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Research article

Students' Understanding of the Integer Concept in Terms of Ethno-Mathematical Experience in a Traditional Marbles Game

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Abstract.
The goal of this qualitative study was to examine students' understanding of the integer concept in terms of ethno-mathematical experiences in a traditional marbles game. A total sample of 54 students was selected from a population of 63 grade VII students at SMP Negeri 30 Konawe Selatan using simple random sampling techniques. Observations, questionnaires and test descriptions were used as data collection techniques. The data were analyzed descriptively. The findings revealed that the majority of students consciously and unconsciously applied mathematical concepts to the marbles game. Even though the average score did not meet the minimum completeness criteria, students who never implemented the concept had a higher average score of concept understanding than students who implemented it. When examining the percentages of concept understanding based on ethno-mathematical experience, students in the good, sufficient and poor categories understood the integer concept at 33.93%, 37.59% and 41.07%, respectively. Students with a low level of ethno-mathematical experience had a higher average understanding of concepts than students with a high / good level of ethno-mathematical experience, according to the findings.

Keywords: concept of integers, ethnomatematic experience, traditional marbles game, mathematics

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1. Introduction

Mathematics is a subject that is not only a lesson in school, but can also be applied in everyday life. As in buying and selling, making house designs, even in traditional children's games. However, according to Arisetyawan [1], the results of the PISA (Program for International Student Assessment) study analyzed by Stacey show that Indonesian students are less able to use mathematical concepts to solve problems related to everyday life. Students have not been able to use mathematical concepts because in the learning process at school they have not connected mathematics with culture

and daily activities. This has resulted in the low learning achievement of students in some schools in mathematics.

Without understanding the concept, students cannot solve math problems. So that understanding the concepts in learning mathematics is considered very important. Understanding itself is defined as understanding or a comprehensive understanding of the involvement between concepts and facts. In other words, students are said to have an understanding of the concept if they not only know the concept but are also able to apply it in everyday life and also understand the relationship between the two.

Indicators of the ability of mathematical concepts in the 2013 curriculum, namely: a) restating the concepts that have been learned; b) classifying objects based on whether or not the requirements that constitute the concept are met; c) identify the properties of the operation or concept; d) apply the concept logically; e) presenting concepts in various forms of mathematical representation (tables, graphs, diagrams, sketches, mathematical models or other means); f) linking various concepts in mathematics and outside mathematics; g) developing necessary and / or sufficient conditions for a concept [2].

Based on the results of observations (October 2019) conducted at SMP Negeri 30 Konawe Selatan, it is known that students' understanding of the concept of integers is quite low. This can be seen when students are given several questions about algebra, there are still many students who make mistakes in solving integer operations on these questions. Then the researcher tried to find out more details about the understanding of the concept of integer students by giving a preliminary test with 7 essay questions (story questions) in January 2020, which can be seen in table 1 below.

Table 1: Mean Value of Student's Integer Concept Understanding

No	Class	Mean
1	VII A	34,64
2	VII B	48,12
3	VII C	16,19

This is also confirmed by research conducted by Ayu et al. [3], which stated that some students could not answer the Two Variable Linear Equation System (SPLDV) questions properly due to errors in the operation of integer numbers by students. In addition, one of the factors that influence student success in solving questions is their numerical ability. However, the results of the research by Sitriani et al [4] show that the numerical abilities of State Junior High School students in Kendari City are still low.

The problems experienced by these students can be overcome by leading students 'thoughts to understand mathematical concepts by linking the material with students' experiences in everyday life. The student experience can be in the form of culture which is closely related to mathematical concepts (ethnomatematics). Usually within one school scope brings together students with different cultural backgrounds, so that it is very possible that the experiences experienced by students are also different. The experiences of these students were obtained from local customs, traditional dances, traditional games and so on. However, the thing that students are closest to is traditional games.

According to Harmalik [5], experience is defined as a source of knowledge and skills, educational in nature, which is a unity around student goals, educational experience is continuous and interactive, helping students' personal integration. Meanwhile, Dahlan & Revina [6] defines ethno-mathematics as a knowledge that links mathematics with culture, where mathematics is taught according to local culture and the uniqueness of student character so that students can mingle and perceive mathematics as part of their culture.

In addition, from the results of Mauliadi's [7] research, it is known that the application of ethnomatics can increase effectiveness in higher order mathematics thinking skills by implementing mathematical concepts in students. Fajriah et al [8] also stated that ethnomatematics facilitates students to be able to construct mathematical concepts as part of literacy. However, previous researchers have not provided detailed information about students' understanding of the integer concept when viewed from ethno-mathematics or ethno-mathematical experiences.

Based on the description above, it is necessary to carry out further studies to find out how students understand the concept of integers when viewed from ethnomathematical experience. Ethno-mathematical experiences are things that have been experienced (tasted, lived, borne, etc.) by students related to the concept of integers that exist in culture such as in the game of marbles, both experienced directly and indirectly (through media / senses) and experience of implementation the concept of the game. This research can be used to help teachers reflect on learning mathematics with culture (ethnomatematics) so that students not only know a concept but are also able to apply it. This is what encourages researchers to raise the problem with the title "Statistical description of students' understanding of the concept of integers in terms of ethnomatematic experience at SMPN 30 Konawe Selatan.

2. Research Methods

This type of research is descriptive qualitative research. This research was conducted to examine students' understanding of the integer concept in terms of their ethnomatic experience. Understanding these concepts is observed by examining the results of students' work in completing tests of understanding the concept of integers and questionnaires related to ethnomatematic experience. This test is designed to measure students' understanding of concepts in which the elements needed to answer questions are searched for, created and compiled by the students themselves [9]. Meanwhile, questionnaires are used to obtain information about the situation of students by giving questions / statements in writing [10]. This research was conducted at SMP Negeri 30 Konawe Selatan, Wonua Village, Konda District, Konawe Selatan Regency with a total population of class VII of 63 students. The sample used was 54 students who were selected using simple random sampling technique. The data were obtained through observation, questionnaires and tests which were then analyzed descriptively by presenting the research data in the form of tables / graphs and images which were then interpreted and studied.

3. Result and Discussion

Students' understanding of the concept of integers was measured using description questions that had also been previously validated. The integer material has been taught by grade VII teachers in odd semesters. So that the researcher does not provide treatment in the implementation of teaching but by giving questions that are different from the usual story questions given. These questions adapt to traditional games which contain integer calculations, such as playing marbles. The ethnomatic experience indicator attainment is presented in the following.

The results of the calculations in Table 2 above show that the total average achievement of students' ethno-mathematics experience indicators is 55.34% of the ideal percentage of 100%, with details of the game indicators that have been seen as 10.50% of the ideal percentage of 20%; games that have been played at 10.96% from the ideal percentage of 20%; the type of marble game that has been seen is 11.38% from the ideal percentage of 20%; The type of marble game that has been played is 11.25% from the 20% percentage and the implementation of the concept that has been done by students is 11.25% from 20%. So it can also be seen that the highest percentage achievement lies in the indicator of the type of marble game (with the media of the hole, triangle,

Table 2: Achievement of Ethnomatic Experience Indicators

No	Indicator	Mea (%)	Ideal (%)
1.	Marbles game has never been seen	10,50%	20%
2.	A game of marbles has been played	10,96%	20%
3.	Types of marbles games (with the media of holes, triangles, lines, circles) that have been seen	11,38%	20%
4.	This type of marbles game (with the media of holes, triangles, lines, circles) has ever been played	11,25%	20%
5.	Students have implemented the concept of integers	11,25%	20%
	Sum	55,34%	100%

line, circle) that has been seen and the lowest percentage lies in the indicator of the marble game that has been seen.

The percentage achievement of indicators is only half of it, in the sense that the ethno-mathematical experience of students' traditional games does not only focus on the traditional marbles game. This is normal, because the culture that develops in the student environment is very diverse. So that students may not only have ethnomatematic experience in traditional games as presented by the researcher in the questionnaire, but also have experience in other traditional games. For example, the ethno-mathematical experience these students have can be seen in Figure 1 below:

From Figure 1 it can be seen that the students have ethnomatematic experience in other traditional games such as jumping rope and crank. Whereas in the data, the percentage of students who have experience implementing the integer concept shows a higher level than students who have no experience. This is in accordance with the opinion of Mauliadi [7] which states that ethnomatematics is a calculation technique related to mathematics in a cultural environment, so that without realizing it when playing traditional games, students have implemented mathematical concepts, one of which is integers. The percentage of students who have experience implementing the concept is presented in Figure 2 below.

Figure 2 shows that the number of students who have implemented the concept in the marble game that students play, both consciously and unconsciously, is 46 out of

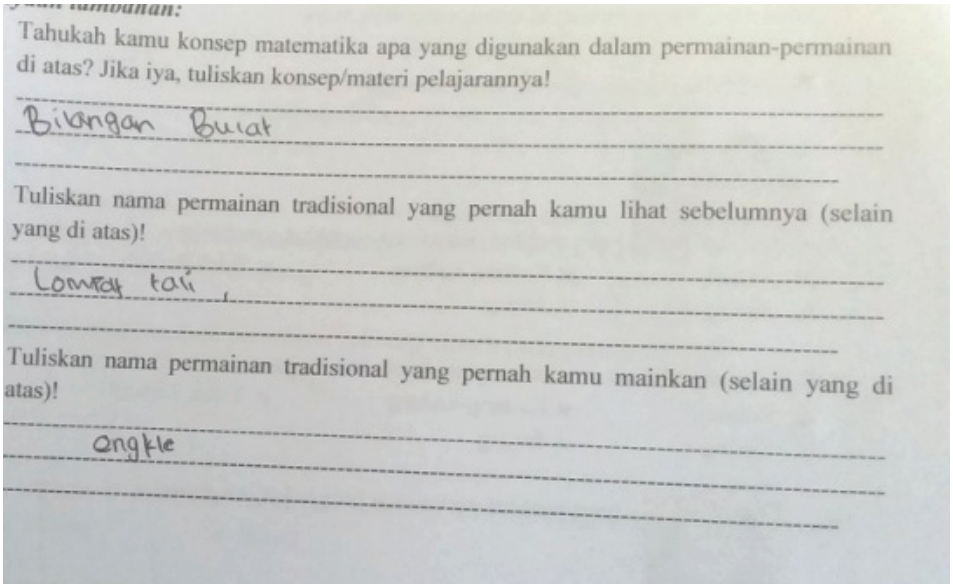


Figure 1: Students' Ethno-Mathematical Experience.

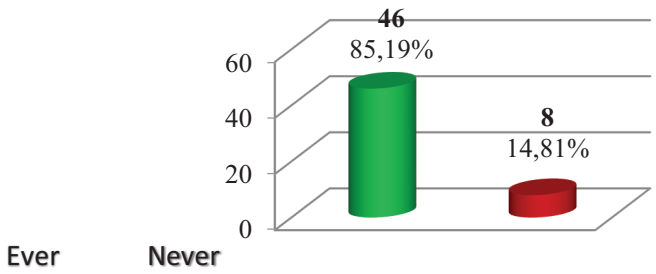


Figure 2: The percentage of students who have experience implementing the concept.

54 students and 8 out of 54 students who never implement it. So that the percentage generated from these calculations is dominated by students who have implemented the concept, namely 85.19% compared to students who have never implemented the concept, namely 14.81%. Furthermore, the researchers analyzed students' understanding of concepts in terms of experience implementing the concepts in the games presented in Table 3 below.

Table 3: Concept understanding statistics in terms of experience implementing concepts in games

Statistics	Students' Concept Understanding Based on Experience in Implementing the Concept	
	Ever	Never
Mean	36,49	43,75
Varians	603,67	429,07
Max	100	57,14
Min	0	7,14
Mode	42,86	57,14

The results of statistical calculations show that the mean score of understanding the concept of students who have implemented the concept is 36.49; The maximum score is 100 and the minimum score is 0 with a variance of 603.67, which means that the conceptual understanding of students who have implemented the concept has great diversity. Meanwhile, mean score of students' concept understanding who never implemented the concept was 43.75; the maximum score was 57.14 and the minimum score was 7.14 with a variance of 429.07, which means that the conceptual understanding of students who have never implemented the concept is quite diverse.

In these statistics, it can be seen that students who have never implemented the concept comprehension mean score is greater than students who have implemented it even though the mean score has not reached the minimum completeness criteria (KKM). The variance obtained by students who have implemented the variety and diversity is not as large as that of students who have never implemented the concept. This indicates that when students have experience implementing concepts, students have even a little understanding of the concept. This can be seen from the highest score of one hundred students who have experience implementing the concept.

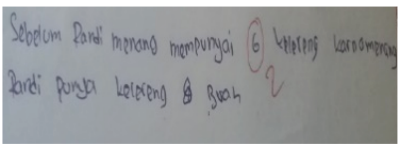
Researchers also analyzed students' understanding of concepts with ethnomatematic questions in terms of each indicator, namely restating the concepts that have been learned; classify objects based on whether or not the requirements that form the concept are met; identify the properties of the operation or concept; apply the concept logically; presents concepts in various forms of mathematical representation (tables, graphs, diagrams, sketches, mathematical models or other means); linking various concepts in mathematics and outside mathematics; and developing the necessary and / or sufficient terms of a concept, which are presented in the following table.

The results of the calculations in table 4 above show that the total average achievement of the conceptual understanding indicators obtained by students is 37.57% of the ideal percentage of 100%, with detailed indicators restating the concepts that have been studied is 3.70% of the ideal percentage, namely 14.29%; classify objects based on whether or not the requirements that form the concept are met is 9.26% of the ideal percentage, namely 14.29%; identify the characteristics of the operation or concept of 6.88% from the ideal percentage of 14.29%; apply the concept logically at 9.52% from the ideal percentage, namely 14.29%; presents concepts in various forms of mathematical representations (tables, graphs, diagrams, sketches, mathematical models or other means) 1.85% of the ideal percentage of 14.29%; linking various concepts in mathematics and outside mathematics at 2.91% of the ideal percentage, namely 14.29%; and developing the necessary and / or sufficient conditions for a concept of 3.44% from

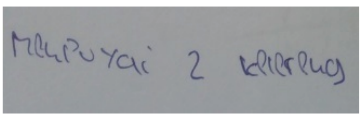
Table 4: Achievement Indicators Understanding Konse p Students With Problem Etnomatematika.

No	Indicator	Mean (%)	Ideal (%)
1	Restate learned concepts	3,70%	14,29%
2	Classify objects based on whether or not the requirements that form the concept are met	9,26%	14,29%
3	Identify the properties of the operation or concept; apply the concept logically	6,88%	14,29%
4	Apply concepts logically	9,52%	14,29%
5	Present concepts in various forms of mathematical representation (tables, graphs, diagrams, sketches, mathematical models or other means)	1,85%	14,29%
6	Link various concepts in mathematics and outside mathematics	3,44%	14,29%
7	Develop the necessary and / or sufficient terms of a concept	3,44%	14,29%
	Sum	37,57%	100%

the ideal percentage of 14.29%. So it can be concluded that the achievement of the highest percentage of indicators is in the indicators of applying the concept logically and the lowest achievement of indicators is the indicators presenting concepts in various forms of mathematical representation (tables, graphs, diagrams, sketches, mathematical models or other ways). This can be seen in the students' answers to the test questions that had been given at the time of the research. For example, students' answers in applying the concept logically can be seen as in Figure 3 below:



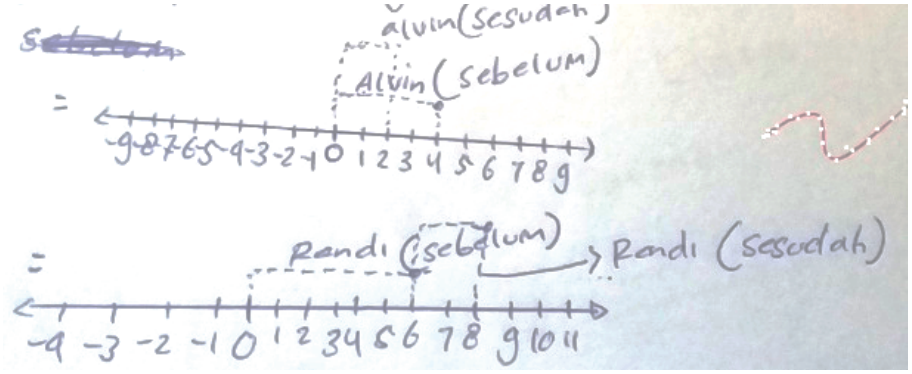
(a) Correct answer



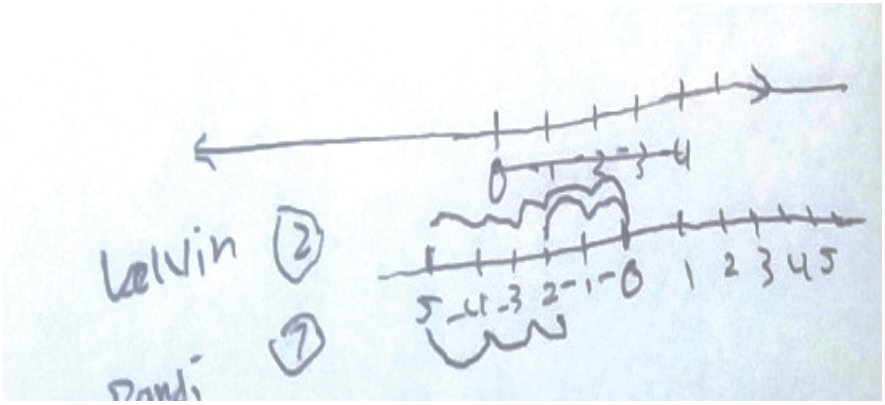
(b) Incorrect answer

Figure 3: Answers to Logical Applying Concepts.

From Figure 3 it can be seen that in answer (b) students have tried to apply the concept of integers logically in answering the questions presented, but students are still wrong in analyzing the purpose of the question, where students should focus enough on Randi's marble after winning and being given marbles by Alvin increased to 8 marbles. So that many students still cannot apply the concept logically correctly. Furthermore, the answer presents the concept in the form of a number line can be seen in Figure 4 below:



(a) Correct Answer



(b) Incorrect Answer

Figure 4: Answers Presenting Concepts in Number Line Form.

It can be seen from Figure 4 in point (b), students can already make integer lines but students still cannot present the concept in the form of a number line correctly. This can be seen from the student's answer which only made a number line but was not correct in presenting the arrow line direction on the number line, which should be presented completely and accurately. So that the indicator presenting the concept in various forms of mathematical representation becomes the indicator with the lowest achievement compared to other indicators of concept understanding. Furthermore, the researcher analyzes the percentage of students' concept understanding based on the level of ethno-mathematical experience presented in the following table.

From table 5 above it is known that the average understanding of students at a high level of experience is 33.93 with an mean percentage of 30.13%; at a middle level of experience, the mean understanding of students was 37.59 with an mean percentage of 33.39%; and at a low experience level, the mean score understanding of students

Table 5: Percentage of Students' Concept Understanding Based on Ethnomatematic Experience Level.

Experience Level	Score Interval	The Number of Students	Mean of Student Undestanding	Mean (%)
High	54 - 44	8	33,93	30,13%
Middle	44 – 30	38	37,59	33,39%
Low	≤ 30	8	41,07	36,48%

was 41.07 with an mean percentage of 36.48%. So it can be concluded that the mean understanding of the concept of integers is quite low, even though the level of ethno-mathematical experience is high. Meanwhile, at a low level of experience students obtain a fairly high mean understanding compared to students who have a high level of experience. This indicates that ethno-mathematical experience has nothing to do with understanding the concept of integers. Furthermore, the researchers suggested to the school / teacher to give more dedication related to understanding the concept while still paying attention to students' interest and motivation in learning so that later it could make it easier for students to solve math problems related to everyday life.

4. Conclusion

From table 5 above it is known that the average understanding of students at a high / good level of experience is 33.93 with an average percentage of 30.13%; at a moderate level of experience / good enough, the average understanding of students was 37.59 with an average percentage of 33.39%; and at a low / bad experience level, the average understanding of students was 41.07 with an average percentage of 36.48%. So it can be concluded that the average understanding of the concept of integers is quite low, even though the level of ethno-mathematical experience is high. Meanwhile, at a low level of experience students obtain a fairly high average understanding compared to students who have a high / good level of experience. This indicates that ethno-mathematical experience has nothing to do with understanding the concept of integers. Furthermore, the researchers suggested to the school / teacher to give more dedication related to understanding the concept while still paying attention to students' interest and motivation in learning so that later it could make it easier for students to solve math problems related to everyday life.

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