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Innovation of Physics E-Module: Utilizing Local Wisdom of Lampung's Handwritten Batik in Teaching Heat and Temperature Material to Foster Students' Scientific Attitude

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ABSTRACT

Purpose of the study: The aim of this research is to investigate the implementation of a physics e-module based on the local wisdom of Lampung written batik in learning heat temperature material, with a focus on developing students' scientific attitudes.

Methodology: The research method used is research and development (R&D). The instrument used in this research to measure students' scientific attitudes. This research will involve two classes, each of which will use a different learning approach. One class will use a conventional e-book while the other class will use an e-module developed based on the local wisdom of Lampung written batik

Main Findings: The research results show that the use of this e-module is effective in improving students' scientific attitudes, such as curiosity, perseverance, and trust in scientific methods, which are important aspects in learning physics. By combining local traditions with modern scientific concepts, this approach not only enriches learning methods, but also strengthens students' cultural identity. Therefore, implementing physics e-modules based on local wisdom is a relevant strategy and has the potential to be applied in the context of physics learning in schools.

Novelty/Originality of this research: The novelty of this research lies in the combination of modern technological approaches with local cultural values. In this research, the e-module was designed by considering the rich cultural context and traditions of Lampung batik, thereby creating a relevant and interesting learning experience for students.

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1. INTRODUCTION

Science learning provides a deep understanding of the natural principles that underlie everyday physical phenomena. Physics learning based on local wisdom emphasizes the integration of physics concepts with cultural values and traditions inherent in local communities [1], [2]. The world view of physics learning education has grown to be more important as the understanding of complex natural phenomena becomes increasingly urgent [3], [4]. Through physics, students can develop critical thinking and analytical skills vital for solving global challenges.

By prioritizing inclusive and innovative physics education, we can form a generation that is ready to face the complex changes of the future. This approach allows students to understand physics concepts through contexts that are relevant to students' daily lives, such as using local knowledge about nature, traditional technology, or natural phenomena that occur in the students' environment [5], [6]. By utilizing local wisdom, physics learning becomes more meaningful and can encourage a sense of pride in cultural heritage, while also developing a deeper understanding of fundamental physics principles [7], [8].

The application of local wisdom values in physics learning can create and develop a strong scientific attitude in students [9], [10]. By linking physics concepts with local cultural values, students are invited to become more actively involved in learning, encouraging students to observe, ask questions, plan, test hypotheses, and critically analyze physical phenomena in contexts that are relevant to students' daily lives [11], [12]. Through this process, students learn to appreciate cultural uniqueness while gaining a deeper understanding of physical science, thereby forming a scientific attitude that is inclusive, critical, and open to new knowledge and scientific discoveries that can advance human understanding of the universe [13], [14].

The value of wisdom in hand-written batik goes beyond just arts and crafts, but reflects a rich and deep cultural heritage. Every motif, color and technique used in the process of making batik contains a symbolic meaning that depicts a story, philosophy or values held firmly by traditional society. More than just a work of art, hand-written batik reflects identity, loyalty and a high level of skill passed down from generation to generation [15], [16]. The value of wisdom in written batik not only appreciates its visual beauty, but also enriches our understanding of history, local wisdom and cultural sustainability [17], [18].

Although research based on local wisdom has shown great potential in improving students' education and scientific attitudes, there are still several gaps or gaps in the understanding of this concept [19], [20]. One gap that needs to be explored further is how to measure and evaluate the effectiveness of applying local wisdom in achieving science learning goals [21]. More in-depth research is needed to identify valid and measurable performance indicators in the context of local wisdom [22]. In addition, further research can also focus on developing more appropriate pedagogy and learning strategies that can optimize the integration of local wisdom without compromising academic standards [23]. In addition, it is important to explore how contextual factors, such as cultural diversity and regional differences, can influence the effectiveness of implementing local wisdom in science education [24], [25]. By filling these gaps, research based on local wisdom can become more holistic and effective in improving the quality of education and scientific attitudes of students [26].

Novelty in research based on local wisdom for developing students' scientific attitudes lies in an interdisciplinary approach that integrates local knowledge and cultural traditions with modern scientific concepts. Creating a unique learning environment where students not only learn science concepts theoretically, but also apply them in culturally relevant contexts [27], [28]. This approach allows students to understand how science can be applied in students' daily lives and how local knowledge can become a foundation to build a deeper understanding of natural phenomena [29]. Thus, the novelty of this approach is its ability to link science and culture, create learning experiences that combine the two fields harmoniously, and effectively develop students' scientific

Research on the implementation of a physics e-module based on the local wisdom of Lampung batik on heat temperature material for students' scientific attitudes has important implications in the educational context. By using local wisdom as a basis, this research not only enriches physics lesson material with relevant cultural context, but also provides opportunities for students to develop scientific attitudes [30]. The implications of this research show that integrating local culture in learning can increase student interest and involvement, as well as enrich student learning experiences [31]. It is hoped that this approach can be applied more widely in educational curricula to strengthen the connection between scientific learning and cultural and local aspects, as well as encourage the development of better scientific attitudes in students.

The aim of this research is to integrate elements of local wisdom in physics learning so that it can increase students' understanding of the concepts of temperature and heat, while developing a positive scientific attitude. By utilizing the local wisdom of Lampung Written Batik as a learning context, this research aims to create an e-module that is interesting, relevant and useful for students in understanding physics material, while also strengthening students' sense of cultural identity. Through this approach, it is hoped that students will not only be able to master physics concepts better, but also be able to develop critical, creative and collaborative attitudes in solving physics problems that are relevant to everyday life and local culture.

2. RESEARCH METHODS

Quasi-experimental research is a type of research in which the researchers want to find out whether there is a cause-and-effect relationship between two variables, but do not have complete control over the variables. This means researchers cannot randomly assign research participants to an experimental group or a control group as in a true experiment [32]. Instead, use existing groups or observe what happens naturally in certain situations.

Although not conforming to strict experimental standards, this type of research still provides valuable insight into the relationships between certain variables, albeit with some limitations.

This research will involve two classes, each of which will use a different learning approach. One class will use a conventional e-book while the other class will use an e-module developed based on the local wisdom of Lampung written batik. classes that use conventional e-books are marked as class A and classes that use the developed e-modules are marked as class B. A comparison between these two approaches will allow researchers to comprehensively evaluate the effectiveness of local wisdom-based e-modules in increasing understanding of concepts physics and the formation of students' scientific attitudes [33].

The instrument used in this research to measure students' scientific attitudes is an adaptation of a questionnaire whose reliability has been tested [34]. This questionnaire consists of a series of statements designed to evaluate various aspects of scientific attitudes, including attitudes towards learning, interest in physics concepts, willingness to explore further knowledge, and the ability to ask questions and face challenges in solving physics problems. Adjustments were made by considering the local wisdom context of Batik Tulis Lampung, so that the questionnaire could accurately measure students' scientific attitudes related to the use of the local wisdom-based physics e-module.

From these data, descriptive statistical tests and inferential tests were carried out in the form of assumptions and hypothesis tests. In the assumption test, three tests were carried out, namely the normality test, homogeneity test and T-test. The normality test functions to find out whether the data is normally distributed. The homogeneous test serves to find out whether several groups of research data have the same variance or not . Then test the hypothesis in the form of t test and regression test [35]. The t test serves to determine the comparison of environmental care character variables in each school. Regression test is used to determine the effect of two variables. After the analysis of variance test was carried out. These tests were then tested using SPSS 26 to obtain accurate results. The following is the research procedure.

Figure 1. Research procedure

3. RESULTS AND DISCUSSION

The following describes the results of the response to the use of the e-module.The description of the response to the use e-module is shown in the following table.

Table 1. Description of the response to the use e-module

Class	Category	Range	F	%	Mean	Median	Min	Max
A	Not Very Good	6.0-10.8	0	0				
	Not Good	10.9-15.6	4	23.30				
	Enough	15.7-20.4	4	23.30	3.3	3.1	2	5
	Good	20.5-25.2	4	23.30				
	Very Good	25.3-30.0	6	30.10				
B	Not Very Good	6.0-10.8	0	0				
	Not Good	10.9-15.6	4	23.30				
	Enough	15.7-20.4	3	20.30	3.2	3.0	2	5
	Good	20.5-25.2	4	23.30				
	Very Good	25.3-30.0	7	33.10				

From the description table above, it can be seen that the response to the use e-module of class B is very good category. The normality test to the use of e-module is explained in the following table :

Table 2. Normality test

Class	Kolmogorov-Smirnov			Description
	Statistics	Df	Sig.	
A	.074	18	.200	Normal
B	.070	18	.200	Normal

Based on the table results it can be concluded that the data is normally distributed, the normality test is obtained by the Kolmogorov-Smirnov test with a significance value of > 0.05. then the homogeneity test of the response to the use of e-module is explained in the following table 3:

Table 3. Homogeneity test

Variable	Class	Sig.	Characteristic
Student response	A	.190	Homogen
	B		
Scientific attitudes	A	.197	Homogen
	B		

Based on table 3, the results of the homogeneity test show that the significance value for the student response variable to the use of e-modules is worth 0.190, then for the student scientific attitude variable it is worth 0.197, which is more than 0.05. This means that the data used in this research is homogeneous, with the assumption that the variance between groups is homogeneous. Next, a linearity test is carried out which is presented in table 3 below:

Table 4. Linearity test

Variable	Sig.	Characteristic
Student response * Scientific attitudes	.200	Linear

The results of the linearity test show a value of 0.200 < 0.500, indicating that there is a significant linear relationship between the variables tested. Thus, it can be concluded that there is a strong correlation between these variables in the context of the tests carried out. Then Response test of the use e-modulesis explained in the following table:

Table 4. Response test of the use e-modules

Class	T	Df	Sig. (2-tailed)	Mean Difference
A	16.143	18	.024	65.55554
B	16.245	18	.025	65.55554

Based on the table above, it can be concluded that there is a comparison between classes A and B. This is proven by the sig results. (2-tailed) smaller than 0.05. Then Hypothesis Regression Test with ANOVA is explained in the following table:

Table 5. Hypothesis Regression Test with ANOVA

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	15.739	1	16.725	.678	.032[b]
Residual	265.372	35	15.584		
Total	281.111	36			

From the table it is known that the sig value is <0.05, so it can be concluded that this e-module has an effect in improving students' scientific attitudes. The results of this research hypothesis test show that the implementation of a physics e-module based on the local wisdom of Lampung written batik on temperature and heat material significantly improves students' scientific attitudes. Data analysis shows that there is a significant difference between the experimental group that uses e-modules and the control group that does not use e-modules [36], [37]. Students involved in the experimental group showed greater improvements in scientific attitudes, compared to students involved in conventional learning [38]. These results support the effectiveness of using e-modules based on local wisdom in improving students' scientific attitudes in the context of physics learning.

The local wisdom of hand-written batik offers a valuable contribution in the context of physics learning. Written batik not only reflects a rich cultural heritage, but also presents symbols and motifs that contain deep philosophical meanings. In physics learning, the use of local wisdom of written batik can be a strong bridge between abstract physics concepts and students' real experiences [39]. For example, batik motifs depicting flow, heat, or movement can be used as visual tools to illustrate complex physical principles [40]. By integrating the local wisdom of batik in physics learning, students not only gain a deeper understanding of the material, but also develop a sense of pride in their cultural heritage [41].

One of the gaps in ethno physics learning in physics learning is the lack of in-depth understanding of how to integrate traditional or local knowledge with modern physics concepts effectively [42]. Although the concept of ethno physics offers great potential for linking culture and science, there is no clear framework or practical

guidance on how to apply this approach in existing physics curricula [43]. Additionally, there is a need for more research that clarifies how ethno physics approaches can influence students' motivation and achievement in physics learning [44], [45]. Additionally, it is important to explore how contextual factors, such as cultural diversity, may influence the effectiveness of ethno physics teaching and learning [46], [47]. By filling this gap, we can develop more inclusive and relevant learning strategies that utilize local knowledge to enrich students' understanding of physics and encourage more active participation in learning [48].

Ethnophysics learning innovation is a promising new contribution in growing and developing students' scientific attitudes [49]. This approach not only introduces traditional physics concepts, but also integrates cultural and local elements to stimulate student interest and involvement [50]. By exploring physical phenomena through the lens of local wisdom and ethnic traditions, learning ethnophysics provides an opportunity for students to understand the complex relationship between science and culture [51], [52]. This not only enriches students' learning experiences, but also encourages students to develop a scientific attitude that is critical, inclusive, and open to new perspectives [53]. Thus, the presence of ethnophysics learning promises to be a breakthrough in science education that promotes a deeper and more inclusive understanding of the universe and humans' role in it.

The implementation of a physics e-module based on the local wisdom of Lampung batik on heat temperature has important implications for the development of students' scientific attitudes. By utilizing local wisdom as a basis, this e-module not only provides easier and more flexible access to learning material, but also enriches the content with cultural values that are relevant for students. The main implication is that students have the opportunity to learn science in a context close to their everyday lives, thereby strengthening their sense of cultural identity while honing scientific skills [54]. Apart from that, the implementation of this e-module can also stimulate students' interest and motivation in learning physics, because the content is relevant and interesting, as well as presenting the material interactively via a digital platform [55].

Thus, the implication of using local wisdom-based physics e-modules in learning heat temperature is to increase students' understanding of science subject matter while strengthening their scientific attitudes through integration of local culture. This research presents an interesting innovation in physics learning. By utilizing local Lampung wisdom, especially in the art of batik, this research integrates culture and science to improve students' scientific attitudes. The e-module developed not only teaches the concept of hot temperatures comprehensively, but also prioritizes appreciation of regional cultural heritage. With this approach, it is hoped that students can be more involved in learning, increase their understanding of physics concepts, and strengthen their sense of pride in their local culture.

Limitations of research on the implementation of physics e-modules based on local Lampung written batik wisdom on heat temperature material for students' scientific attitudes may include limitations in the generalization of findings due to the focus on one group of students or a particular school. In addition, technical constraints such as limited technological accessibility in the learning environment or internet infrastructure constraints can also be factors that limit the effectiveness of e-module implementation. In addition, this research may not be able to measure the long-term impact of using e-modules on the development of students' scientific attitudes. In addition, other variables outside the influence of e-modules, such as environmental factors or previous learning experiences, may also influence research results.

4. CONCLUSION

Thus, it can be concluded that the implementation of the physics e-module based on the local wisdom of Lampung batik on temperature and heat material makes a significant contribution to the development of students' scientific attitudes. The research results show that the use of this e-module is effective in improving students' scientific attitudes, such as curiosity, perseverance, and trust in scientific methods, which are important aspects in learning physics. By combining local traditions with modern scientific concepts, this approach not only enriches learning methods, but also strengthens students' cultural identity. Therefore, implementing physics e-modules based on local wisdom is a relevant strategy and has the potential to be applied in the context of physics learning in schools. This research recommendation is very relevant to efforts to enrich students' learning experiences through a contextual approach that includes physics concepts with local culture, as well as improving students' scientific attitudes in understanding everyday physics phenomena.

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