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Initial perception of junior high students on ethnomathematics-based online learning during the COVID-19 pandemic

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ABSTRACT

This research aimed to determine the students' initial perception in Islamic-based junior high school and Madrasah Tsanawiyah (MTs) in Yogyakarta toward ethnomathematics-based online learning during the COVID-19 pandemic in 2020. The descriptive quantitative method was employed through a questionnaire for data collection followed by descriptive statistical analysis. The research population were 600 junior high students and MTs in Yogyakarta. The instrument was validated by expert judgment and proved reliable as research means with Cronbach's Alpha coefficient of 0.873. Results indicated students' perception in several categories: strongly positive by 7% or 42 students, positive by 23% or 138 students, moderate by 40.67% or 244 students, negative by 24% or 144 students, and strongly negative by 5.33% or 32 students. The general conclusion was that junior high and MTs students in Yogyakarta had moderate initial perception toward ethnomathematics-based online learning during the COVID-19 pandemic.

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1. INTRODUCTION

Mathematics has specific language and rules that people use to work on quantity, measurement, and form. Culture alike, mathematics has unique languages, symbols, and intellection to comprehend matters in society. On the other hand, various mathematics learning topics are not directly related to students' lives that nowadays have grown in high-tech-dominated environments with a highly developed communication method. Therefore, ethnomathematics or mathematics with cultural aspects becomes more significant in bringing math closer to people, especially in Indonesian society that consists of various cultures.

Education and culture are two essential parts of daily life, as a culture becomes an indivisible part of society while education is one of the basic needs. The aforementioned culture is the beliefs, habits, and products generated by society and passed down through generations [1]. Yogyakarta and Central Java Javanese culture was used as a contextual learning problem in this research as cultural-based education is also a part of the strategic plan of the province. It was mentioned in Provincial Regulation 77 of 2012 on Yogyakarta Special Province Education Strategic Plans that Yogyakarta will be designed as the prominent cultural-based education center in South East Asia by 2025 [2], based on Javanese culture in particular, whose noble values might enrich national culture and complement global culture development. These values can also strengthen educational objectives, implementation, and management of educational content.

Ethnomathematics can be used as connecting bridge between culture and education, as mentioned in previous research that the learning concept can correlate mathematics and daily life [3]. Ethnomathematics is a concept, knowledge, study, or approach that correlates mathematics with culture [4]. Ethnomathematics is a

concept for knowledge improvement in mathematics development through various cultures worldwide [5]. Another opinion states that ethnomathematics is very much in accordance with constructivist theory requires students to build understanding and knowledge through what they have learned and previously explore in daily life [6]. Ethnomathematics application is expected to improve students' ability in learning mathematics to achieve learning objectives.

National Council of Teacher of Mathematics formulates mathematics learning objectives: i) Learn to communicate (mathematical communication); ii) Learn to reason (mathematical reasoning); iii) Learn to solve problems (mathematical problem solving); iv) Learn to connect ideas (mathematical connections); and v) positive attitudes toward mathematics [7]. Besides cognitive aspects, the affective aspect or students' attitude is considered vital as it directly impacts mathematical learning. This is due to mathematics learning's relation to concept learning, procedure, application, and students' perception of mathematics.

Perception is someone's presumption obtained by the five senses during information comprehension; students argue on mathematics learning from its objective, basis, and benefit after what they see and hear. Someone will continuously connect to the surrounding and carries out activities through perception, such as student activity in mathematics learning. Prior to student activities in ethnomathematics-based education, the teacher needs to understand students' perceptions of ethnomathematics that will impact the learning process. A positive perception of mathematics learning might facilitate learning goals, including student achievement; as previously mentioned, students' perception of mathematics correlates with student performance during learning [8].

The importance of students' perception is not reflected in the actual conditions of Indonesia's current educational achievements. In Programme for International Student Assessment (PISA), Indonesia was ranked 63 out of 70 countries in 2015 with a mathematics ability score of 386 [9], then declined to 73 out of 79 with a score of 379 in 2018 [10]. Besides the decline, Indonesia's PISA score in 2018 was below the OECD's average score of 489. The low capability of mathematical critical thinking ability can also be seen in the low average score of the National Examination in 2019 [11]. Based on these facts, the low students' perception and quality of education must be improved through innovation. Innovation can improve students' understanding of mathematics concepts and develop students' positive perceptions of the mathematics learning process.

Some institutions are unprepared for a sudden transition in learning innovation. Nurhakiki and Sari mentioned that change from a conventional class to online learning affects student comprehension. The intrinsic factor of students, such as culture and learning experience, also shape student perception of online learning [12]. Those already familiar with online learning and information technology will probably find it easier to do online classes compared to the opposite. Online learning has various technical problems, from lousy connection, lack of motivation, costly internet charges, and inadequate facilities, all of which bring troubles for students and school personnel, such as teachers and staff. On the other hand, teachers also have to provide media and learning materials that are suitable for students' online learning.

Recently, innovation in mathematics learning has been vastly employed in Indonesia due to the COVID-19 pandemic social distancing restriction since March 2020. Mathematics learning in junior high schools previously presented directly in class has been turned into an online meeting. Instruction Letter by the Minister of Education and Culture of the Republic of Indonesia Number 4/2020 stated that the learning process must be carried out at home via online or remotely without a direct meeting. According to previous research, online learning refers to any educational activity in which participants are geographically distant from one another, in which students and teachers are physically present in various locations [13]. Online learning is defined as an online-based learning process in synchronous or asynchronous mode [14]. In synchronous mode, students and teachers engage in a real-time virtual meeting with interaction and a possibility for direct feedback. Whereas asynchronous mode enables an unlimited learning model due to its method in which teachers provide online learning materials accessible at any time and place.

Blended learning reportedly gained positive responses from students [15], mainly due to comfortable interaction among students and teacher-students during the face-to-face learning model. Students expressed that such a model enables them to understand the instructions and mathematics concepts better. As hybrid learning is not possible during the present pandemic era and must be replaced by a full-online learning model, schools in Yogyakarta province employed various online mathematics learning through various platforms. Several of them are asynchronous using online applications, such as WhatsApp and Google Classroom. There are several challenges, such as lack of feedback, motivation, or reward from teachers, which otherwise can be delivered during the offline meeting. Even though such measures can be done through online means, such as Google meet or Zoom video conference, but teacher-student bonding is not as strong as an offline meeting. However, the limitation of video conferences or virtual meetings between teachers and students becomes the main challenge that hinders direct feedback, thus hampering students' positive perceptions.

Scida and Saury mentioned that two factors could determine online learning results. First, online activity and computers or smartphones must be customized using themes that enable concrete and constructive technology utilization. Second, students must be active in searching for information or knowledge related to learning materials [16]. Therefore, online activity should allow students to communicate effectively with their teachers, facilitate active learning, and enable effective knowledge application and student interaction. Teachers need to understand the learning process well and be skilled in designing online learning material through a mathematics curriculum. It is essential to develop and implement a mathematics curriculum that combines elements and cultural values from society's daily life, including folklore, games, and instruments, to enhance students' motivation and generate positive perceptions of mathematics learning [17].

From the previous description, this research was conducted to measure the perception of junior high students in Yogyakarta and its aspects toward ethnomathematics-based online learning during the COVID-19 pandemic. Ethnomathematics was used to help the student gain a positive perception of online mathematics learning. It was assumed that ethnomathematics innovation might enhance the online mathematics learning atmosphere to be more interesting and fun. The importance of a pleasant learning atmosphere is evidenced by a student's poor academic achievement with a negative perception [18]; thus, teachers and educators are required to create an innovative and interesting learning atmosphere to achieve learning objectives.

2. RESEARCH METHOD

This study was descriptive quantitative research using a survey for data collection. The objective was to measure initial student perception toward ethnomathematics-based online learning during the COVID-19 pandemic. Questionnaires were distributed to respondents, junior high and MTs students in Yogyakarta Special Province, in December 2020, selected through voluntary random sampling. Respondents were 600 junior high and MTs (public and private schools) students willing to participate in the research by filling out a questionnaire via a Google Form. Their demographic profile is presented in Table 1.

Table 1. Demographic profiles of respondents

Profile	Categories	Number	Percentage (%)
Location	Bantul Regency	173	28.8
	Gunung Kidul Regency	166	27.7
	Kulon Progo Regency	59	9.8
	Sleman Regency	179	29.8
	Yogyakarta City	23	3.8
Class	VII	200	33.3
	VIII	200	33.3
	IX	200	33.3

Questionnaires given were in the form of a Likert scale with 26 statements represented three aspects: understanding the definition of ethnomathematics-based online learning (A1), understanding the benefits and uses of ethnomathematics-based online learning (A2), and students' attention to ethnomathematics-based online learning (A3). Positive statements were rated as strongly agree (5), agree (4), neutral (3), disagree (2), and strongly disagree (1), while negative statements were rated in reverse order. Instruments were previously validated through expert judgment, then analyzed for reliability using Cronbach Alpha (α) statistical test of SPSS 22, and can be classified as reliable at α coefficient>0.60. The instruments had an α coefficient of 0.873, thus proved to be reliable, as shown in Table 2.

Table 2. Reliability statistics result

Cronbach's Alpha	No. of items
0.873	26

All obtained data were then analyzed using descriptive statistical analysis in the form of mean or average (M), median (Me), modus (Mo), and standard deviation (SD). The final results were categories of initial students' perception of ethnomathematics-based online learning. Mean and Standard deviation classification were conducted according to the method applied by Sudijono, as shown in Table 3 [19].

Table 3. Perception categories formula

No.	Interval formula	Category
1.	X ≥ (M + 1.5 SD)	Strongly positive
2.	(M + 0.5 SD) ≤ X < (M + 1.5 SD)	Positive
3.	(M – 0.5 SD) ≤ X < (M + 0.5 SD)	Moderate
4.	(M – 1.5 SD) ≤ X < (M – 0.5 SD)	Negative
5.	X < (M – 1.5 SD)	Strongly negative

The relative frequency was calculated using (1):

$$P = \frac{f}{N} \times 100\% \quad (1)$$

P : the percentage to be calculated (relative frequency)
f : Frequency
N : number of respondents

3. RESULTS AND DISCUSSION

Initial perception of junior high and MTs students in Yogyakarta toward ethnomathematics-based online learning during 2020 COVID-19 was measured on 600 respondents using 26 questions at a score range of 1–5. Overall, statistical analysis of data research resulted mean of 95.58, a median of 96.00, modus of 98, and a standard deviation of 11.510. Table 4 shows the results of descriptive statistics.

Table 4. Descriptive statistic results of research

		1st aspect (A1)	2nd aspect (A2)	3rd aspect (A3)	Total aspect
N	Valid	600	600	600	600
	Missing	0	0	0	0
Mean		36.78	30.07	28.73	95.58
Median		37.00	31.00	29.00	96.00
Mode		38	32	32	98
Std. deviation		4.316	4.410	4.301	11.510
Range		27	25	28	80
Minimum		23	15	12	50
Maximum		50	40	40	130

Survey results were then classified into five categories: strongly positive, positive, moderate, negative, and strongly negative. Table 5 shows a distribution of junior high and MTs students' initial perception in Yogyakarta toward ethnomathematics-based online learning during the 2020 COVID-19 pandemic. Based on the data, the initial perception of junior high and MTs students in Yogyakarta toward ethnomathematics-based online learning during the 2020 COVID-19 pandemic was moderate, with details: 7% strongly positive, 23% positive, 40.67% moderate, 24% negative, and 5.33% strongly negative. In the diagram, the results are presented in Figure 1.

Table 5. Categories of initial perception of respondent toward ethnomathematics-based online learning

No.	Interval	Frequency	Percentage (%)	Categories
1.	$X \geq 112.85$	42	7	Strongly positive
2.	$101.34 \leq X < 112.85$	138	23	Positive
3.	$89.83 \leq X < 101.34$	244	40.67	Moderate
4.	$78.32 \leq X < 89.83$	144	24	Negative
5.	$X < 78.32$	32	5.33	Strongly negative
	Total	600	100	

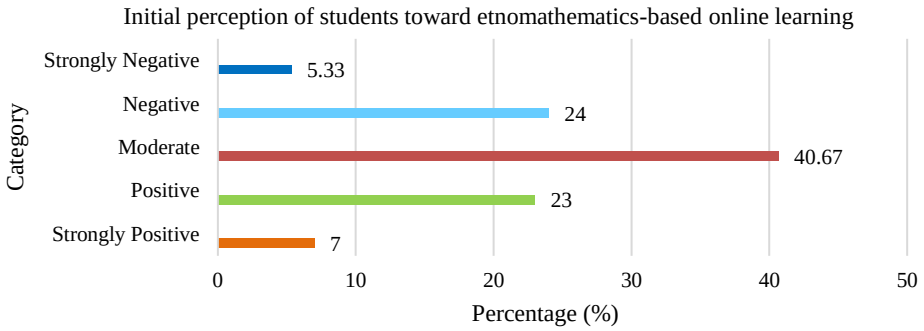

Figure 1. Initial perception of students toward ethnomathematics-based online learning

3.1. Understanding the definitions of ethnomathematics-based online learning (A1)

The radar diagram in Figure 2 showed that the item with a score of 4 had the highest response between 2500 and 3000. It was an indication that junior high and MTs students in Yogyakarta generally understand the definition of ethnomathematics-based online learning. The understanding of ethnomathematics-based online learning was also described statistically in A1, with an average score of $\bar{x}$=3.68. From Table 6, it can be concluded that students understand the definition of ethnomathematics-based online learning. However, they did not understand that ethnomathematics-based online learning is flexible (space/time) and contextual, as seen in indicators 10, 9, 7 with $\bar{x}$ below 3.5 of 3.12; 3.1; and 2.92, respectively. Due to various indicators, A1 had $\bar{x}$<3.5. It can be concluded that students had an adequate understanding of the definition of ethnomathematics-based online learning.

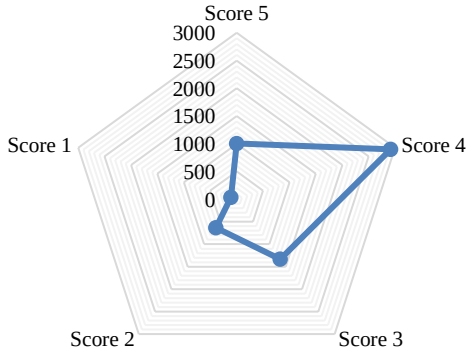

Figure 2. Radar diagram for A1

Table 6. Descriptive statistics of questionnaire results for A1

No.	Empirical indicator	SD	D	N	A	SA	$\bar{x}$	σ
3.	Online learning is a learning process using electronic devices (computers, laptops, and smartphones) with internet networks.	0	3	29	245	323	4.48	0.61
1.	Ethnomathematics is mathematics that is related to culture in society.	1	9	79	364	147	4.08	0.67
2.	Various cultural objects (temples, traditional houses, traditional musical instruments) can contain mathematical values	3	24	71	376	126	4	0.73
6.	Ethnomathematics-based online learning contains virtual exploration activities (online) about objects or cultural sites related to mathematics.	1	19	88	396	96	3.94	0.67
4.	Ethnomathematics-based online learning is an online mathematics learning method (using electronic devices with internet networks) related to culture.	5	27	120	339	109	3.87	0.79
5.	Ethnomathematics-based online learning uses various props from various cultural sites.	4	25	146	353	72	3.77	0.74
8.	Ethnomathematics-based online learning is rigid and not creative*)	65	285	159	74	17	3.51	0.94
10.	Ethnomathematics-based online learning limits the time to learn mathematics*)	30	210	187	149	24	3.12	0.97
9.	Ethnomathematics-based online learning limits mathematical space/environment to learn mathematics*)	26	214	185	144	31	3.1	0.99
7.	Ethnomathematics contains concepts that too abstract*)	12	136	269	161	22	2.92	0.85
	Average						3.68	

*) negative items

The result of the first aspect illustrates the potential benefits of online learning strategies to begin to break down classroom walls, redefine learning spaces, eliminate barriers between school and home, and make learning more accessible in various ways. The teacher, one of the developers of ethnomathematics content, can properly produce online learning scenarios; the ethnomathematics content can take the epistemological booster's role to carry mathematical knowledge and concepts to students [20].

Learning Implementation Plans that a teacher prepares, particularly for mathematics, must be designed based on and accommodate students' knowledge and life experience in their cultural sphere. According to Mahmudah, students must be provided with adequate learning conditions, implementation, and evaluation to study mathematics [21]. Putra and Mahmudah also explained that in formal mathematic learning in school, teachers might start their learning process by exploration of student's informal mathematic knowledge obtained from the society they live in [22]. Interesting learning materials must be concrete, relevant, and relatable to students' daily life, which can be developed from the local culture.

3.2. Understanding the benefit and uses of ethnomathematics-based online learning (A2)

The radar graphic in Figure 3 shows the highest response by item with a score of 4 between 2500 and 3000. It was indicated that junior high and MTs students in Yogyakarta understand the benefit and uses of ethnomathematics-based online learning. Students' understanding of the benefits and uses of ethnomathematics-based online learning was also indicated by the statistical description in A2, with an average score of $\bar{x}$=3.8. In Table 7, all indicators had $\bar{x}$>3.5, thus can be concluded that students had a sufficient understanding of the benefits and use of ethnomathematics-based online learning.

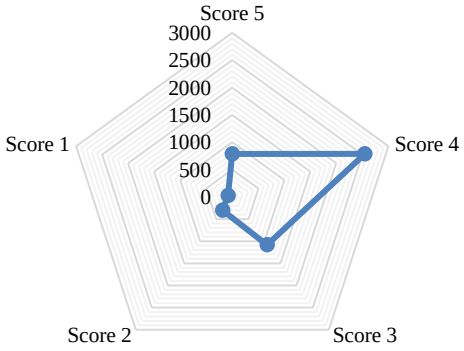

Figure 3. Radar diagram for A2

Table 7. Descriptive statistics of questionnaire results for A2

No.	Empirical indicator	SD	D	N	A	SA	$\bar{x}$	σ
18.	Cultural preservation is not important; hence learning ethnomathematics is not necessary *)	181	290	79	35	15	3.98	0.95
11.	Cultural objects (temples, traditional houses, traditional musical instruments) might help me to learn about 2D shapes in mathematics	5	23	92	370	110	3.93	0.75
13.	Activities in ethnomathematics-based online learning boost my creativity	2	23	154	342	79	3.79	0.73
14.	-Illustrations in ethnomathematics learning video help me to solve mathematics problems	2	26	154	329	89	3.79	0.75
15.	Ethnomathematics is unnecessary in daily life*)	116	323	99	44	18	3.79	0.94
12.	Ethnomathematics-based learning video makes me interested to learn mathematics	6	27	163	330	74	3.73	0.77
17.	Pictures and videos illustration in ethnomathematics do not support learning success*)	68	290	160	68	14	3.55	0.92
16.	Ethnomathematics make it difficult for me to understand mathematical material *)	67	273	183	57	20	3.52	0.93
	Average						3.8	

*) negative items

These results for student understanding aspect can be a favorable capital to develop an ethnomathematics-based online learning model. When students positively perceive technology integration's benefits and use in mathematics learning, the learning process becomes constructivist, improving student engagement, hence maximum learning results [23]. Most of junior high and MTs students in Yogyakarta agree that ethnomathematics is needed as an effort to preserve culture, indicated by the highest average score

of 3.98 for indicator 18. Using ethnomathematics, student personal character can be developed [24], such as higher student nationalism and pride toward local culture. The lowest score of 3.52 for indicator 16 showed that ethnomathematics-based mathematic learning was quite challenging to be understood by students of junior high school and MTs in Yogyakarta. This result was contrary to those of Risdiyanti, Prahmana, and Shahrill that ethnomathematics might ease and facilitate students to understand mathematics as it correlated with student culture and daily life, taking meaning from the knowledge learned and contributing to real-life problem solving [25].

3.3. Students attention to ethnomathematics-based online learning (A3)

In the radar graphic in Figure 4, the item with a score of 4 also obtained the highest response between 2000 and 2500, as an indicator that junior high and MTs students in Yogyakarta generally paid attention toward ethnomathematics–based online learning, as also indicated statistically descriptive by an average score of $\bar{x}$=3.6 for A3. Results in Table 8 also indicated that almost all indicators in this aspect had an average mean above 3.5, except indicator 25 at $\bar{x}$=3.37. The results also indicated that although students pay attention to ethnomathematics-based online learning, they are only willing to learn during school hours. With indicator had $\bar{x}$<3.5, it can be concluded that students pay adequate attention to ethnomathematics-based online learning.

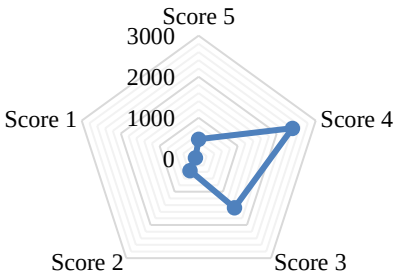

Figure 4. Radar diagram for A3

Table 8. Descriptive statistics of questionnaire results for A3

No.	Empirical indicator	SD	D	N	A	SA	$\bar{x}$	σ
19.	Ethnomathematics-based online learning has various interesting parts	2	11	89	405	93	3.96	0.63
26.	I don't need to find out about cultural sites related to mathematics, either offline or online*)	91	303	136	54	16	3.67	0.93
21.	I practice working on mathematical problems with the help of ethnomathematics illustrations	1	40	199	309	51	3.62	0.74
20.	I feel very enthusiastic when observing online learning videos about ethnomathematics	4	37	221	287	51	3.58	0.76
23.	I'm not interested in learning using ethnomathematics*)	50	292	194	47	17	3.52	0.86
24.	I don't like work on ethnomathematics illustrated problems *)	50	283	207	46	14	3.52	0.84
22.	I feel happy during ethnomathematics-based online learning	4	46	237	270	43	3.5	0.77
25.	I only learn ethnomathematics in school*)	45	256	198	78	23	3.37	0.93
	Average						3.6	

*) negative items

From the result for indicator 21 with an average score of 3.62, it can be concluded that illustrations of site images or cultural artifacts helped students solve mathematics problems, as it is closer to student's daily life. When teacher relate learning materials to real-life situations, contextual learning occurs. The contextual problem offers various options for student engagement during learning mathematics, motivating them, and presenting some challenges in the classroom [26]. Simamora, Saragih, and Hasratuddin mentioned that contextual learning using ethnomathematics provides space for students to explore problem-solving methods by their knowledge for meaningful learning [27].

The appropriate online learning model is needed to increase students' attitudes and attention to ethnomathematics learning. The students' portion of involvement in the learning process needs to be considered when developing teaching-learning scenarios. In ethnomathematics online learning, students are directed to explore virtually their culture and relate to the mathematical concepts. It can influence student motivation, autonomy, and participation in acquiring mathematical concepts and problems [28].

4. DISCUSSION

The findings of this research indicated that even though culture is an integral part of life, including in mathematics learning, but still face difficulties to be implemented. A previous study by Peni noted three possible barriers during culture-based mathematics learning: i) Mindset and student's interest; ii) Ability to use learning resources and innovation; and iii) Practical barriers [29]. On the other hand, researching the initial perception of student on ethnomathematics for online learning is the first step to increase student interest. Previous research by Arthur, Asiedu-Addo, and Assuah reported that negative perception of students significantly impacts their interest in learning mathematics [30]. This research aimed to measure the initial perception of student on ethnomathematics-based online learning during the COVID-19 pandemic. The results are expected to provide information for teachers during the development of the ethnomathematics-based online learning model.

The results from the questionnaire indicated that more than one-third of subjects had enough perception of ethnomathematics-based online learning. The result was affected by three aspects: students' knowledge of the learning method definition and its benefits, as well as their interest in the learning process. Kasmin, Othman, and Ahmad previously noted that students' understanding of the benefit of learning mathematics could bring their positive perception [31]. Suppose students only learn mathematic theory sans its benefit. In that case, they tend to dislike mathematics, resulting in negative perception, particularly when they face difficulties. Mathematics is only one of the problematic compulsory subjects just for the school grade. When mathematics is taught using relatable means to students' daily lives, they might better understand learning mathematics while having a positive mind reaction.

This research showed a positive impact of students' knowledge on the definition and benefit of ethnomathematics-based online learning. However, students' interests had a low average score. The Ethnomathematics approach can be used to introduce mathematical learning benefits while drawing students' interest. Nowadays, in the pandemic era, we might use a combination of cultural values from students' living surrounding through technology. Teachers can produce learning videos that contain cultural–related concepts to solve a mathematics problem. For example, Andong traditional cartwheels can be used to calculate mileage for circle geometry problem solving, or Joglo traditional house can be used to solve the two-dimensional problem of paint volume that covers the entire roof surface. In addition to learn more about culture, ethnomathematics is expected to improve students' participation during a mathematic learning process [32]. A high level of students' participation or activity during online mathematic learning indicates teachers' ability to enhance students' interest during the learning process. According to the research results of Wasike, students' perception was significantly correlated and positively impacted mathematics learning achievement [33]. Therefore, the role of mathematic teachers is critical to create and design constructive online learning. Teachers can implement an ethnomathematics approach adapted to students' characteristics in mathematic learning plans.

5. CONCLUSION

Based on overall research results, it can be concluded that the initial perception of junior high and MTs students in Yogyakarta on ethnomathematics-based online learning during 2020 COVID-19 can be classified as moderate with the highest frequency on moderate category. The three aspects might influence the results. Students' understanding of the definition of ethnomathematics-based online learning was adequate. The second aspect of students' understanding of the benefits and uses of ethnomathematics-based online learning was sufficient. Students also pay adequate attention to ethnomathematics-based online learning.

The research results can be used as a reference for further research to develop an ethnomathematics-based online learning model, particularly during the COVID-19 pandemic. Although initial students' perception can be classified as moderate, students' understanding of the benefits and uses of ethnomathematics-based online learning had a high mean score. That student had good potential to participate in ethnomathematics-based online learning appropriately, thus, learning outcomes will be achieved as expected.

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