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The Influence of Ethnophysics Flipbook Media on the Learning Outcomes of High School Students on Temperature and Heat Materials

Atiqotul Hasanah[1], I Ketut Mahardika[1,2,3,4], Ernasari[1]

[1] S1 Physics Education FKIP University of Jember
[2] S1 Science Education FKIP University of Jember
[3] S2 Science Education FKIP University of Jember
[4] S3 Science Education FKIP University of Jember

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Abstract

Physics learning in schools in general is still centered on the material available in books. But there is very little learning about physics that really relates to the culture that exists in the student environment. The purpose of this study is to examine the influence of the use of ethnophysics flipbook media on student learning outcomes. This study is a quasi-experimental research using a non-equivalent control group design. This research was carried out in the even semester of the 2024/2025 school year, precisely at SMAN Kalisat. Sample selection was carried out by a homogeneous testing method, selected by lot to obtain control and experimental classes. Based on the results of the normality test, the Sig. value obtained is 0.000 where the value is < 0.05 so that the data is not distributed normally. Then it was followed by the Mann-Whitney U test because the data was abnormal. The results of the Mann-Whitney U Non-Paramentric test showed that the significant values obtained were 0.000 < 0.05. So it can be concluded that the use of ethnographic flipbook media has an effect on the learning outcomes of high school students on Temperature and Heat material.

Keywords: *Flipbook, Ethnophysics, Learning Outcomes, Learning Media*

(*) Corresponding authors: atikahasanah851@gmail.com

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INTRODUCTION

Many students consider physics to be a daunting and less exciting field of science. The low learning achievement of students in physics subjects is caused by various factors, such as a dense curriculum, students' difficulties in understanding the material presented in textbooks, lack of effective use of learning media, and learning approaches that are still conventional that make students less active in the learning process (Sandari, 2020). The concepts of temperature and heat are closely related to natural phenomena, as most of their phenomena occur in everyday life. According to Kulkarni & Tambade (2013), the concepts of temperature and heat have a great contribution in physics due to their wide application in various areas of science technology (Sukma & Diyana, 2024).

Most physics learning in schools is still centered on the material available in books. But very little physics learning is associated with the culture that exists in the student environment (Astuti & Bhakti., 2021). In addition, around the student environment there are many examples of local wisdom that can be attributed to physics lessons. Therefore, it is necessary to learn physics using an ethnoscience

approach. One example of the culture around the school is the culture of drying rice and making bricks. Physics learning in schools that integrates local wisdom into modern knowledge can be beneficial for students because it can relate physics lessons to daily life (Muhyidin & Hasan., 2024). This has been proven through research by Siyati & Kamariyah (2022) which explains that ethnoscience learning methods can improve students' intellectual understanding and critical thinking skills. This increase is influenced by the great enthusiasm and interest of students in following the learning process.

In addition, rapid technological advances in the world of education have made it a challenge for students and teachers (Dani et al., 2021). In Nurvitasari & Asmaningrum (2018), a teacher needs to master computer technology in order to be able to innovate that follows changes and developments in modern science and technology (Halmuniati et al., 2022). So teachers need to create teaching materials that students can access independently and also with teachers at any time (Putri et al., 2023). The reality is that many educators still rely on conventional teaching materials. Mistakes in choosing teaching materials can cause students to fail to understand the subject matter and the achievement of learning outcomes does not reach the minimum standard of targeted learning (Yulaika et al., 2020). Flipbooks can be one of the learning media used. The incorporation of local wisdom into flipbook media not only brings the material closer to students' lives, but also strengthens cultural identity and increases the relevance of physics learning in the modern era. Based on research, Khotimat et al (2023) concluded that by applying flipbooks as a learning tool, there is a positive impact on the academic achievement of SMK Negeri 2 Pangkep students.

Based on data obtained through observation and interviews at SMAN Kalisat, the researcher received information that teachers still rely on LKS books to explain the material, so there is a need for variations in teaching media. Students' physics learning outcomes can be influenced by the effectiveness of the use of learning media. That is why effective and interactive learning media is needed to convey abstract physics material, one of which is temperature and heat material and to increase the ease of students in understanding concepts. The availability of teaching materials that utilize modern technological developments is expected to encourage students' interest in learning the material and ease of completing assignments (Bektiarso et al., 2023).

Based on the problems that have been described, in order for physics learning activities to be in line with 21st century technological innovations and also have a good impact on the physics learning outcomes of high school students, it is necessary to conduct research related to the above problems. So the researcher wanted to carry out a research with the title "The Influence of Ethnophysics Flipbook Media on the Learning Outcomes of High School Students on Temperature and Heat Materials".

RESEARCH METHODS

This study is a quasi-experimental research using a non-equivalent control group design. This research was carried out in the even semester of the 2024/2025 school year, precisely at SMAN Kalisat. The population in this study is all students of grade XI Science at SMAN Kalisat. Sample selection was carried out by the

homogeneous test method. After the test is carried out, it will be randomly selected and the control class and the experimental class will be obtained. In the control class, no treatment was given or did not use ethnophytic flipbook media, but in the experimental class, treatment was given using ethnophytic flipbook media. The data collection method uses observation, interviews, documentation and tests (pretest and posttest). The data analysis technique uses a data normality test, and an independent t-test for student learning outcomes.

RESULTS OF RESEARCH AND DISCUSSION

This study took the population of students in grade XI Science at SMAN Kalisat, which includes grades XI 1 to XI 4. The determination of the sample as the object of research includes the experimental class and the control class which is determined through a homogeneity test using the SPSS 22 application. The Semester End Summative Value (SAS) of physics in odd semesters is the data used in this study. The following are the results of the homogeneity test of the student population of SMAN Kalisat.

Table 4.2 Results of the Homogeneity Test of Semester End Summative Value (SAS) Odd Physics

Test of Homogeneity of Variances

Nilai SAS

Levene Statistic	df1	df2	Sig.
.496	3	131	.686

The data of the odd semester physics end-of-semester summative value (SAS) in table 4.2 shows a significance value (Sig.) of 0.686 which indicates that the value is greater than 0.05 ($0.686 \geq 0.05$), so that the data in the class XI science population is homogeneous. Therefore, the determination of samples to be used as experimental classes and control classes uses cluster random sampling techniques by conducting lotteries, namely class XI 1 as the experimental class and class XI 4 as the control class. The materials used in this study are temperature and heat. The purpose of the research was to experiment with ethnophysics flipbook media. In class XI 1, learning is applied with the help of ethnophysics flipbook media, while in class XI 4, ordinary learning is applied with the help of flipbook media.

From the data obtained, the next step is to conduct a normality test. The test is carried out to determine whether the data of student learning outcomes is distributed normally. With a sample count of more than 50, the Kolmogrov-Smirnov test was chosen as the analysis method. Details of the test results can be seen in Table 4.3

Table 4.3 Results of Normality Test of Student Learning Outcome Data

		Kolmogrov-Smirnov[a]			Shapiro-Wilk		
	Kelas	Statistic	df	Sig.	Statistic	df	Sig.
Hasil Belajar	Pretest Eksperimen	.281	34	.000	.815	34	.000
	Posttest Eksperimen	.223	34	.000	.910	34	.009
	Pretest Kontrol	.227	35	.000	.854	35	.000
	Posttest Kontrol	.238	35	.000	.876	35	.001

Based on Table 4.3, the results of the significance of the pretest and posttest were obtained from the same learning outcomes in the experimental class and the control class which showed the same value, which was 0.000. A Sig. value exceeding 0.05 indicates that the data has a normal distribution. However, the results showed that the Sig. value in the experimental class and the control class < 0.05 so that it did not meet the normal distribution requirements. The results of data processing showed that students' physics learning outcomes in both classes were not distributed normally. Therefore, in the hypothesis testing process, the Independent Sample T-test cannot be used because the data does not meet normal assumptions. Instead, the non-parametric Mann-Whitney U test was used for hypothesis analysis, utilizing SPSS 22. The results of these tests are presented in the following Table 4.4:

Table 4.4 Mann-Whitney U test results Learning outcomes

Test Statistics[a]

	Hasil Belajar
Mann-Whitney U	136.500
Wilcoxon W	766.500
Z	-5.645
Asymp. Sig. (2-tailed)	.000

a. Grouping Variable: Kelas

From the Mann Whitny-U test listed in Table 4.4, an Asymp Sig. (2-tailed) value of 0.000 was obtained, which indicates that the value is less than 0.05 (0.000 < 0.05). The conclusion of these results is the acceptance of the alternative hypothesis (Ha) and the rejection of the null hypothesis (Ho). Thus, there was a significant difference in the achievement of learning physics between students in the experimental class with the ethnophysics flipbook media and the students in the control class without the media. Therefore, the use of ethnophysics flipbooks has an effect on the achievement of learning outcomes of high school students. N-gain analysis was then used to evaluate improved learning outcomes in both classes. The results of the calculation can be seen in the following Table 4.5:

Table 4.5 Test Results N-gain Score of Each Indicator

Indikator	Eksperimen		Kontrol	
	N-Gain	Kategori	N-Gain	Kategori
C1	-0,08	Rendah	-0,35	Rendah
C2	0,70	Tinggi	0,46	Sedang
C3	0,34	Sedang	-0,23	Rendah
C4	0,57	Sedang	0,37	Sedang
C5	0,33	Sedang	0,30	Sedang

Table 4.5 shows that there is an increase in the experimental class and the control class in each of the learning outcome indicators. In the experimental class, the memory ability (C1) did not improve, with an N-Gain test value of -0.08. However, in the aspect of comprehension (C2), the N-Gain test showed a value of 0.70. To apply (C3), the N-Gain test value is 0.34, while the analysis (C4) shows a value of 0.57. Finally, in the evaluation aspect (C5) the N-Gain test value reached 0.33. Meanwhile, in the control class, the ability to remember (C1) showed an N-Gain test result of -0.35. However, in the aspect of understanding (C2) the N-Gain test results reached 0.46. As for applying (C3), the negative N-Gain test value was recorded at -0.23. In the analysis aspect (C4) the N-Gain test showed a value of 0.37, while in the evaluation (C5) the value of the N-Gain test reached 0.30.

In this study, the assessment was carried out using a learning outcome test with 10 multiple-choice questions, both for pretest and posttest. This study was conducted three meetings with a duration of about 90 to 135 minutes. The study aims to examine the effect of the use of ethnophysical flipbook media on the learning outcomes of high school students.

The learning media applied in the experimental class is the ethnophysics flipbook media on temperature and heat materials. This media contains temperature and heat material that is integrated into the local wisdom of the culture of drying on and making bricks accompanied by pictures and videos in it and also many navigation buttons that can be used, in addition to that there are LKPD that are used during learning, and quizzes that can be accessed at the end of the lesson. In the use of this ethnophysics flipbook media is quite easy, students only need to click on the link sent by the researcher in the whatshap group. After accessing the ethnophysics flipbook link, it will go directly to the website, then it will enter the initial display (cover). The use of this ethnophysics flipbook is very practical because it can be stored on a mobile phone or laptop, so that the material can be accessed by students flexibly, wherever and whenever needed.

Based on the results of the research, the learning outcome data can be known by the distribution of the pretest before learning begins and also the distribution of the posttest after the learning activity in the last sub-chapter of the material that has been carried out in the control class and the experimental class. The questions in the pretest and posttest consist of 10 multiple-choice questions that are in accordance with the cognitive realm ranging from C1 – C5. Students are given 30 minutes for each pretest and posttest. The data obtained from the pretest and posttest are then processed statistically.

The results of the N-Gain calculation based on indicators in the cognitive domain C1 (remembering) showed that the experimental class got an N-Gain score of -0.08 which was included in the low category. A negative N-Gain value was also recorded in the control class, which was -0.35. One of the main factors that causes

this is the low literacy of students. Based on the results of observations made during the learning process, most students only listen to the teacher's explanation without trying to read or understand the teaching material independently. This finding is strengthened by research by Sari & Rosdiana (2024) which states that low science literacy among students is influenced by reluctance to read, because physics material is considered difficult due to the large number of formulas. On the other hand, the use of mobile phones that are not used for learning also reduces their involvement in learning. In addition, the lack of interest in reading students is also the main factor in the low cognitive ability at the C1 level (remembering) found during observation. Students who have a low interest in reading tend not to be actively involved in understanding the material independently, so basic information that should be easily remembered is not absorbed optimally. This is in accordance with research by Kinasih & Mariana (2021) which reveals that students' high interest and motivation to learn will have an influence on the learning outcomes that students will get.

Furthermore, the indicator in the cognitive domain C2 (understanding), the experimental class showed an N-Gain value of 0.70 which was included in the high category. Meanwhile, the control class got an N-Gain value of 0.46 which was categorized as low. The results showed that students from the experimental class were able to understand the material delivered through the ethnophysics flipbook well. This can happen because when the material is delivered, students can follow and understand the meaning of learning by understanding the content of the material on each page of the ethnophysics flipbook and responding to the questions given, supported by a hands-on practicum related to local wisdom. This is in accordance with the research of Silalahi & Budiono (2023) concluding that the use of web-based flipbooks as teaching materials can facilitate teachers in delivering science material. In addition, students also understand the material delivered through the teaching materials faster. In addition, Rahmadiningrum & Wulandari (2024) stated that e-Book media based on local wisdom in the form of flipbooks is able to improve students' cognitive understanding and learning outcomes.

The C3 cognitive achievement indicator (applying) in the experimental class obtained an N-Gain value of 0.34 which is included in the medium category. This means that in the experimental class, they are able to apply the concepts of the material that have been taught through the ethnophysics flipbook. This success is supported by a video footage from youtube in an ethnophysics flipbook that displays events that occur in daily life related to the concepts of temperature and heat. This is in line with Solihati's (2022) research which states that the use of learning media based on local wisdom can provide a more valuable learning experience. In addition, research by Regina & Wijayaningputri (2022) states that through the exploration of community science knowledge, students can transform indigenous knowledge that is considered cultural heritage into a science concept that can be accounted for, thereby expanding the use of natural resources. Meanwhile, in the control class, an N-gain value of -0.23 was obtained which was in the low category. This is due to the inability of students to solve counting problems. Difficulties in applying concepts in numerical form are the main obstacles in improving learning outcomes. This is in line with the research of Patandean et al (2023) that the difficulties faced by students in learning physics are

the difficulty of determining the formula that must be used to solve the problem. In addition, Sutrisna's research (2021) states that there is a tendency for students to use memorization techniques as a vehicle to master science rather than thinking skills, so that many students memorize a concept that they actually do not understand and understand.

The C4 cognitive learning outcome indicator (analyzed) showed that the N-Gain value in the experimental class reached 0.57 and was included in the medium category. Meanwhile, the control class obtained a value of 0.37 which was also in the same category. This means that students in both classes, experiments and controls are able to analyze the material that has been delivered through an ethnophysics flipbook. In the ethnophysics flipbook, there are examples of pictures of drying rice and bricks in the surrounding environment. During the LKPD work, students are given the opportunity to observe the rice drying process in the morning – afternoon through a simple practicum. This statement is in line with the findings of a study conducted by Putri et al. (2025) which states that there is a traditional method for drying grain, namely using heat from sunlight. Students can analyze the changes that occur as the drying takes place by answering questions to solve in their groups. Through discussion assignments, students have the opportunity to analyze calculation problems and contextual problems related to daily life in the context of temperature and heat materials. This is in accordance with the opinion of Silfia (2023), because e-flipbook media can improve students' cognitive understanding through problems both in the real world and problems contained in reading texts.

The C5 indicator (evaluating) in the experimental class, the N-Gain value reached 0.33 and was classified as moderate. Meanwhile, the control class showed a value of 0.30 which was also in the medium category. This means that students in the experimental and control classes are able to assess the local wisdom of the material in the ethnophysics flipbook. This finding is in line with the research of Gustalia & Setiyawati (2023), which emphasizes that the implementation of IPAS learning with a local wisdom-based approach allows students to pay more attention to the social and cultural environment and instill local cultural identities and values. In addition, research by Jufrida et al. (2020) states that learning resources taken from local wisdom can contribute to restoring character values that are beginning to fade among students.

During the learning process, there are several technical obstacles that hinder the effectiveness of using flipbook media, including: lack of preparation when starting a lesson about the use of learning media. One of them is that the mobile devices used by some students do not support opening the browser or displaying ethnophysics flipbooks properly, so students only listen to the teacher, not read the material in it. In addition, some students do not have adequate internet quota access, so learning time becomes less effective because they have to wait or experience obstacles in accessing the material online.

CONCLUSION

The following narrative can be used to convey these two points in a concise and academic manner:

The use of ethnophysics flipbook media in learning shows a significant influence on the learning outcomes of high school students, especially on temperature and heat materials. This media not only presents teaching materials in visual and interactive form, but also integrates local cultural elements that are relevant to physics concepts, so as to increase student involvement in the learning process.

The effectiveness of the use of ethnophysics flipbook media can be seen from the improvement of students' cognitive learning outcomes. This is supported by data on the acquisition of an N-gain value of 0.35 which is included in the category of moderate increase. This value shows that after using the learning media, students experience a significant increase in understanding compared to before the learning took place. Thus, ethnophysics flipbooks have been proven to be able to make a positive contribution to the achievement of student learning outcomes, especially in the cognitive realm.

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