Ethnomathematics Journal
Volume 2, No. 2, September 2021 (57-66)
Online: http://journal.uny.ac.id/index.php/ethnomath

Teachers' perceptions of ethnomathematics in Sorong Regency, West Papua

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Submitted: 19 August 2021 | Revised: 7 Sept 2021 | Accepted: 7 Sept 2021 | Available Online: 18 Sept 2021

Abstract

The purpose of this study was to describe the knowledge of teachers in Sorong Regency on the concept of ethnomathematical approach, the role of ethnomathematical approach, the implementation of ethnomathematical approach, the implementation characteristics of ethnomathematical approach, and ethnomathematics knowledge of West Papua. This is a qualitative research with qualitative descriptive methods. Data were collected using a questionnaire distributed through Google Form. The study selected several teachers as the research respondents to answer the existing problems in accordance with the research objectives. The results showed that in terms of conceptual knowledge, most teachers had been aware of ethnomathematics and had known the purpose of ethnomathematical approach, but they had no idea about the principles, advantages, and the weakness of ethnomathematical approach. Judging from the role of ethnomathematical approach, most teachers stated that ethnomathematics helped guide students in their learning, helped students appreciate unexpected useful discoveries, helped them to reflect from their learning, and provided them with opportunities to collect information needed to solve math problems, think logically, consistently, systematically, and to take notes carefully. As seen from the implementation of ethnomathematical approach, most of the teachers had never implemented ethnomathematical approach in the classroom, and they had no idea about the principles of implementation, ethnomathematical learning strategies, ethnomathematical learning resources, and management of learning environment in ethnomathematical approach. Based on the implementation characteristics of ethnomathematical approach, most teachers had no idea about the instruments, content, and cooperation in ethnomathematical learning. Meanwhile, in terms of ethnomathematics knowledge, most of West Papuan teachers had never heard of the application of ethnomathematical learning using *sero kokas*, a traditional Papuan Tifa tools, Papuan bow and arrow, Papuan *noken*, and ethnomathematical artifacts from Papua for classroom learning.

Keywords: *Ethnomathematics, ethnomathematical approach, Papuans, teacher's perception*

How to cite:
Heriyanto, B., & Astutik, H. S. (2021). Teachers' perceptions of ethnomathematics in Sorong Regency, West Papua. *Ethnomathematics Journal*, *2*(2), 57-66. https://doi.org/10.21831/ej.v2i2.41134

INTRODUCTION

The 2013 curriculum aims to sustain education in Indonesia by ensuring that every student acquires life skills as individuals and as citizens of the nation who are faithful, productive, creative, innovative, and affective. The 2013 Curriculum is expected to shape the personality and character of students who are able to contribute to the social life, the nation, and civilized world. Indonesia is one of Asian countries with a multi-cultural population. Of the various cultures in Indonesia, Papua Island is one of the main islands with diverse cultures. The Papua region consists of two provinces with more than 200 tribes. The number of tribes that inhabit Papua is attributed to the fact that the Papuan

tribes still inhabit remote and difficult-to-reach areas. The isolation of the remote areas of Papua gives rise to their distinctive knowledge that flourishes in every region or hinterland. One of this distinguished knowledge is mathematical knowledge.

Information derived from jubi.co.id related to the education in Papua from Robertus Naum, an activist of Tanah Papua Intellectual Institute of Sorong Branch, indicated that the 3 year leadership of the incumbent Regent of Sorong Regency, Stephanus Malak, during his 3 had successfully introduced a free learning education program known as the Regional School Operational Encouragement (Bosda) for the citizens ("Bupati Sorong Dinilai Berhasil Terapkan Pendidikan Gratis," 2015). The Sorong Regency Government provides free education to elementary to high school students throughout Sorong Regency ("Bupati Sorong Dinilai Berhasil Terapkan Pendidikan Gratis," 2015). This is a major leap despite the disconcerting fact of the lack of training program to improve the quality of teachers in suburbs and remote areas in Papua.

In addition to providing ease of financial burden for students' education, the Sorong Regency Government has been rampantly improving infrastructure and facilities, as well as school sports ("Bupati Sorong Dinilai Berhasil Terapkan Pendidikan Gratis," 2015). Apart from this fact, there has been an insufficient training program to increase teachers' capacity in Papua, not to mention to the devoid of well-established training pattern to increase teacher's capacity. In the last few years, there has been no teacher training program ever conducted in this regency. Thus, Robertus Naum required the Sorong Regency Government to carry out regular training as a way to improve the quality and capacity of teachers for more efficient learning. The government is also expected to share support and encouragement for partner institutions concerned with improving the learning quality of Sorong Regency, such as Muhammadiyah Learning University Sorong (UNIMUDA Sorong) and the UNICEF Partnership Program.

The need to improve the learning process in order to enhance the academic quality of school students is not only applicable at the national level, but also at the regional level for students in Papua and West Papua. Modouw (in Pemerintah Provinsi Papua Republik Indonesia, 2021) articulated that the quality of student learning in Papua is still far behind that of other provinces in Indonesia. The 2014 report on the Acceleration of Development of the Papua and West Papua Province (UP4B) revealed that1243 high school graduates received scholarships, but during the period from 2012 to 2014, 11% of scholarship recipients withdrew from the program (Katharina, 2015). This is due to the lack of student experience in the academic field and the students' lack of readiness to explore higher education.

The research on the learning ability of Papuan students in 2008 conducted by the Department of Education uncovered that 77% of Papuan school students will experience learning barriers that are likely to force them to drop out of school. This is mainly attributed to a huge gap between the learning culture of the local area in the family and the school culture, which has an impact on the decreasing achievement in the National Examination (UN) results for Junior High School level (SMP/MTS) in Sorong Regency. This decrease is apparent from the junior high school students' achievement in the National Examination in the 2018/2019 and 2019/2020 academic years of Sorong Regency, as presented in Figure 1 and Figure 2.

NO.	KODE	NAMA SATUAN PENDIDIKAN	NPSN	STATUS	JUMLAH PESERTA	BAHASA INDONESIA	BAHASA INGGRIS	MATEMATIKA	IPA	RERATA NILAI
.	3303999	KABUPATEN SORONG	-	N & S	1.878	61,13	48,66	43,35	46,91	50,01

Figure 1. National Examination Results of Junior High School Students/MTS for the 2018/2019 Academic Year in Sorong Regency

NO.	KODE	NAMA SATUAN PENDIDIKAN	NPSN	STATUS	JUMLAH PESERTA	BAHASA INDONESIA	BAHASA INGGRIS	MATEMATIKA	IPA	RERATA NILAI
.	3303999	KABUPATEN SORONG	-	N & S	1.968	59,54	46,38	42,23	46,28	48,61

Figure 2. National Examination Results of the Junior High School Students/MTS for the Academic Year 2019/2020 in Sorong Regency

Source: (Pusat Penilaian Pendidikan Kementerian Pendidikan dan Kebudayaan Republik Indonesia, 2019)

In the 2019/2020 academic year, students of Sorong Regency had the lowest average Mathematics score in the National Examination in Sorong Regency in West Papua Province with an average score of 42.34. The comparison of mathematics scores in Sorong Regency with the average mathematics score in the Province and at the National level is presented in Figure 3.

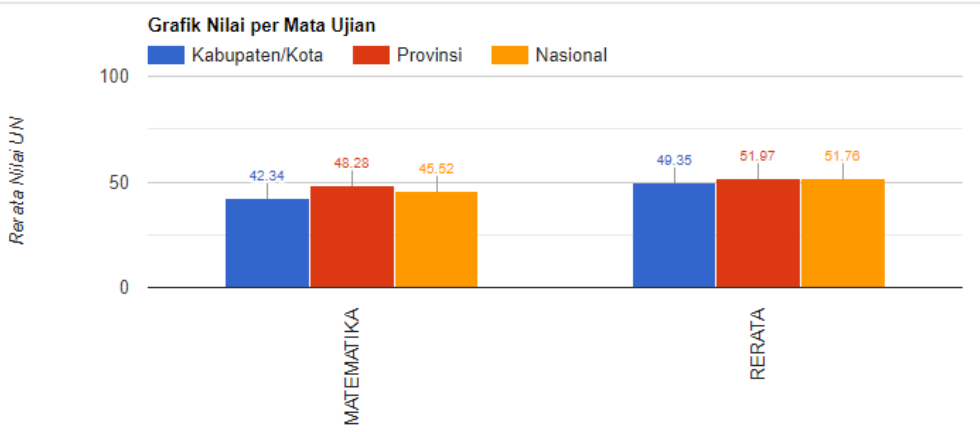

Figure 3. Average Mathematics Score of Sorong Regency in the National Examination Compared to that of Provincial and National Level

Given these problems, it is conclusive that there is an insufficient preparation to improve the quality of teachers in rural and remote areas. Another problem is dealing with the unsuitable learning model applied in the teaching and learning activities (KBM) in Sorong Regency for the students' character and the people of West Papua, thus affecting student learning outcomes. The use of the right learning model is expected to affect student learning outcomes. In this line, ethnomathematical learning model is deemed necessary since it encourages students to be more involved with mathematics learning by utilizing the media in their surroundings.

The use of the right learning model can help students get ideas in solving math problems understudy. This learning model serves as an instrument applicable for teachers to support learning interactions both directly and indirectly with overall implications (Sudjana & Rifai, 2003). By using the ethnomathematics-based learning model, the teacher can connect many aspects in students' surroundings with mathematics learning as a way to ease students' understanding about the material, including learning about culture.

According to Prabawati (2016), ethnomathematics is the investigation of mathematical ideas in a local culture. Wahyuni et al. (2013) also held that ethnomathematics is a type of mathematics learning model that is influenced or dependent on culture. Furthermore, Knijnik (in Unodiaku, 2013) articulated that ethnomathematics has the other side of examining the mores, practices, and mathematical ideas of social groups. The National Council of Teachers of Mathematics (NCTM) (in Unodiaku, 2013) pointed out that ethnomathematics is characterized as an investigation of the relationship between mathematics and culture or mathematics that is practiced between recognizable social encounters. Thus, ethnomathematics is the application of mathematics learning based on culture, tradition, artifacts and local cultural practices.

The results of different ethnomathematical explorations are applied in the classroom by using social assets and tools as works of art, expressions, folklore, values, ethics, morals, and theories that are unshakable within the framework of beliefs. In Sundanese society, mathematics is applied through a number framework, estimation, calculation, and design forming (Abdullah, 2017). Ethno-mathematics will be used as a methodology that connects students' different perspectives in the use of culture with mathematics in schools (Rosa & Orey, 2011). D'Ambrosio (2001) revealed that ethnomathematics complements the efforts of teachers and students in learning formal school mathematics and provides relevant contextual meaning.

Ethnomathematics approach refers to an approach to learning mathematics that is influenced or oriented towards the surrounding culture, as well as which grows and develops in the community and is in accordance with the local culture as a foundation in building concepts that is widely believed to solve the problems (Heryan, 2018). Ethnomathematics approach will make it easier for students to understand the material, because it is directly related to their culture in activities of daily living.

Thus, it is conclusive that ethnomathematics learning approach emphasizes more on how students can understand and build mathematical concepts based on the massively flourishing and developing culture in the local community in order to provide meaningful mathematics learning for students. Therefore, the application of ethnomathematics mathematics learning is expected to help students to better understand mathematics, better comprehend their culture, and help teachers to more easily instill their own cultural values in students.

Figure 4 explains the concept of an interactive curriculum in the application of ethnomathematics based on the teacher's control in the learning process. Frans and Kosolosky (2014) mentioned three important components in ethnomate-matics-based learning, namely: 1) Instruments in ethnomathematics-based learning include the use of language, body language or behavior, counting, drawing, getting information, and culture; 2) The content or materials of ethnomathematics learning is generated from books, previous experiences, print media, TV and media in general, or objects found in museums, and other historical relics; and 3) Cooperation in ethnomathematics-based learning is carried out through group discussion, seminars, panel discussions, and so on. In addition, ethnomathematics-based learning approach is greatly considered in Indonesian given its diverse tribes and cultures, and the fact that each tribe has its own way of solving problems (Sirate, 2015).

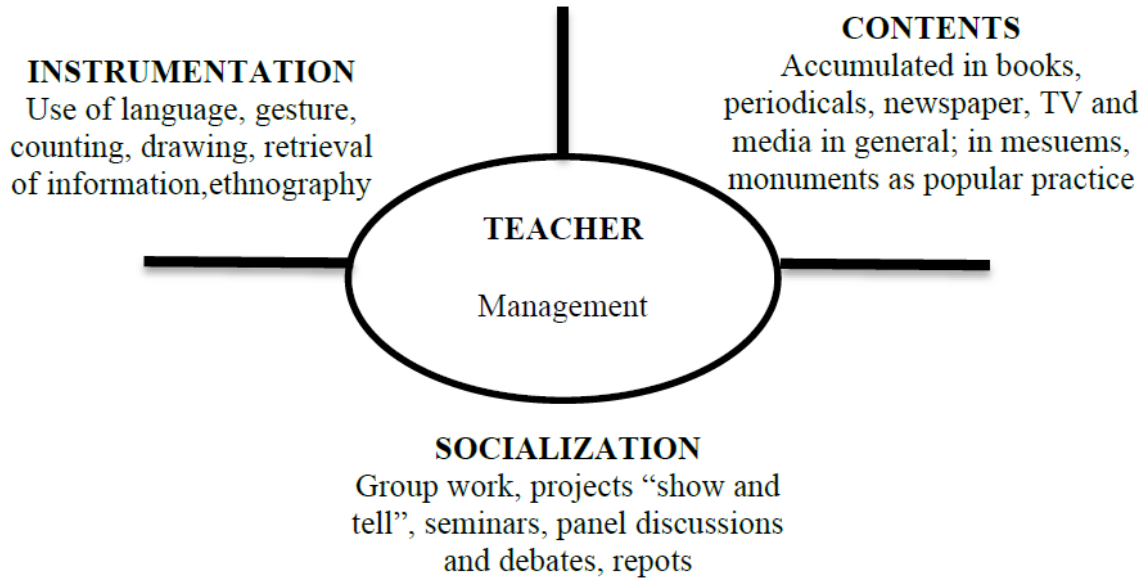

Figure 4. The Concept of Interactive Curriculum in the Application of Ethnomathematics

The use of ethnomathematics as a learning approach aims to sharpen students' awareness of the local culture and improve their mathematical abilities. The abovementioned research background generates the identification of the following problems 1.) The currently applicable learning model is generally non adaptable to the habits and characteristics of students in Papua and West Papua; 2.) Students share negative perceptions of the use of learning media by teachers; 3.) There has been lack of training to improve the quality of teachers in suburbs and remote areas; and 4.) Student learning achievement is very low, especially in Sorong Regency, West Papua.

The purpose of this study was to describe the knowledge of teachers in Sorong Regency, West Papua related to the concept of the ethnomathematics approach, the role of ethnomathematics approach in schools, the implementation of ethnomathematics approach, the application of ethnomathematics approach, the application characteristics of ethnomathematics approach, and knowledge of ethnomathematics in West Papua. This research is expected to provide opportunities to reflect on the ongoing instructional development, specifically in the ethnomathematical learning approach, as well as to increase the understanding of researchers and teachers in the development of ethnomathematics approaches, thus bringing up new ideas in the future, as well as adding references regarding ethnomathematics approach in mathematics learning.

METHOD

This is a qualitative research with qualitative descriptive methods. The descriptive analysis in this study was conducted by examining the perceptions of mathematics teachers in Sorong Regency, West Papua through several approaches related to the concept of ethnomathematics approach, the role of ethnomathematics approach in schools, the implementation of ethnomathematics approach, the application of ethnomathematics approach, the application characteristics of ethnomathematics approach, and ethnomathematics knowledge of West Papua. This study is expected to: 1.) Provide opportunities to reflect on the ongoing instructional development, more specifically in ethnomathematics learning approach of West Papua; 2.) Increase the understanding of researchers and teachers in the development of an ethnomathematics-based learning approach, thereby bringing up new ideas in the future; 3.) Add a reference on ethnomathematics approach in mathematics learning; and 4.) Produce a mathematics learning model that is adaptive to the local community.

This research was conducted online by way of distributing questionnaires using Google Forms and conducting online interviews, given the hard-hitting Covid-19 pandemic, which prevented the researchers to have a direct face-to-face meeting with research subjects. The research subjects were mathematics teachers in Sorong Regency, West Papua, while the research object was ethnomathematics learning approach, the role of ethnomathematics approach in schools, the implementation of ethnomathematics approach, the application of ethnomathematics approach, the application characteristics of ethnomathematics approach, and ethnomathematics knowledge of West Papua.

The researchers collected data by distributing questionnaires through Google Form. The samples were selected through random sampling technique by selecting several teachers as respondents to answer the existing problems in accordance with the research objectives, including elementary school teachers, junior high school mathematics teachers, high school mathematics teachers, and vocational school teachers in Sorong Regency, West Papua. The respondents were selected based on different school levels: 1 (Elementary school), stratum 2 (Junior High School), stratum 3 (Senior High School), and stratum 4 (Vocational School). The result of this grouping is divided into 2 groups, A and B based on the accreditation rank, thus generating a total number of 8 teachers from each school. The selection of respondents from A and B accredited schools was also conducted using a purposive sampling technique considering the limited knowledge of respondents to investigate the topic understudy.

RESULTS AND DISCUSSION

In this study, the assessment of teacher perceptions of ethnomathematics in Sorong Regency is divided into 6, namely the concept of ethnomathematics approach, the role of ethnomathematics approach in schools, the implementation of ethnomathematics approach, the application characteristics of ethnomathematics, the application of ethnomathematics approach, and ethnomathematics in West Papua. Table 1 on the teacher's perception of ethnomathematics in terms of ethnomathematics approach revealed that 25% of teachers have never heard of or know about a culture-based learning approach (ethnomathematics). Furthermore, 25% of teachers expressed that they had no idea about the purpose of the culture-based learning approach (ethnomathematics). On the principles and advantages of ethnomathematics approach, 62.5% of teachers stated that they had no knowledge of ethnomathematics, while 87.5% of teachers articulated that they were unaware of the weaknesses of ethnomathematics learning approach.

The interviews uncovered that some teachers perceived ethnomathematics approach as a culture-based learning by combining between mathematics learning and local culture. Ethnomathematics-based learning is used by teachers as a medium/learning module in learning mathematics and as an introduction to local culture. Some teachers were well aware that ethnomathematics approach is carried out by delivering learning based on local culture, learning using local cultural media, learning that integrates culture in the learning process, learning obtained from local wisdom, and doing mathematics learning with local culture.

Table 1. Percentage of Teachers' Perceptions of Ethnomathematics Approach

Rating Description	Statement	Percentage	
		Yes	No
Ethnomathematics approach	1. Have you ever heard of or know about a culture-based learning approach (ethnomathematics)	75%	25%
	2. Do you know the purpose of the culture-based learning approach (ethnomathematics)	75%	25%
	3. Do you know the principles of ethnomathematics approach?	37,5%	62,5%
	4. Do you know the advantages of ethnomathematics approach?	37,5%	62,5%
	5. Do you know the weaknesses of ethnomathematics approach?	12,5%	87,5%

Table 2. Percentage of Teachers' Perceptions on the Role of Ethnomathematics Approach in Schools

Rating Description	Statement	Percentage	
		Yes	No
The role of ethnomathematics approach in schools	1. Is ethnomathematics approach able to guide students in obtaining opportunities to carry out discovery activities and investigate patterns to determine mathematical relationships?	75%	25%
	2. Can ethnomathematics approach help students appreciate unexpected discoveries as useful?	100%	0%
	3. Can ethnomathematics approach make students try to think reflexively, namely looking for the benefits of mathematics?	100%	0%
	4. Does ethnomathematics approach give students the opportunity to collect the information needed to solve mathematical problems?	87,5%	12,5%
	5. Does ethnomathematics approach give students the opportunity to do logical, consistent, systematic thinking and take notes?	100%	0%
	6. Can ethnomathematics approach develop the ability and skills to solve mathematical problems?	100%	0%

Based on Table 2, the teacher's perception of ethnomathematics in terms of the role of ethnomathematics approach in schools shows the value that as many as 75% of teachers state that ethnomathematics approach can guide students in obtaining opportunities to conduct discovery activities and investigate patterns to determine mathematical relationships. As many as 100% of teachers stated that ethnomathematics approach could help students appreciate unexpected discoveries as useful. Furthermore, 100% of the teachers stated that ethnomathematics approach could make students try to think reflexively, namely looking for the benefits of mathematics. Then 87.5% of teachers stated that ethnomathematics approach gave students the opportunity to collect the information needed to solve mathematical problems. 100% of teachers stated that ethnomathematics approach gave students the opportunity to do logical, consistent, systematic thinking and take notes. And 100% of teachers stated that ethnomathematics approach can develop abilities and skills to solve mathematical problems.

Based on the results of interviews with teachers they assume that the role of ethnomathematics approach carried out in schools in addition to studying mathematics, ethnomathematics makes students more familiar with regional culture, and can facilitate students in developing mathematical concepts. The use of an ethnomathematical approach in schools can not only be used to convey mathematics learning but can also be used to introduce regional culture. That way students can identify and use the connections between mathematical ideas related to culture, especially in West Papua. In addition, the approach using ethnomathematics in schools can also broaden students' knowledge and make students aware that mathematics is closely related to their daily lives. Ethnomathematics approach can be implemented in learning activities to improve problem solving skills, especially regarding the material of flat shapes and spatial shapes.

Table 3. Percentage of Teachers' Perceptions of the Implementation of Ethnomathematics Approach

Rating Description	Statement	Percentage	
		Yes	No
Implementation of ethnomathematics approach	1. Do you know the principles of implementing the ethnomathematics approach?	0%	100%
	2. Do you know the steps for ethnomathematics approach?	0%	100%
	3. Do you know the learning strategies used in ethnomathematics approach?	12,5%	87,5%
	4. Do you know the sources of learning in ethnomathematics approach?	37,5%	62,5%
	5. Do you know the management of the learning environment in an ethnomathematics approach?	25%	75%

Table 3 on the teacher's perception on the implementation of ethnomathematics approach indicates that 100% of teachers had no idea about the principles of implementing ethnomathematics approach. As many as 100% of teachers were also unaware of the steps of ethnomathematics approach, and 87.5% of teachers had no knowledge about the learning strategies used in ethnomathematics approach. 62.5% of teachers also had no clue about the learning resources in ethnomathematics approach, and 75% of the teachers did not know the management of the learning environment in ethnomathematics approach. From the interviews, it was clear that thus far, schools in their area have never implemented an ethnomathematics approach in the classroom. No wonder, many teachers were unaware of the proper implementation of ethnomathematics approach, and the implementation principles, strategies, learning resources and management of the learning environment with an ethnomathematics approach.

Table 4. Percentage of Teachers' Perceptions of the Application Characteristics of Ethnomathematics

Rating Description	Statement	Percentage	
		Yes	No
Application Characteristics of Ethnomathematics	1. Do you know the instruments in ethnomathematics-based learning?	12,5%	87,5%
	2. Do you know the content of ethnomathematics learning?	25%	75%
	3. Do you know about cooperation in ethnomathematics-based learning?	25%	75%

Table 4 on the teacher's perception of application characteristics of ethnomathematics approach delineates that 87.5% of teachers had no clue about the instruments in ethnomathematics-based learning, while 75% of teachers were unaware of the content of ethnomathematics learning. Furthermore, 75% of teachers had no knowledge about cooperation in ethnomathematics-based learning, and 25% of teachers explained that the characteristics of the content of ethnomathematics can be found through the surrounding environment, articles, pictures, internet, surrounding culture, and from local artifacts. It can be concluded that the teacher's perception of ethnomathematics as seen from the application characteristics of ethnomathematics approach indicates that most teachers were clueless about the instruments in the application of ethnomathematics and the values of cooperation in ethnomathematical learning.

Table 5. Percentage of Teachers' Perceptions of the Implementation of Ethnomathematics Approach

Rating Description	Statement	Percentage	
		Yes	No
Implementation of ethnomathematics approach	1. Have you ever implemented an ethnomathematics approach in the classroom?	0%	100%
	2. Can you implement ethnomathematics approach?	25%	75%

Table 5 on the teacher's perception of ethnomathematics when viewed from the implementation of ethnomathematics approach in schools revealed that 100% of teachers had never implemented ethnomathematics approach in the classroom. Furthermore, as much as 75% of teachers were unable to implement ethnomathematics approach. The interviews with teachers revealed that ethnomathematics is an appropriate learning approach to be applied in West Papuan schools. Moreover, teachers also believed that they need some training and adjustments to the established Basic Competencies (KD). Some teachers also thought it was impossible for them to apply ethnomathematics approach, especially in Sorong Regency, West Papua. This assumption was due to several factors, especially the lack of knowledge and shallow understanding of teachers about ethnomathematics and its relation to mathematics in schools.

Table 6. Percentage of Teachers' Perceptions of Ethnomathematics of West Papua

Rating Description	Statement	Percentage	
		Yes	No
Ethnomathematics of West Papua	1. Have you ever heard of sero-kokas ethnomathematics lessons?	12,5%	87,5%
	2. Have you ever heard of ethnomathematics learning using traditional Papuan Tifa tools?	62,5%	37,5%
	3. Have you ever heard of ethnomathematics learning using a Papuan bow and arrow?	12,5%	87,5%
	4. Have you ever heard of ethnomathematics learning using Papuan noken?	37,5%	62,5%
	5. Have you previously used ethnomathematical artifacts from Papua for classroom learning?	0%	100%

Table 6 related to the teacher's perception of ethnomathematics as seen from ethnomathematics knowledge of West Papua indicated that 87.5% of teachers had never heard of serokokas ethnomathematics learning, while 62.5% of teachers were unaware of ethnomathematics learning using traditional music instrument of Papuan Tifa. As many as 87.5% of teachers had never heard of ethnomathematics learning using Papuan bows and arrows, 62.5% of teachers were clueless about ethnomathematics learning using Papuan noken, and 100% of teachers had never used ethnomathematical artifacts from Papua for classroom learning. Most of the teachers stated that they had never heard of ethnomathematics of West Papua, and thus they had a very shallow understanding and knowledge of ethnomathematics from Papua.

CONCLUSION

The study generated the following conclusions: 1.) Teachers' perceptions of ethnomathematics in terms of knowledge of ethnomathematics approach indicate that some teachers were aware of ethnomathematics learning approach by linking mathematics with local culture; 2.) From the interview, it was clear that ethnomathematics approach had a considerable role in schools to help students learn mathematics and local culture; 3.) Teachers' perceptions of ethnomathematics in terms of the implementation of ethnomathematics approach in schools indicate that teachers considered ethnomathematics as an appropriate learning model to be implemented in Papua, but there is still a need for training and adjustment of Basic Competencies (KD); 4.) In terms of the implementation of ethnomathematics approach, it was obvious that some teachers had no idea about the proper implementation of ethnomathematics approach because so far their schools had never implemented it; 5.) In terms of the application characteristics of ethnomathematics approach, it was apparent that most teachers had no idea about the instruments and content/materials in mathematics-based learning, even though ethnomathematics learning materials are commonly found in the surrounding environment, research articles, pictures, internet, cultural practices, as well as local artifacts; and 6.) In terms of ethnomathematics knowledge of West Papua, it was clear that most teachers had never heard of ethnomathematics from West Papua, and thus they had a shallow understanding and knowledge of ethnomathematics from Papua.

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