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Implementation of Mathematic Teaching Materials Based On Ethnomatematics of “Museum Kereta” Of Yogyakarta Palace to Optimize Learning Interests and Outcomes

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Implementation of Mathematic Teaching Materials Based On Ethnomatematics of “Museum Kereta” Of Yogyakarta Palace to Optimize Learning Interests and Outcomes

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Article Info

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Abstract

Technological developments in education have gradually shifted conventional methods. Online learning that is carried out in a relatively long time results in students experiencing burnout which reduces student interest and learning outcomes. In addition, frequent online activities by students can have a negative impact on eroding noble cultural values. To overcome these problems, an innovation in learning is needed. The purpose of this study was to analyze student interest and learning outcomes after the implementation of ethnomatematics-based mathematics teaching materials at the “Museum Kereta” of Yogyakarta Palace. The type of research used is quasi-experimental research with one group pretest-posttest. The research was conducted online with 17 students of grade VI SDN 3 Sukodono in the academic year 2020/2021. The research procedure was carried out in three stages, namely pretest, implementation of teaching materials, and posttest. Collecting data in this study using interest questionnaires and learning outcomes tests. The results of the questionnaire were analyzed based on the average classical score and based on indicators of interest. The pretest and posttest results were analyzed using t-test. The results showed that after the implementation of ethnomatematics-based mathematics teaching materials of learning interest is at high criteria and student learning outcomes become optimal.

Keywords: Implementation, ethnomatematics of “Museum Kereta”, learning outcomes

Introduction

Era 4.0 has triggered rapid developments in various fields. In the world of education, this phenomenon is gradually shifting conventional methods. One of the suitable learning strategies to be developed in this millennial era is online-based learning. Online learning is information and communication technology to enable students to learn anytime and anywhere (Dahiya, et al., 2016). In simple terms, Brown (2002) states that online learning (electronic learning) is a learning activity that utilizes networks (internet, LAN, WAN) as a method of delivery, interaction and facilitation and is supported by various other forms of learning services.

Online learning has the very risk of having a negative impact on students by the lack of educational content on the internet (Halupa, 2016; Anh, 2017; Nazarlou, 2013). In this case, the role of parents is needed in supervising student learning. These negative impacts can cause the erosion of the nation's noble cultural values. This is due to the lack of application and understanding of the importance of cultural values in society.

Cultural values as a foundation for national character are important things to be instilled in every individual. One of the media that can connect culture and education, especially mathematics, is ethnomatematics (Rahmawati, et al., 2019; Rosa & Orey, 2011; Hariastuti, et al., 2019). Ethnomatematics is a form of culture-based learning in the context of mathematics (Muhtadi, et al., 2017; Widada, 2018). Ethnomatematics was introduced by D'Ambrosio (2006) which states that ethnomatematics is analogous to a lens to view and understand mathematics as a cultural product.

Through the application of ethnomatematics in education, it is hoped that students can better understand mathematics and their culture, so that cultural values which are part of the national character are embedded from an early age (Setiana, 2020; Maryati 2019). Therefore, teachers should choose the right learning strategy to improve student competence while instilling a student's cultural character.

The conditions of the Covid-19 pandemic have forced learning at all levels of education to be carried out online (Dhawan, 2020; Field & Hartnett, 2020; Simamora, 2020). However, due to the long pandemic condition, students began to feel bored with studying at home. Monotonous learning by only giving assignments causes student learning interest to decline. Interest is a powerful motivational process that energizes learning, guides academic and career trajectories, and is essential to academic success (Harackiewicz, et al., 2016). Interest is a choice of certain forms of an activity when a person is not under pressure from outside himself (Nitko, 2007). Interest can also be said as indulgence and involvement in a deliberate activity (Schunk, 2010). Interest is related to curiosity (Elliot, 2000). So that learning interest can be said to be an interest and involvement of students in learning activities without any pressure from outside themselves. Based on the definition, several aspects of learning interest can be derived, namely: (1) Having an interest in activities related to understanding the material, (2) participating in learning, (3) interacting with teachers and friends, (4) reading books, (5) completing questions, (6) doing exercises / assignments, and (7) following the implementation of tests.

Decreased learning interest due to online learning that is carried out for a long time causes various problems in learning (Hamid et al., 2020). Those problems including students being not enthusiastic about taking part in learning, lazy to read subject matter, lazy to do assignments given by the teacher, so they do not want to take tests. Especially in learning mathematics, abstract mathematical objects make it difficult for students to learn them independently during online learning (Febriana, et al., 2019). This situation will ultimately result in student learning outcomes that are not optimal.

Learning outcomes are defined as statements of what a learner knows, understands and is able to do after completion of learning abilities (Harris & Clayton, 2019). Learning outcomes include cognitive, affective, and psychomotor abilities (Suprijono, 2009). The object of the assessment is to determine the learning outcomes of students, namely in the form of new abilities that students acquire after they follow the learning process about certain subjects. Factors that influence learning outcomes can be classified into internal factors and external factors (Raresik, 2016).

Learning outcomes that are not optimal are certainly not expected so that it forces various parties to immediately take corrective actions. In addition, in mathematics learning it is necessary to contextualize mathematical concepts to make it easier for students to understand these concepts. One of the efforts to improve student interest and learning outcomes that are not optimal is by providing innovations in learning. One of the innovations in learning can be provided through teaching materials.

In previous research, researchers have conducted a study on the development of mathematics teaching materials based on ethnomatematics of "Museum Kereta" of Yogyakarta Palace. The "Museum Kereta" is a horse-drawn carriage garage owned by the Yogyakarta Palace which is located in the Yogyakarta Palace complex located in Yogyakarta City, Yogyakarta Special Region. Various cultural elements that can be studied are several horse-drawn carriages belonging to the Yogyakarta Palace, either still in use or which have been museumed. The teaching materials that are arranged contain materials for flat and space structures.

Based on this description, the researcher carried out research with the implementation of ethnomatematics-based mathematics teaching materials of "Museum Kereta" of Yogyakarta Palace to optimize student interest and learning outcomes. The novelty of this article is the implementation of ethnomatematic based teaching materials through online learning to optimize the interest and learning outcomes of elementary school students. The formulation of the problem of this research is how the students' interest and learning outcomes after the implementation of ethnomatematics-based mathematics teaching materials of "Museum Kereta" of Yogyakarta Palace? Based on the formulation of the problem, the research objective was determined, namely to analyze student interest and learning outcomes after the implementation of ethnomatematics-based mathematics teaching materials of "Museum Kereta" of Yogyakarta Palace.

Method

Types of research

This type of research is quasi-experimental research with one group pretest-posttest. To determine the effectiveness of teaching materials implemented in mathematics learning in terms of student interest and learning outcomes.

Research Settings

The research was carried out through online learning in August 2020 for the 2020/2021 school year for SDN 3 Sukodono students located in Sukodono Village, Donorojo District, Pacitan Regency, East Java.

Population and Sample

The population in this study were all students of SDN 3 Sukodono. Through purposive sampling technique, the research sample was determined, namely 17 students of class VI.

Research procedure

The research procedure consisted of 3 stages, namely pretest, implementation of teaching materials, and posttest. Implementation of online learning with assistance from parents through video converence using the google classroom platform for 3 meetings with a duration of 45 minutes in each meeting. Learning is carried out using ethnomatematics-based mathematics teaching materials of “Museum Kereta” of Yogyakarta Palace which have been distributed to students in the form of learning handouts before the implementation of online learning.

Data Collection Instruments and Techniques

Data collection techniques through tests and questionnaires. The test was carried out twice through pretest and posttest. The pretest was given before giving the treatment, while the posttest was given after the implementation of the lesson by implementing ethnomatematics-based mathematics teaching materials at the Yogyakarta Palace Railway Museum. The questionnaire instrument was arranged based on the indicators of students' learning interest mathematics, namely: (1) interested in understanding mathematics material, (2) doing math exercises / assignments, (3) taking mathematics lessons, and (4) carrying out evaluation tests for learning mathematics. The learning interest questionnaire contains 20 statements with answer choices: always, often, sometimes, and never. The answer is converted into a score on a scale of 1-4. The test instrument consists of 5 description questions in the material of flat shapes and shapes. Two experts validated the learning interest test and questionnaire instruments with valid results, so the test instrument was feasible to use in research. The validity test was also carried out using Product Moment Pearson Correlation which states 20 questionnaire statements and 5 test questions are valid. By using Cronbach's Alpha, the test reliability calculation results were $0.850 > 0.60$ so that the test reliability was high. Meanwhile, the reliability results of the questionnaire showed that the Cronbach's Alpha value was $0.911 > 0.60$ in the high category.

Data analysis technique

To test the effectiveness of the implementation of ethnomatematics-based mathematics teaching materials at the Railway Museum in terms of student learning outcomes, it was carried out through paired sample t-test analysis. The analysis was carried out using the SPSS 20 for window software at a significance level of 5%. Before testing the hypothesis, first the assumption test is carried out, namely the normality test. The normality test was carried out on the pretest results of 17 students with the following results.

Table 1. Normality Test Results
Tests of Normality

	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
pretest	,136	17	,200*	,941	17	,336
posttest	,096	17	,200*	,981	17	,967

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Based on Table 1, it can be seen that the Shapiro-Wilk Sig value at the pretest is $0.336 > 0.05$ and at the post-test is $0.967 > 0.05$, so it can be said that the data comes from a normally distributed population. Furthermore, after the post-test results were obtained, the t-test was carried out on a sample of 17 students. The research hypothesis formulation is:

$H_0: \mu_{pre} = \mu_{post}$: Mathematic teaching materials based on ethnomatematics of Yogyakarta Palace “museum kereta” is not effective in optimizing student learning outcomes

$H_a: \mu_{pre} < \mu_{post}$: Mathematic teaching materials based on ethnomatematics of Yogyakarta Palace “museum kereta” is effective in optimizing student learning outcomes

To analyze students' learning interest, it was carried out by analyzing the classical learning interest questionnaire score and the score analysis for each indicator. The percentage of each analysis is then calculated and then qualifies it based on the qualifications of the student's interest as stated in Table 2 below.

Table 2. Criteria for Student Learning Interest

Percentage (%)	Criteria
$80,0 < \bar{M} \leq 100,0$	Very high
$60,0 < \bar{M} \leq 80,0$	High
$40,0 < \bar{M} \leq 60,0$	Moderate
$20,0 < \bar{M} \leq 40,0$	Low

Results and Discussion

Learning Interest

The results of the analysis of the classical interest questionnaire obtained an average percentage score of 78.5%. Based on the qualifications of student learning interest, it can be concluded that student learning interest is at high criteria. The analysis based on the indicators of mathematics learning interest can be seen in Table 3 below.

Table 3. Results of Learning Interest Analysis Based on Interest Indicators

No	Indicator	Percentage	Criteria
1	interested in understanding math material	82%	Very high
2	doing math exercises / assignments	78%	High
3	follow mathematics learning	80%	High
4	carry out a mathematics learning evaluation test	74%	High

Learning outcomes

Data collection through tests was carried out before and after the implementation of ethnomatematics-based mathematics teaching materials for the “museum kereta” in online learning. Data were analyzed using paired sample t-test on SPSS with the following results.

Tabel 4. Paired sample test result
Paired Samples Test

		Paired Differences				t	df	Sig. (2-tailed)	
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower				Upper
Pair 1	pretest posttest	-18,58824	2,98033	,72284	-20,12058	-17,05589	-25,716	16	,000

Based on Table 4 above, it is found that the p-value is 0.000 less than 0.05. It can be concluded that H0 is rejected and Ha is accepted, this means that the implementation of ethnomatematics-based mathematics teaching materials of Museum Kereta is effective in optimizing student learning outcomes.

Discussion

The success of the learning process that occurs in the classroom cannot be separated from the role of the teacher in determining learning methods or strategies (Munawaroh, 2017; Hernawati, 2017). In learning, one of the teacher's duties is to act as a facilitator who facilitates student learning needs to achieve learning goals (Terpollari, 2011; Purnama, 2015). However, learning that is carried out online does not provide the opportunity for teachers to maximize the learning process due to various obstacles. Time and space constraints are of course an obstacle that is felt by both teachers and students.

Online learning, especially what has been carried out at SDN Sukodono 3, can be said to be relatively difficult to implement, because the conditions in the area are in mountainous areas so that there is minimal signal from cellular operators. In fact, the main key to smooth online learning lies in the relatively stable operator signal. These constraints cause learning not to be carried out as it should. As a solution, the teacher only provides modules and assignments to students without knowing the students' abilities in completing these assignments. Therefore, many students have started to feel bored with existing learning routines.

Online learning through the implementation of ethnomatematics-based mathematics teaching materials provides a special enthusiasm for students to learn. With good preparation and planning, online learning through video conference can be carried out and have a positive impact on students.

1. Student's learning interest

Based on the results of the analysis of the student interest questionnaire, it can be seen that the average score of the student interest questionnaire is at a high qualification, so it can be said that the implementation of ethnomatematics based mathematics teaching materials is effective in increasing student learning interest (Parmawati & Yugafiati, 2017; Herawaty, et al., 2019). The analysis was also carried out based on the indicators of learning interest as follows.

a. Interested in understanding math material

Based on the results of the learning interest questionnaire, it is known that students' interest in understanding mathematics material has an average percentage of 82% which is included in the very high category. Thus the implementation of mathematics teaching materials can increase students' interest in understanding mathematics material. Images in modules or textbooks can influence the learning process

(Kasmaienezhadfad, 2015). Students usually look at the picture first before reading the text. With the images in the teaching materials that students learn, it raises students' curiosity about these images, so that students will also have interest and motivation to study the material contained in it (Pluck & Johnson, 2011; Shin et al., 2019).

- b. Do math exercises / assignments
Based on the results of the learning interest questionnaire, it is known that the efforts of students in doing individual tasks have an average percentage of 78% with high qualifications. Thus the implementation of mathematics teaching materials can increase students' efforts in doing individual assignments. With the desire of students to study the material that is in teaching materials, it makes students have an understanding of the concepts being studied. Armed with this understanding of the concept, it raises the desire to simultaneously work on the practice questions contained in the teaching material (Jazuli et al., 2017).
- c. Take mathematics lessons
Based on the results of the learning interest questionnaire, it is known that the efforts of students in participating in learning have an average percentage of 80% with high qualifications. Thus the implementation of mathematics teaching materials can increase students' efforts in participating in mathematics learning. The ethnomatematics-based mathematics teaching material of the Railway Museum includes pictures of the "Museum Kereta" collection that can be observed and studied during learning. In addition, in the implementation of online learning, animations and videos are also provided showing the "Museum Kereta", so that there is a desire from students to return to learning mathematics at the next meeting (Rahmawati, 2018).
- d. Carry out a mathematics learning evaluation test
Based on the results of the learning interest questionnaire, it is known that the efforts of students in carrying out the mathematics learning evaluation test have an average percentage of 74% with high qualifications. Thus the implementation of mathematics teaching materials can be said to be sufficient to increase students' efforts in carrying out the mathematics learning evaluation test. During the learning process using ethno-matematics-based mathematics teaching materials, students have an understanding of the material being studied, namely flat shapes and space shapes. Armed with this understanding, making students ready to carry out evaluation tests that are carried out after the last lesson (Jazuli et al., 2017).

Based on the description above, the results of the average score analysis and interest indicators show that the percentage of students' learning interest is in the high category. This shows that the implementation of ethnomatematics-based mathematics teaching materials of "Museum Kereta" of Yogyakarta Palace is effective in optimizing the learning interest of grade VI students of SDN Sukodono 3.

2. Student learning outcomes

Based on the results of hypothesis testing using the t-test, it can be seen that there is a significant difference between the pre-test and post-test scores carried out after the implementation of learning using ethnomatematics-based mathematics teaching materials of "Museum Kereta" of Yogyakarta Palace. This shows that the implementation of ethnomatematics-based mathematics teaching materials of "Museum Kereta" of Yogyakarta Palace is effective in optimizing the learning outcomes of grade VI students at SDN Sukodono 3.

The advantages of ethnomatematics-based mathematics teaching materials for of "Museum Kereta" of Yogyakarta Palace are that the teaching materials contain pictures of the Yogyakarta Palace's trains which have cultural and historical values that students have never seen or studied before. In the pictures, the concept of flat and spatial shapes is inserted so that students feel mathematics is close to their lives. By linking learning materials to real life contexts, students can easily understand the content of the material provided by the teacher. Through contextual mathematics, it will make it easier for students to learn mathematical objects and concepts that are abstract in nature (Widjaja, 2013; Selvianiresa & Prabawanto, 2017).

Besides being effective in optimizing student interest and learning outcomes, the implementation of ethnomatematics-based mathematics teaching materials of "Museum Kereta" of Yogyakarta Palace also has a positive impact in developing students' noble cultural characters. Through these teaching materials students learn local culture at the same time. Culture has a fundamental role and function as the main foundation in the life order of the nation and state because a nation will be great if cultural values have taken root in people's lives.

Conclusion

After the implementation of ethnomatematics-based mathematics teaching materials of “Museum Kereta” of Yogyakarta Palace, an analysis of student interest and learning outcomes is carried out. The results of the analysis of classical student learning interest based on the average score and the analysis of each indicator can be concluded to be at high criteria. The analysis of student learning outcomes based on the t-test indicated that there was a significant difference between the pretest and posttest scores. Thus it can be concluded that the implementation of ethnomatematics-based mathematics teaching materials of “Museum Kereta” of Yogyakarta Palace is effective in optimizing student interest and learning outcomes.

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