ETHNOMATHEMATICS: INCREASED UNDERSTANDING OF MATHEMATICAL CONCEPTS IN DEBUS AND PATINGTUNG ARTS BANTEN INDONESIA

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ETHNOMATHEMATICS: INCREASED UNDERSTANDING OF MATHEMATICAL CONCEPTS IN DEBUS AND PATINGTUNG ARTS BANTEN INDONESIA

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Abstract

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Purpose: This study aims to find out how students' ability to understand mathematical concepts after being given ethnomathematics learning and to find out the increase in students' mathematical understanding abilities after being given ethnomathematics learning to class IXB students of Mts mathla'ul falah siremen.

Methodology: This research is a descriptive qualitative research. Data collection techniques used were observation, distributing questionnaires, interviews, and testing students' ability to understand mathematical concepts. The research instrument used was an interview sheet with the leadership of Debus Surosoan and students and a test of students' ability to understand mathematical concepts. The analysis technique used in this study is the analysis of the results of the observation sheet, analysis of the results of interviews with the head of Padepaokan Debus Surosoan and students, and analysis of the test results for students' ability to understand mathematical concepts using the N gain test. Description analyst to find out the increase in the understanding of mathematical concepts of Class IXB students at Mts mathla'ulfalah siremen.

Results: The results of the study stated that after learning about ethnomathematics in geometrical learning, namely tubes, there was an increase of 24% from the test results of the application of ethnomathematics in the arts of debus and patingtung, from the results of the N gain test the increase was declared ineffective because it had a less accumulated percentage of 40% which is only 36%.

Conclusion: Increased mathematical comprehension ability of students after being given learning Ethnomathematics has increased, learning using the Debus and Patingtung ethnomathematical approaches in terms of the results of trials to get the accumulated scores of students after learning with an ethnomathematical approach has increased by 24% with pretty good criteria so that learning with the Debus and Patingtung ethnomathematical approaches is quite well used in mathematics learning in the classroom.

Keywords: implementation, ethnomathematics, increased understanding.

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1. Introduction

This research was motivated by the lack of mathematical understanding ability of students. Because of this, it is essential for an educator's efforts to improve students' mathematical understanding skills in every learning in the classroom by presenting learning innovations. Among these innovations is to combine cultural elements with the material being studied, which is then called ethnomathematical learning. Based on this background, the purpose of this study can be formulated to find out how students can understand mathematical concepts after being given ethnomathematical learning. Moreover, To find out the improvement of students' mathematical understanding ability after being given ethnomathematics learning.

2. Method

The type of research used is qualitative, descriptive, and quantitative, conducted by observation activities at Padepokan Debus Surosowan and trials applying ethnomathematics learning in class IXB Mts Mathla'ulfalah Siremen. This study's research subject data sources are Padepokan leader Debus Surosowan and class IXB student Mts Mathla'ulfalah Siremen. The source of data in this study, documentation, and interview results are sources of information data and pretest results and posttests of students and students of mts mathlaul'falah siremen class IXB. And literature studies.

Data collection techniques were collected by observing and conducting interviews with Padepokan chairman Debus Surosowan, debus players, music players, and spectators. Moreover, conduct tests of the ability to understand mathematical concepts in class IXB Mts mathla'ulfalah siremen. The research instrument the author prepared is interview sheets for studio leaders, performers, audience members, music performers, and instruments testing students' mathematical concepts.

Analysis of Interview Results of the Chairman, performers, audience, and music performers.

The interview activity of the studio leader, players, and the audience is the researcher's first step, aiming to dig deeper into the use of ethnomathematical concepts found in debus and patigtung martial arts. Furthermore, the interview results were processed and used as source material for teaching students to understand how students' ability to understand mathematical concepts after being given ethnomathematical learning in debus and patingtung arts and to find out the increase in students' mathematical understanding abilities after being given ethnomathematical learning in debus and patigtung arts.

Analysis of the results of the student's mathematical concept comprehension ability test.

The research uses a test question scoring rubric as a measuring tool for answering a question on a precisely determined indicator. Analysis of the results of the test of students' mathematical concept comprehension ability aims to determine the results of increasing students' mathematical understanding ability in debus and patingtung art and how students' mathematical understanding ability after being given ethnomathematical learning in debus and patingtung art, the results of the test of students' mathematical concept understanding ability are carried out by analyzing descriptively and also doing the N-gain test.

This heading is for subheadings elsewhere in the manuscript.

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3. Results and discussion

Padepokan Debus Surosowan was established in the early 1950s. Padepokan Debus Surosowan in Kampung Turus Railway Station, Tegal Sari, Walantaka, Serang City, is the oldest hermitage that teaches debus. Padepokan Debus in Serang City, Banten, recorded 16 performances at international festivals. Banyan trees towered large in the courtyard of Padepokan Debus Surosowan. The leaves are dense, making the courtyard standing since the 1950s feel shady. In addition, the tree, which is more than a century old, has become a symbol of the splendor of the hermitage founded by the Banten debus figure, H Muhammad Idris (alm).

When he first researched on July 21, 2023, at Padepokan Debus Surosowan, researchers conducted interviews with leaders as well as debus players at Padepokan Surosowan, as follows:

The results of the interview.

1) Interview of Padepokan chairman Debus Surosowan.

The several questions the researchers asked aimed to add in-depth information about implementing mathematical elements in the art of Debus and Patingtiung.

Table. 1 Interview table of the head of the hermitage

No	Question		Answer
1	"What kind of thing do debus players do before doing attractions.?"	:	"*Before that, the first one I read a little bit, I did not read it yet, which was too late, after I just got excited about it*." "Before doing debus, there are four stages that must be done: the first is reading solawat, after that, reading dhikr, the third is belu, after that, it starts immediately. play gembrung silat and debus"
2	At the time of about to pierce the iron or Slashing hand with a cleaver, whether there are specific calculations so that these objects do not work in the body player"	:	"*However, it is a cause that is in the hands of dbus players who are only responsible for lilahitaala, lahaulawalakuata ilabillah, only to gain the power that Allah has made when the players dust nig lianae who carry amulets, from the knowledge of the knowledge* *black*"
			"If that is the case, what is used in this hermitage is only hoping for pleasure from Allah *lahaulawalakuata ilabillah*, unlike other debus players who use amulets, if like that using black magic."

3	" Regarding Wafak, Is It Always Used in Debus Games?"	:	"*Ikumah become gna each other, intinemah debus iku art sng hope for Allah's help alone*" "Back to each person, The point is that debus is an art that hopes for God's help alone."
4	"Regarding Patingtung, what the **** is patingtung?"	:	"*Patingtung is part of debus, lamu debusmah atraksine seagrass patingtung is music*." "Patingtung is a debus component, if debus is the attraction, if patingtung is accompaniment music."
5	"Why, Given Patingtung's name.	:	"*Because of the Sound, the little drums that are not good at the time when they are not allowed to do the people who are happy when they are sling, they are not made into accompaniment music,*" "Because of the sound, which is produced from a small drum and there is also a large drum, in the past Patingtung was often used to accompany the procession of people who were email go first."

Based on the results of the interview, the researcher analyzed ethnomathematics found in debus and patingtung art and concluded that debus and patingtung art have mathematical elements, as contained in the interview activity in point 3, which states about wafak
Interview with four students of class IXB mts Mathla'ulfalah Siremen,
Before being introduced to ethnomathematics.
There are several questions that the researchers asked, which aim to provide in-depth information about understanding mathematical concepts related to ethnomathematics on August 2, 2023.

Table 2 shows how students were previously introduced to ethnomathematics.

No	Question		Answer

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1	"So far, do you know that in every element of the environment, there must be elements of mathematics included in the work of art.? “	:	Student 1: "masasih kang..?" Student 2: "I do not know. Most I know the mathematical element usually done is buying and selling." Student 3: "Know Kang Jndela's rectangular shape." Student 4: "Do not know"
2	"Do you know debus or patingtung art?"	:	Student 1: "You know Kang, debus is immune to hacking, right?" Student 2: "know debusmah, tpi patingtung do not know" Student 3: "Know debus doang" Student 4: "know debus doang, patingtung just heard"
3	"You know, it turns out that in debus martial arts and Patingtung music, there are elements of mathematics nay loh"	:	Student 1: "What..?" Student 2: "Shaking my head while thinking." Student 3: "Know kng his example painting." Student 4: "Do not know kang"

From the interviews with the four students above, it can be concluded that they do not understand the mathematical concepts contained in debus and patigtung art.

Wawan Cara with four students mts mathla'ulfalah siremen after the introduction of ethnomathematics.

Table 3 is of the student interview table after the introduction to ethnomathematics.

No	Question		Answer
1	"After learning ethnomathematics, what benefits can be taken?"	:	Student 1: "So we know the math in our environment better." Student 2: "So love learning" Student 3: "So I understand the mathematics that can be useful in art." Student 4: "Can you understand more?"
2	"What is the difference after Kakang explains about ethnomathematics contained in debus and patingtung art, with before explained.	:	Student 1: "It is clear that it is different to understand better." Student 2: "The difference is better." Student 3: "When it has not been explained, mah rada does not believe the debus period exists as the mathematical element." Student 4: "Understand more"

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3	"Meaning now you understand ethnomathematics in debus and patingtung art?"	:	Student 1: "understand more kang" Student 2: "Understand Kang, so it is nice to learn not to get bored." Student 3: "I do not understand much about it, and it is not much." Student 4: "I understand better, and I think debus I am just a mess with most of the math. ”

From the results of student interviews after learning about ethnomathematics, students feel more sensitive to the surrounding environment with mathematical elements.

Results of the Student Mathematical Concept Understanding Ability Test Based on the results of student answers obtained from the results of practice tests on the ability to understand mathematical concepts, results were obtained before and after the introduction of ethnomathematics to debus and programming arts as follows:

Table 4 Result Test Ability Understanding Mathematical Concepts of Students

Before			**After**		
No	**Student name**	**Value**	**No**	**Student name**	**Value**
1	Abdul rouf	80	1	Abdul rouf	85
2	Adam	80	2	Adam	80
3	Arman maulana	65	3	Arman maulana	70
4	Evi magfiroh	70	4	Evi magfiroh	70
5	Farid ardiyansah	80	5	Farid ardiyansah	85
6	Kesya novia	80	6	Kesya novia	95
7	M . FAQs	85	7	M . FAQs	90
8	Mita lestari	80	8	Mita lestari	90
9	Nahdatul arif	70	9	Nahdatul arif	70
10	Ningsih	65	10	Ningsih	70
11	Nispa	30	11	Nispa	65
12	Nur Ayu Lestari	40	12	Nur Ayu Lestari	65
13	Nuraeni	60	13	Nuraeni	70
14	Puspa puspita sari	60	14	Puspa puspita sari	70
15	Riana	40	15	Riana	75
16	Rina restianti	50	16	Rina restianti	85
17	Sintiya	80	17	Sintiya	90
18	Subhan	50	18	Subhan	85
19	Sulton	40	19	Sulton	70
20	Winda	40	20	Winda	60
21	Yuliana sfitri	70	21	Yuliana sfitri	85
Total value		1.315	Total value		1.625

The Gain Test then calculates the results of the student's scores. The n-gain test calculates the difference between posttest and pretest scores; gain increases students' understanding or mastery of concepts after the teacher carries out learning. Researchers conducted an N gain test to determine the increase in students' ability to understand mathematical concepts after being given ethnomathematical learning in debus and patigtung arts.

Mathematics learning activities require an approach so that their implementation produces effectiveness. As from the learning objectives themselves, that learning is carried out so that students can master and apply the material to solve a problem. To achieve this teaching goal, teachers should better understand what affects the student learning environment. Among the influential factors in learning is the culture in the community environment students occupy. Culture can determine how students perceive and respond to something. They included understanding mathematical material. When a material is so far from their cultural scheme, of course, the material is difficult to understand. For this reason, an approach is needed in learning mathematics that can connect mathematics with their culture.

Ethnomathematics is a link between mathematics and culture. As explained earlier, ethnomathematics recognizes different ways of learning mathematics. Applying ethnomathematics as an approach to learning mathematics will extensively allow a material learned according to their culture to make the understanding of the material by students more accessible because the material used is directly related to their culture, which is their daily activity in society. Of course, this helps teachers as facilitators in learning to facilitate students in understanding a material. Not only that, ethnomathematics is a breath of fresh air for students when studying mathematics because it is not just counting. Ethnomathematics gives students the freedom to solve problems, analyze, and give opinions on an object that is considered to have mathematical elements based on what students believe.

Speaking of culture, Banten is one of the regions entrusted as the center of civilization of Islamic cultures. Among these cultures that are also the media of Islamic syiar are debus and patigtung martial arts. Then, from these two arts, what things have elements of mathematics, consider the results of the following research:

As we already know, debus is included in martial arts that show the limb immunity of the debus player himself. Of course, this must be done by reliable people because in doing debus, the stages must be ignored. Here is the ethnomathematics in debus.

In debus art performances, players will usually wear typical clothes from debus. The debus player's outfit comprises a lomar, headband, kampret, and pants.

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Figure 1 Debus's Clothing

A tailor will apply mathematics to make dusty clothes that are proportional and comfortable to use. Start by measuring fabric material, dusting shirt patterns, and then calculating the seam allowance. In addition, calculating the total cost of making debus clothing also uses mathematics. In its manufacture, tailors need to design dusty clothes by applying geometry.

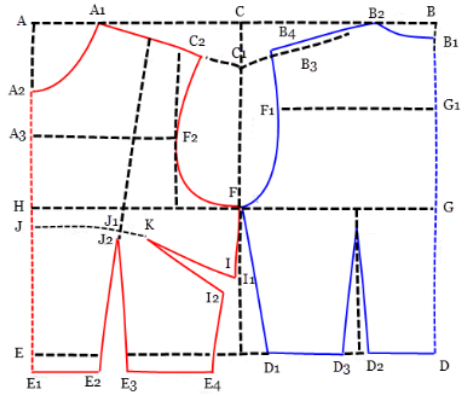

Figure 2 Clothing Design by Applying the Concept of Geometry

In mathematical language, a beautiful shirt is a set of 2-dimensional shapes that will be sewn together to become one whole piece. Making basic clothing patterns is divided into measuring and drawing patterns. The measurement process is carried out to obtain the required size, which is then used to draw patterns on the fabric. Body parts measured for debus clothing patterns include body circumference, neck circumference, shoulder width, chest-length, chest width, peak height, back length, back width, side length, waist circumference, hip circumference, hip height, shirt length, sleeve length, elbow length, wrist circumference, upper back width. In the process of drawing the archetype, there are 3 parts: the basic pattern of the front body, the basic pattern of the back body, and the basic pattern of the hands. In drawing patterns, there are mathematical elements in the form of connecting between points with a line behind horizontal, vertical, or diagonal lines and making right angles. The manufacture of such elements has special rules in their calculations (scales) because pattern-making is inseparable from mathematical calculations for size accuracy.

Making clothing patterns is closely related to mathematical concepts used in lessons at school. Such fundamental concepts are scale, geometry (plane of lines and angles), and operations of real numbers. Operations on numbers are operations of addition, subtraction, multiplication, and division, and operations on fractional forms are often used in everyday life even though people are unaware of using them.

Wafaq is the art of writing Arabic letters and kalimah, with ink mixed with mystic or za'faron as writing utensils. The goal is a blessing, hoping for salvation. Usually, every wafaq that will be written always begins with hadarat, and writing lafdz asma jaljalut is the wafaq's content. (Suhemi 2021).

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Some people think that wafaq is an object with supernatural powers, including some debus players, but according to the explanation above, it can be concluded that wafaq is the art of inscribed ink on written media that aims to hope for blessings. Apart from that, wafaq is generally a set of Arabic numbers that form a pattern, which, when added together, each column has the exact total.

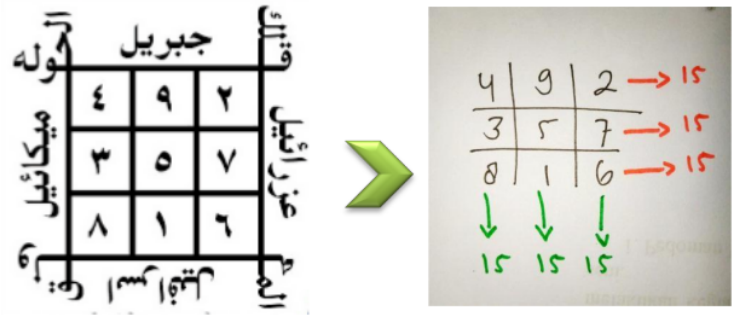

Figure 3 wafaq

From the picture of the wafaq, we can see from all the element rows and columns that it has the same result when added together. This shows that there is a mathematical element when making the wafaq pattern.

Patingtung is used to accompany debus reef and debus bandrong. It consists of 1 large kendang, 2 small kendang, a small gong, a roast gong (made from a drum filled with water and at the top of which is placed a long convex iron), kenuk, angkeb, kecrek, and trumpet. Some are also a combination of penca and tambourine drums.

If we analyze how the scales (tones) are named, it can be seen that most of the tone names are based on the sequence of numbers from one to three with regional naming. This shows the influence of formal mathematical developments on the naming of the barrel and its representation by sorting the barrel (tone) from low notes to high notes ranging from one to three. This means that one of the formal mathematical proofs influences the way of thinking of Banten people in composing the sound of the tone of patingtung.

Table 5 Patingtung beats and tone patterns

Patingtung tone beats and patterns		
Beats	**Sound**	**Tone**
1	**Pa**	**Low**
2	**Ting**	**Keep**
3	**Tung**	**Tall**

The musical instruments used in the patingtung game consist of 1 large kendang, 2 small kendang, small gong, grilled gong (made from a drum filled with water and at the top placed a long iron that has a convex), kenuk, angkeb, kecrek, and trumpet, on this musical instrument there are also mathematical elements in it such as the shape of building space as follows:

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Figure 4 Patingtung musical instrument

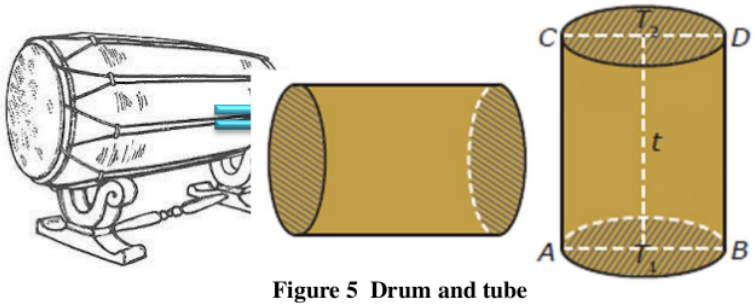

Figure 5 Drum and tube

The drum musical instrument in Patingtung art has mathematical elements of building space, namely in the tube type. The tube is a space that has three surfaces, consisting of a flat circular plane called the base and lid and one upright side plane in the form of a curved plane.
Gong is one of the components of the patingtung musical instrument, which is how to play it by being beaten. The mathematical element in the visible gong is the circle's flat shape.

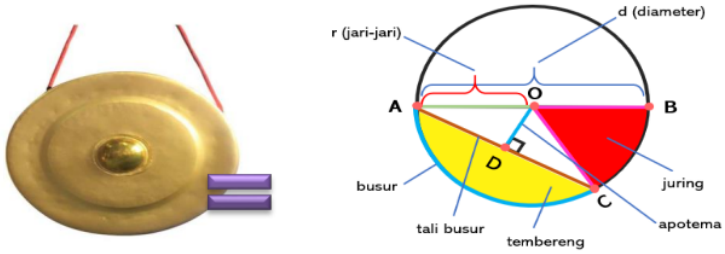

Figure 6 Gong and circle

The picture shows that the mathematical elements contained in one of the patingtung musical instruments, namely Gong, have mathematical elements in the form of a flat circle shape.
Student activities and the learning process by introducing the implementation of ethnomathematics in debus and patingtung arts in class IXB Mts mathla'ulfalah siremen can be seen into three activities as follows:
The role of the teacher in the opening activity is vital, especially being able to direct students

firmly to stay focused on the learning and learning process. That way, the learning process that occurs at the beginning will be in line with the following process and by the understanding (Miarso, 1993) in (Siregar *et al.*, 2010) that learning is a conscious effort by educators to control the learning process by the goals that have been set and can make students learn.

In the opening activity, the teacher greets students, conducts attendance, arranges class situations, motivates students, and conveys learning objectives. At this meeting, the teacher used conventional learning methods.

In the core activity, the teacher explained the relationship between art and mathematics, and the teacher also explained what ethnomathematics is and related it to the learning material being carried out, namely the material for building classroom IX. After the explanation was completed, the teacher asked several questions to students about what had been explained earlier.

In the closing activity, the teacher concluded the material that had been delivered. Furthermore, to close the learning process, the teacher said a greeting, which all students then answered.

Figure 7 learning activity

From the series of learning activities above, the teacher observes student activities. In the learning carried out after being introduced to the implementation of ethnomathematics in debus and patingtung arts, students seemed enthusiastic in paying attention and following learning so that students could restate the concepts that had been taught, give examples of concepts and re-present mathematical concepts that had been taught, as evidenced by the many questions asked by students after the teacher invited students to ask. Of course, this is by the indicators put forward by Pramudia (2019), namely (1) students can restate a concept, (2) give examples and imitate concepts, and (3) present concepts in various forms of mathematical representation.

Learning with Ethnomathematics is a link between mathematics and culture and a breath of fresh air for students in learning mathematics. As explained earlier, ethnomathematics recognizes different ways of learning mathematics. By applying ethnomathematics as an approach to learning mathematics, it will be possible that a material learned by student culture will make understanding of a material more straightforward because the material used is directly related to the student's culture.

Menurt Purwanto (2009: 44) "Understanding or *comprehension* is the ability to expect the *testee* to understand the meaning or concept and the facts known. In this case, *the testee* not only memorizes verbally but understands the concept of the problem or fact in question".

4. Conclusion

The ability to understand students' mathematical concepts after being given ethnomathematical learning has changed for the better, as seen from the fulfillment of indicators of understanding mathematical concepts by students, such as students can restate mathematical concepts contained in debus and patingtung, students can group objects that are considered to have similar mathematical elements, students can provide other examples of other objects around that have mathematic elements in In it, and students can solve existing problems according to their understanding.

Increased mathematical comprehension ability of students after being given learning Ethnomathematics has increased, learning using the Debus and Patingtung ethnomathematical approaches in terms of the results of trials to get the accumulated scores of students after learning with an ethnomathematical approach has increased by 24% with pretty good criteria so that learning with the Debus and Patingtung ethnomathematical approaches is quite well used in mathematics learning in the classroom. Based on the results of the percentage of test analysis that showed an average score of 24% with improvement criteria, it can be said that learning using the implementation of ethnomathematical mathematics, which aims to improve students' understanding of mathematical concepts, is effectively used in the learning process in the ability to understand mathematical concepts of grade IXB students Mts Mathla'ulfalah siremen. However, the results were declared ineffective when the N gain percentage test, which was 36.20, was carried out. This is because the examiner provides material delivery before conducting pretest activities, then after the pretest score is obtained, the examiner conducts learning using ethnomathematical implementations in debus and patingtung arts with the same material and then conducts a posttest. That is what causes the results of pretest scores with student posttest results to have a difference that is not far enough. So, the percentage of N gain test scores calculated from students' pretest and posttest scores is declared ineffective. Based on the test results of students' ability to understand mathematical concepts, it can be concluded that when students have not been taught about ethnomathematics, the total score of all students is 1,315. Then, after being taught, the student's score became 1,625. The difference between the first and second values increased by 24%. It shows an increase in test results after students are introduced to implementing ethnomathematics found in debus and patingtung arts. Therefore, the implementation of ethnomathematics in debus and patingtung arts, which aims to improve students' understanding of mathematical concepts, has been successfully used in the mathematics learning process.

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