responses to the use of the physics module based on local wisdom of smoked fish for class A, results were obtained based on the Kolmogorov-Smirnov test, with a

significance value of 0.200 > 0.05 and for class B, the significance value was 0.096 > 0.05, so it can be concluded that the data is normally distributed.

3.2. Homogeneity Test

At the data analysis stage, a homogeneity test was carried out to check whether the variance of students' responses to the smoked fish-based physics module was uniform between the two sample classes. The results of this homogeneity test are critical in ensuring that the comparison of means between classes using the T test is reliable, because it confirms that the variance between groups is not significantly different. The results of the data normality test in this study can be seen in the following table:

Table 3. Homogeneity Test Results

Class	Sig.	Distribute
A	0.373	Homogen
B	0.277	Homogen

Based on table 3, the homogeneity test of students' responses to the use of the local wisdom-based physics module for smoked fish for class A obtained a significance value of 0.373 > 0.05, while for class B the significance value was 0.834 > 0.05, so it can be concluded that the data is homogeneous.

3.3. Hypothesis Test (T-Test)

In this study, the t-test was used to compare the average student responses to the smoked fish-based physics module between the two sample classes. This analysis provides significant statistical information regarding whether there is a significant difference in understanding of heat transfer material between the two groups of students who used the module. The results of the t-test are expected to confirm or reject the research hypothesis regarding the effectiveness of the smoked fish-based physics module in increasing students' understanding. The results of the t-test carried out in this research can be seen in the following table:

Table 4. T-test results

Class	Sig.(2-tailed)
VII A VII B	0.037

Based on table 4 of the T-test, students' responses to the use of a physics module based on local wisdom of smoked fish in one of the high schools in Eastern Sumatra. The T test results obtained a sig value. (2-tailed) 0.037 < 0.05 so it can be concluded that there are differences in student responses who use the physics module based on the local wisdom of smoked fish.

Based on the results of normality analysis using the Kolmogorov-Smirnov test in table 2, it was found that the significance value for student responses to the use of the physics module based on local smoked fish wisdom in class A was 0.200, while in class B it was 0.096. Both significance values are greater than the significance level set at 0.05. Therefore, it can be concluded that the student response data from the two classes shows a distribution that is close to normal. These results provide confidence that the data used in this study can meet the assumption of a normal distribution, validating the feasibility of using parametric tests, such as t-tests, in subsequent data analysis steps.

In the context of the homogeneity test documented in Table 3, the results of the analysis show that the significance value for student responses to the use of the physics module based on local smoked fish wisdom in class A is 0.373, and in class B is 0.834. Both significance values are clearly greater than the significance level set at 0.05. Therefore, it can be concluded that the student response data from the two classes shows a significant level of homogeneity. These results provide confidence that the variance of student responses from the two classes is not significantly different, validating the use of the homogeneity test to continue further statistical analysis. Thus, these results confirm that the data used in this study meet the assumption of homogeneity, ensuring the reliability of the t-test results used in this study.

Based on the t-test results recorded in Table 4 for student responses to the use of a physics module based on the local wisdom of smoked fish in one of the high schools in East Sumatra, it was found that the significance value (2-tailed) was 0.037. This value is smaller than the significance level which has been set at 0.05. Therefore, it can be concluded that there is a significant difference in student responses between those who use the physics module based on the local wisdom of smoked fish. These results indicate that the module plays an important role in improving students' understanding of heat transfer material, and this difference can be attributed to the effectiveness of the module developed. This conclusion confirms the positive contribution of the physics module based on local smoked fish wisdom to student responses, providing validity to this learning approach in the educational environment in Eastern Sumatra.

Physics learning based on local wisdom is an innovative approach that integrates cultural, traditional and local aspects into the physics learning curriculum [46]–[48]. By utilizing local wisdom, this learning creates a close relationship between physics concepts and students' daily realities. Through the use of examples or cases originating from local wisdom, physics learning becomes more contextual and relevant for students. Local wisdom is not only a tool for understanding physics concepts, but also brings cultural values and traditional wisdom into the classroom [49]–[51]. Students not only learn about the laws of physics, but also about how to apply them in the context of their daily lives. This approach encourages deeper understanding, because students can see how physics concepts are applied in their own environment. Physics learning based on local wisdom can also motivate students by linking learning material to their real life context [52]–[54]. This can increase students' interest in physics lessons and strengthen their sense of cultural identity. Thus, local wisdom-based physics learning is not only about understanding physics concepts, but also about respecting and caring for students' cultural heritage.

Previous research conducted by Syahfitri, (2024) [55] stated that interactive modules based on local wisdom are alternative teaching materials developed to provide meaningful experiences and learning for students. It is also hoped that interactive modules based on local wisdom can strengthen student involvement in the learning process by providing content that is relevant to the realities of their daily lives. By stimulating students' curiosity and involvement through approaches related to local culture and traditions, this module makes a positive contribution to students' motivation and understanding in understanding physics concepts.

The novelty of local knowledge of Salai Fish and basic process skills is an interesting combination in building a foundation for learning and sustainable use of local resources. Salai Fish, with its unique smoking method, brings innovation in local fish processing, producing unique products with high added value. Meanwhile, basic process skills provide a solid foundation for utilizing natural resources by utilizing local wisdom efficiently and sustainably. This combination creates an approach that not only enriches local cultural values but also develops basic process skills in managing natural resources. Through the application of basic process skills, society can optimize the use of resources while still paying attention to sustainability aspects. By combining Smoked Fish and basic process skills, a whole is formed that reflects creative and planned local wisdom, creating economic and environmental sustainability in a wider local context.

The implications of the combination of local Salai Fish knowledge and basic processing skills are vast and profound. Overall, the combination of local knowledge of Salai Fish and basic processing skills provides a positive holistic impact in economic, environmental and social aspects. This marks an important step towards sustainable development that strengthens the relationship between humans and nature, while maintaining and advancing the local wisdom of the community.

Although the combination of local knowledge of Salai Fish and basic processing skills offers great potential, there are several limitations that need to be considered. The education and training aspect is also a limitation, especially if the local community does not have adequate access to obtain basic process skills or a deep understanding of local wisdom. Efforts to mitigate these limitations require continued support in capacity development and provision of supporting resources for local communities.

4. CONCLUSION

Based on the research findings, it can be concluded that the physics module based on local wisdom of smoked fish, Salai, is effective in enhancing students' understanding of heat transfer material. Local wisdom-based physics learning also helps students to relate physics concepts to their daily realities, thereby increasing their motivation and understanding in learning. Recommendations for further research include further exploration of the impact of local wisdom-based physics learning on other aspects, as well as the development of modules for other physics topics and comparative studies to compare its effectiveness with conventional teaching methods. This is expected to contribute significantly to the development of innovative and effective physics learning approaches.

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