Pegem Journal of Education and Instruction, Vol. 12, No. 4, 2022 (pp. 192-199)

RESEARCH ARTICLE WWW.PEGEGOG.NET

Elementary School Students Reflection: Didactical Design Analysis on Integer and Fraction Operations on Mathematical Concepts with Sundanese Ethnomathematics Learning

Supriadi Supriadi

Primary School Teacher Education Department,, Universitas Pendidikan Indonesia, Ciracas No.38 , Serang City, Banten, Indonesia

Abstract

This article analyzes elementary school students' didactical situation in traditional games through ethnomathematics learning. The conventional game studied was *Endog-Endogan* or egg games from the Sundanese culture, West Java, Indonesia. This qualitative and quantitative study applied the design of the didactic learning stage. The quantitative study employed the Rasch Winstep Model to survey 56 elementary school students from grades 2 to 6 as respondents in implementing Endog-Endogan games in mathematics learning. The instruments used in this stage were the worksheet, documentation, and observation. Data analysis was carried out by collecting and describing the data of students' responses in Student Worksheets to obtain the data on findings of student learning obstacles. Then the data from the questionnaire were analyzed using a rash model: person and item reliability, unidimensional, and summary of items. The study results showed that the didactic design process in ethnomathematics learning teaching materials could be optimum with *Endog-Endogan* games because almost all teacher predictions were equal to elementary school students' responses. Besides, traditional games can be used as a solution to make learning mathematics easy and flexible with the mathematical concepts taught.

Keywords: education, ethnomathematics, traditional games, Sundanese culture.

Introduction

The concept of integers and fractions is one of the elementary school materials still considered difficult by students. Students still cannot distinguish negative numbers from positive ones as they still have initial knowledge of the concept of natural numbers in lower elementary grades (Lewis et al., 2020). In addition, fractional numbers have the same difficulty level, and students still have the initial knowledge that the denominator is considered the same as the natural number in fractional arithmetic operations (Ben Hmed et al., 2015). For this reason, learning's creativity is needed to overcome these misconceptions. The vital requirement to improve the efficiency to reform mathematics education encouraged broader thoughts of varied essential factors, such as background result, civilization, and ethnicity. There is a need to construct an appropriate school culture on the main philosophy of even-handedness, pluralism, and agreement. Teacher education and professional development should house these changes. The ethnomathematical move towards has to turn out to be the main power behind developing these instructions.

D'Ambrosio (2020)ethno and mathematics (D'Ambrosio 1987 defined ethnomathematics as the mathematics practiced among individual cultural groups, a sense that it deals with mathematical conceptions and techniques urbanized in dissimilar cultures to resolve real-life problems. In education, the ethnomathematical move is an addition to the mathematical concepts and practices originating in the learners' culture with conventional and official academic mathematics fields (Rosa et al., 2015). In other words, ethnomathematical learning is a process in which learners use mathematical experiences from their have and different cultures to appreciate how mathematical ideas are formulated and practical (Rosa et al., 2017).

Ethnomathematics-based teaching utilizes this move towards addressing the factors above of power in the educational process. It also introduces conservative mathematics so that its power, beauty, and usefulness are better longed-for and its association to recognizable practices and concepts becomes an open (Achor et al., 2009). The learners become aware of how people become relevant to mathematics in their daily life, enhancing their ability to make significant mathematical

Corresponding Author: supriadi.upiserang@upi.edu

https://orcid.org: 0000-0003-0752-1557

How to cite this article: Supriadi S (2022). Elementary School Students Reflection: Didactical Design Analysis on Integer and Fraction Operations on Mathematical Concepts with Sundanese Ethnomathematics Learning. Pegem Journal of Education and Instruction, Vol. 12, No. 4, 2022, 192-199

Source of support: Nil

Conflict of interest: None.

DOI: 10.47750/pegegog.12.04.19

Received : 19.05.2021

Accepted : 23.07.2022 **Published:** 01.10.2022

relations and more profound sympathy for all forms of mathematics (Begg, 2001). Ethnomathematics practices can augment the mathematics curriculum in some ways: help students appreciate abstract mathematics concepts (Owens, 2014), promote learning appointment (Verner et al., 2013), and improve motivation and positive attitude toward the direction of mathematics (Shirley, 2001), expand the visuospatial way of thinking abilities (Owens, 2015) strengthen problem-solving skills, and creativity (D'Ambrosio & D'Ambrosio, 2013; Massarwe et al., 2011). The cultural background of ethnomathematics activities allows the mathematics teachers, as an educator, to augment students' knowledge about their controlled culture and other cultures (Cimen, 2014), hold up the configuration of their cultural individuality (Rosa & Orey, 2010; Verner et al., 2013), and endorse multicultural consciousness and honesty (Gerdes, 1998; Zaslavsky, 2020). The creativity of learning mathematics in elementary schools that individuals can complete is culture-based learning, one of which is Sundanese ethnomathematics learning. The concept of mathematics based on a cultural perspective agrees that students should reproduce and feel happy about their culture and the culture and behavior of others. The study of mathematics with culture is supported by findings from Confucian cultural heritage in mathematics classes (Sum & Kwon, 2020). Connecting mathematics, culture, environment, and habitual action considers students' cultural diversity in learning instruction to expand the information performance (d'Entremont, 2015).

Therefore, this article examines the relationship between mathematics and culture with traditional forms of Sundanese culture, West Java, Indonesia, arranged in Sundanese ethnomathematics concepts. The traditional game used was the game of *Endog-Endogan* (eggs). Sundanese culture originates from the resident populace of Western Java in Indonesia. They are the second leading population in Indonesia, other than Javanese in Central and Eastern Java, with an approximate number of 48 million in 2018. Sundanese is commonly Muslim and simple to interrelate communally. Based on researchers from Austronesian in Southeast Asia (Roosita et al., 2008). Sundanese culture originated in Taiwan and reached Java between 1,500 and 1,000 BC. Among Sundanese residents, several traditional communities are called indigenous rural communities, which secretly practice stronger traditional customs than contemporary communities. These indigenous people still live in relatively undeveloped villages spread across various districts in West Java.

The idea of Sundanese ethnomathematics is every manifestation of one's ideas based on the vision of Sundanese culture, which is built in the course of mathematical thinking development, by showing that mathematics is a cultural product (Supriadi, 2019; Supriadi et al., 2019; Supriadi, 2020; Supriadi & Arisetyawan, 2020).

Sundanese ethnomathematics learning can be a long lesson in improving elementary school mathematical thinking development because this learning prioritizes the development of students' mathematical thinking. The elementary school mathematical thinking ability developed through this learning is relatively innovative to contemplate with the Sundanese cultural background. It is because the ability to think in designing students' opinions that need to be considered is the ability to believe creatively in mathematics.

This article aims to analyze the didactic situation of students' worksheets and questionnaires from Sundanese ethnomathematics learning on elementary school student's mathematical modeling and creative thinking skills on integer and fractional operations material.

Method

Research Design

This research used qualitative and quantitative analysis, the didactical design method (Salinas et al., 2013; Rudi et al., 2020) to create a knowledge worksheet of Sundanese ethnomathematics learning and observation. After obtaining worksheet learning, it used 20 questionnaire items on mathematical modeling and creative thinking as instruments adapted to Sundanese ethnomathematics learning with *Endog-Endogan* games.

Sample and sample collection techniques

The participants in the research subjects used in the learning were students in grades two to six of elementary schools in

Fig. 1: Sundanese Culture from Western Java, Indonesia.

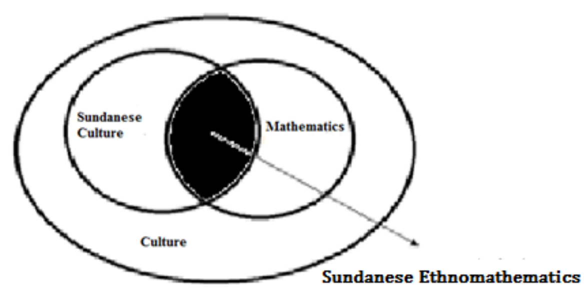

Fig. 2: Sundanese Ethnomathematics Concept

Lebak City, Banten, Indonesia, with a total of 56 students. The elementary school's location was in a rural area, with the learning implementation carried out with one-day one-class with limited face-to-face meetings to prevent COVID-19 transmission. The second grade consisted of five male students and four female students. The third grade had three male students and seven female students. The fourth grade comprised eleven male students and six female students. The fifth grade consisted of two male students and nine female students. Finally, the sixth grade had four male students and five female students.

Data Collection tools

The first data collection tool is the observation of students' answers on the Student Worksheet regarding integers and fractions given after students are given Sundanese ethnomathematical learning with traditional endog-endogan games. The game *Endog-Endogan* is a traditional Sundanese game. This game is easy to play as it only uses one hand as a game medium. Therefore, this game is flexible and to be played anywhere and anytime. One of the cultural benefits of this game is that students have to work together with everyone to build mountains, and if they decrease, they must always trust each other to get back up. Example in this link: https://www.youtube.com/watch?v=Z9-HANc_4Zk

Figure 3, The example of Sundanese ethnomathematics learning in a subtraction operation is as follows:

a. prepare questions for students
b. write questions on the blackboard or worksheet, such as 6-2 =
c. prepare three children to make fists like eggs
d. sing modified *Endog-Endogan* songs

In the second stage, students fill out a questionnaire containing 20 questions from 3 dimensions; creative thinking, interest in learning Sundanese ethnomathematics, and mathematical modeling abilities. There are six items of ability to think creatively about different ways of learning mathematics and their own (original) way of following mathematics lessons. There are six items of interest in learning Sundanese ethnomathematics student interest in learning, group learning, and student interest in learning using Student Worksheets. There are eight items of mathematical modeling ability regarding interest in Sundanese ethnomathematical learning about liking for mathematical modeling ability questions and the benefits of mathematical modeling ability questions.

Fig. 3: Endog-endogan game with the subtraction concept

The dimensions and the items under each dimension are shown in Table 1.

Data Analysis

Data analysis was carried out by collecting and describing the answers from 56 students on the Student Worksheets for grades 2 to 6. The responses were divided into answers that matched predictions, partially matched, and did not match. After the response data is obtained, it will find data on student learning obstacles. Then the data from the questionnaire containing 20 items from the dimensions of creative mathematical thinking, students' interests, and students' mathematical modeling abilities were analyzed using the Rash model: Student symbols with x and items with Q. The rash measurement tools used were the person and item reliability, unidimensional, and summary of items.

Findings

In this section, students' responses are found in answering questions on student worksheets.

Questionnaire Data Analysis for Grade 2 until 6

The data comprised 56 respondents from grade 2 to 6 elementary school students. Based on the analysis results, the value of Pearson's reliability was 0.75, and item reliability was 0.97. The unidimensional assumption was obtained, with the eigenvalue variance explained by measures being 57.6% (> 50%), while the unexplained variance was 42.4% (> 10%).

Figure 5 illustrates the range of students' abilities and difficulty in responding to the questionnaire instrument given. Based on the item map above, information can be obtained that: Item number 1 was the easiest item to answer, while items 3,8,17,19 were challenging to answer. Therefore, it can be denoted that the items in the questionnaire above were the most suitable for measuring the respondent's ability. However, they were not ideal for use for extreme high and low.

The data were in the form of a questionnaire with five scales of 0-4 in table 7, the table above presents the functioning of

Table 1: The Dimensions and Items of the questionnaire

Dimensions	*Item*
Creative thinking	1,2,15,3,4,20
Interest	5,6,7,8,9,10
Mathematical modeling	11,12,13,14,16,17,18,19

Table 2: Students Response Grade 2

Students Response				*Sum*
Number of eggs	*Number of broken eggs*	*Eggs that do not break*	*Mathematical sentences*	
16 (8 of your friends)	7	9	16 – 7 = 9	7
18	9	9	18 – 9 = 9	
8	4	4	8 - 4 = 4	
1	2	8	10 - 2 = 8	
Number of eggs	*Number of broken eggs*	*Eggs that do not break*	*Mathematical sentences*	1
16 (8 of your friends)	7	9	16 – 7 = 9	
18	9	9	18 – 9 = 9	
8	4	4	8 - 4 = 4	
10	2	2	10 - 2 = 2	

Table 3: Students Response Grade 3

Students Response				**Sum**
Number of eggs	*The number of broken eggs*	*Eggs that do not break*	*Mathematical sentences*	**4**
30 (15 of your friends) *OOOOOOOOOO* *OOOOOOOOOO* *OOOOOOOOOO*	**9** *OOOOOOOOO*	**21** *OOOOOOOOOO* *OOOOOOOOOO* *O*	**30 – 9 = 21** *OOOOOOOOOO* *OOOOOOOOOO* *OOOOOOOOOO*	
20	**9**	**11**	**20 – 9 = 11**	
20	**9-3**	**8**	**20 - 12 + 8**	
20	**10**	**10**	**20 - 10 = 10**	
Number of eggs	Number of broken eggs	Eggs that do not break	Mathematical sentences	
30 15 of your friends) OOOOOOOOOO OOOOOOOOOO OOOOOOOOOO	9 OOOOOOOOO	21 OOOOOOOOOO OOOOOOOOOO O	30 – 9 = 21 OOOOOOOOOO OOOOOOOOOO OOOOOOOOOO	**6**
20	9	11	20 – 9 = 11	
20	12	8	20 - 12 + 8	
20	10	10	20 - 10 = 10	
1b	20, 20, 9, 9, 11, 11.			**10**

Table 4: Students Response Grade 4

Number	*Student Response*	*Sum*
1a	1 3	16
	$\frac{1}{3}$	16
2a	2 3	14
	$\frac{2}{3}$	14
2b	$\frac{1}{3}+\frac{2}{3}=\frac{3}{6}$	8
2d	$\frac{1}{3}+\frac{2}{3}=\frac{3}{3}=1$	10

Table 5: Students Response Grade 5

Number	*Student response*	*Sum*
1a	(1 numerator), $3\frac{1}{3}$ Students do not answer	2 9
1b	(1 numerator), $2\frac{1}{2}$ Students do not answer	2 9
1c	$\frac{2}{6},\frac{3}{6}$	12
1d	$\frac{2}{6},\frac{3}{6}$	11
1e	$\frac{2}{6}+\frac{3}{6}$ $\frac{2}{6}+\frac{3}{6}=\frac{5}{6}$ $\frac{2}{6},\frac{3}{6}$	1 9 1

Fig. 3: Students Responses number 1

Fig. 4: Students Responses number 2

each answer option. Based on the table above, it can be seen that all answer choices on a scale of 0-4 function well. It was indicated by a consistent increase in the category measure from -3.64 to 3.18. In other words, people who show an ability of -3 will tend to have no answer, while people who have the ability of 3 will tend to answer strongly agree.

Discussion

Didactic situations in Sundanese ethnomathematics learning (Turk & Arslan, 2012; Modestou & Gagatsis, 2013) in the class studied emerged several learning obstacles that occurred in the ability to model and creative mathematical thinking for students grade 2 through grade 6, or called an epistemological barrier according to didactic theory (Brousseau et al., 2004; Lupu, 2013). These obstacles occurred due to students' limited knowledge of specific contexts. The following is the analysis of learning barriers at each level:

Grade 2 students still have difficulty understanding story problems in subtraction operations using modeling in the form of endog-endogan games because students are accustomed to working on math problems using numbers only. When given a question in the form of a story, students' cognition is not ready to work on it. When students write questions about the same story, students can write them. However, if it is made outside the example, students have difficulty. Thus, students are accustomed to writing according to the existing template.

Grade 3 students still have difficulty reducing unit numbers. If the subtracted number is smaller, students still think that the larger number is easier to reduce by the smaller number. Therefore, visualization with the shape of an egg in the *endog-endogan* game is needed to make it easier for students to answer these questions. Similar findings regarding student difficulties were also found by Kinda (2013)Compare and Peters et al (2014).

Grade 4 students still have difficulty adding fractions. They argue in adding fractions by adding the denominator to the denominator and the numerator to the numerator. This understanding is a misconception that must immediately solve this game model. Because this misconception will interfere with understanding the next concept, this finding is in the opinion of Hamzah et al (2021); many studies in the field of

```
MEASURE   PERSON - MAP - ITEM
              <more>|<rare>
   3                +
                   T|
                 X  |
                XX  |T
                    |
                 X S|
   2           XXX  +
             XXXXX  |
      XXXXXXXXXXXX  |
         XXXXXXXXX M|  Q17    Q19    Q3    Q8
            XXXXXX  |  Q18
              XXXX  |S Q20
   1     XXXXXXXXX  +  Q16    Q4
                 X  |
                 X S|
                 X  |  Q9
                    |  Q10
                    |
   0               T+M
                    |  Q2
                    |  Q15
                    |
                    |
                    |  Q12    Q7
  -1                +
                    |S Q11
                    |  Q13
                    |  Q14    Q5
                    |  Q6
                    |
  -2                +  Q1
                    |
                    |
                    |T
                 X  |
                    |
  -3                +
              <less>|<freq>
```

Fig. 5: Items analysis

Fig. 6: Learning Situation

Table 6: Students Response Grade 6

Number	*Student response and Description*	*Sum*
1	-8	5
	8	4
2	8	9

mathematics education describe that misconceptions are like "snowballs." This misunderstanding will continue to happen in most students in more complex learning topics.

However, after students modeled with games, students can solve the problem that in adding fractions, the part of a whole

Table 7: Summary of Items Result

Summary of Category Structure. Model="R"

Category Observed Label Score Count %				*Obsvd Avrge*	*Sample Expect*	*Infit Mnsq*	*Outfit Mnsq*	*Andrich Threshold*	*CategoryMeasure*	
0	0	22	2	-2.05	-1.73	.91	1.43	NONE	(-3.64)	0
1	1	135	12	.09	-.02	1.09	1.26	-2.44	-1.55	1
2	2	306	27	.46	.59	63	.61	-.54	.21	2
3	3	270	24	1.83	1.61	.73	.82	1.18	1.60	3
4	4	387	35	2.55	2.62	1.31	1.60	1.80	(3.18)	4

is the sum of all parts of the same whole. Students' difficulty in learning the operation of adding fractions is the same as the findings of Hansen et al (2017).

Meanwhile, grade 5 students still have difficulty understanding fractions through story questions. Misunderstanding occurs almost the same as in grade 4, who cannot understand the number of fractions, especially in fractions with non-equal denominators; the denominator is added to the denominator, and the numerator plus the numerator is still found. Students begin to understand fractional models using games so that the fractions that are not worth are arranged in the equivalent fraction model first; after that, students can add up the two fractions that are not worth.

Then, grade 6 students still have difficulty adding integer operations and using the addition of natural numbers because students are not accustomed to working on fraction problems using models or pictures; Students think that negative symbols are considered the same as minuses. Modeling with games can make it easier for students to understand adding up negative numbers with positive and negative numbers with positive. Students' difficulties in learning integers are to the findings of Whitacre et al (2017).

According to the results obtained by Rash Model Analysis, it can be concluded that the students' answers' consistency was sufficient. At the same time, the quality of the statement items in the questionnaire instrument had a perfect reliability estimate (Setyanti et al., 2022). This measurement instrument was still heavily influenced by other factors unrelated to measuring the method's effectiveness. The findings that the instrument employed were able to collect students' data in ethnomathematical learning.

Moreover, the didactic design worksheet is a series of learning to overcome existing learning obstacles. The learning used was Sundanese ethnomathematics learning by using *Endog-Endogan* games, a series of learning activities as a learning path for students to achieve learning goals more meaningfully, called learning trajectory (Simon et al., 2018). The learning activities arranged were *Endog-Endogan* (eggs) modified to encourage students to think about mathematical concepts. In this case, learning activities must be organized to develop the modeling and creative thinking (Weber & Lockwood, 2014).

The didactic design worksheet also refers to the didactic situation theory (Turk & Arslan, 2012). Sundanese ethnomathematics learning with *Endog-Endogan* games was developed to design material conditions and social contracts, framing them together through the expected didactic situations, especially from the student's point of view. Based on the response results, the students learning obstacles for each level in grades 2, 3, 4, 5, and 6 began to decrease. It was evidenced by the many student responses that matched the teacher's predictions. In pedagogic relations, teachers distributed worksheets together but were less than optimal (Simon et al., 2018).

Brousseau et al (2004)Guy Brousseau set himself the goal of verifying experimentally a theory he had been building up for a number of years. The theory, consistent with what was later named (non-radical argued that the modern conception of a teacher is how teachers can wisely trigger students' adaptation to a problem. Students have learned if students can adapt thoughtfully by using prior knowledge. In this regard, Sundanese ethnomathematics learning with *Endog-Endogan* games can lead to student independence in understanding the concepts of addition, subtraction, integers number, and fractions number.

Students' independence in the learning process is called a didactical situation (Brousseau et al., 2004; Modestou & Gagatsis, 2013). Sundanese ethnomathematics learning compiled has been correlated with mathematical concepts. Thus, the teacher's most crucial role is to create a didactic situation by making relations between students and the material. Sundanese ethnomathematics learning is precisely not only enjoyable and meaningful but also more accurate in the student's minds. In addition, Sundanese ethnomathematics learning with Endog-Endogan games has produced optimal positive responses from elementary students in grades 2, 3, 4, 5, and 6. It was indicated by the responses that were entirely by the teacher's predictions.

Conclusion

The conclusion is based on the results of research and discussion that Sundanese ethnomathematical learning using the Endog-Endogan game from West Java, Indonesia:

1. Can make it easier and fun for low-grade students to do modeling in integer subtraction and produce varied answers.
2. Eliminate students' difficulties in reducing smaller units with larger units because students find real models so that abstraction in subtraction operations can be reduced; students can also produce creative answers with more than one answer.
3. Students' difficulties in fractions material can be reduced because students find real models to connect the concepts of numerator and denominator.
4. Adding both equivalent and non-equal fractions with traditional game models makes it easier for students to relate abstract ideas to reality in fractional material.
5. 6. The difficulty of operating negative and positive integers generally is that students misunderstand the difference between symbols and operations. This traditional game can distinguish negative symbols from minuses. Students can easily understand the addition of integers between positive and negative or vice versa because students model pairs of number symbol images and are creative in carrying out operations in the form of installing neutral, positive negative images so that students get a smooth answer from the remaining images.
6. Instrumental analysis and student answers have very significant reliability in both item and person, so we can conclude that Sundanese ethnomathematics learning with endog-endogan games (eggs) effectively overcomes students' difficulties in the material of integer and fraction operations.

Suggestion

Based on the conclusions and implications of Sundanese ethnomathematical learning research, the Supriadi provide the following suggestions:

1. Teachers can use this learning model because it makes it easier for students to make abstract mathematical models easier.
2. The teacher finds a solution by overcoming difficulties in the material of integers and fractions.
3. Other researchers can carry out this research with many students and on other complex materials.
4. Teachers must learn the connection of traditional culture with learning mathematics or ethnomathematics so that students learning mathematics in class can get positive messages to maintain their nation's culture.

Limitation

The research investigates the didactic situation of Sundanese ethnomathematical learning through traditional games. This research was conducted during the COVID-19 pandemic, so the implementation of face-to-face offline learning was limited. The learning activity is only one hour a day and for one day per class. Teachers and students implement health protocols in the classroom. Data were collected to produce research findings from 56 students because only 10% were allowed face-to-face. Learning cannot be done online because the research was conducted in rural locations in independent learning from the Indonesian Ministry of Education and Culture; many students do not have cellphones and limited signals. The data analyzed are answers from student worksheets and questionnaires with mathematical modeling and creative thinking skills and are limited to the operation of addition, subtraction, integers, and fractions.

Acknowledgment

This research was funded by the Ministry of Research, Technology and Higher Education Indonesia, 2021.

References

Achor, E. E., Imoko, B. I., & Uloko, E. S. (2009). Effect of ethnomathematics teaching approach on senior secondary students' achievement and retention in Locus. *Educational Research and Reviews*, *4*(8).

Begg, A. (2001). Ethnomathematics: Why, and what else? *Zentralblatt Für Didaktik Der Mathematik*, *33*(3). https://doi.org/10.1007/bf02655697

Ben Hmed, A., Amairi, M., & Aoun, M. (2015). Stability and resonance conditions of the non-commensurate elementary fractional transfer functions of the second kind. *Communications in Nonlinear Science and Numerical Simulation*, *22*(1–3), 842–865. https://doi.org/10.1016/J.CNSNS.2014.07.014

Brousseau, G., Brousseau, N., & Warfield, V. (2004). Rationals and decimals as required in the school curriculum: Part 1: Rationals as measurement. *The Journal of Mathematical Behavior*, *23*(1), 1–20. https://doi.org/10.1016/J.JMATHB.2003.12.001

Cimen, O. A. (2014). Discussing Ethnomathematics: Is Mathematics Culturally Dependent? *Procedia - Social and Behavioral Sciences*, *152*, 523–528. https://doi.org/10.1016/J.SBSPRO.2014.09.215

D'Ambrosio, U. (2020). In My Opinion: What Is Ethnomathematics, and How Can It Help Children in Schools? *Teaching Children Mathematics*, *7*(6). https://doi.org/10.5951/tcm.7.6.0308

D'Ambrosio, U., & D'Ambrosio, B. S. (2013). The Role of Ethnomathematics in Curricular Leadership in Mathematics Education. *Journal of Mathematics Education at Teachers College*, *4*(1).

d'Entremont, Y. (2015). Linking Mathematics, Culture and Community. *Procedia - Social and Behavioral Sciences*, *174*, 2818–2824. https://doi.org/10.1016/J.SBSPRO.2015.01.973

Gerdes, P. (1998). On Culture and Mathematics Teacher Education. *Journal of Mathematics Teacher Education*, *1*(1).

Hamzah, N., Maat, S. M., & Ikhsan, Z. (2021). A Systematic Review on Pupils' Misconceptions and Errors in Trigonometry. In *Pegem Egitim ve Ogretim Dergisi* (Vol. 11, Issue 4). https://doi.org/10.47750/pegegog.11.04.20

Hansen, N., Jordan, N. C., & Rodrigues, J. (2017). Identifying learning difficulties with fractions: A longitudinal study of student growth from third through sixth grade. *Contemporary Educational Psychology*, *50*, 45–59. https://doi.org/10.1016/J.CEDPSYCH.2015.11.002

Kinda, S. (2013). Generating scenarios of addition and subtraction: A study of Japanese university students. *The Journal of Mathematical Behavior*, *32*(2), 243–250. https://doi.org/10.1016/J.JMATHB.2013.02.009

Lewis, K. E., Sweeney, G., Thompson, G. M., & Adler, R. M. (2020). Integer number sense and notation: A case study of a student with a mathematics learning disability. *The Journal of Mathematical Behavior*, *59*, 100797. https://doi.org/10.1016/J.JMATHB.2020.100797

Lupu, C. (2013). Epistemological and Psychological Fundamentals of the Didactics of Science. *Procedia - Social and Behavioral Sciences*, *92*, 490–494. https://doi.org/10.1016/J.SBSPRO.2013.08.706

Massarwe, K., Verner, I., & Bshouty, D. (2011). Fostering Creativity through Geometrical and Cultural Inquiry into Ornaments. In *The Elements of Creativity and Giftedness in Mathematics*. https://doi.org/10.1007/978-94-6091-439-3_14

Modestou, M., & Gagatsis, A. (2013). A didactical situation for the enhancement of meta-analogical awareness. *The Journal of Mathematical Behavior*, *32*(2), 160–172. https://doi.org/10.1016/J.JMATHB.2013.02.004

Owens, K. (2014). Diversifying our Perspectives on Mathematics about Space and Geometry: An Ecocultural Approach. *International Journal of Science and Mathematics Education*, *12*(4). https://doi.org/10.1007/s10763-013-9441-9

Owens, K. (2015). Changing the teaching of mathematics for improved Indigenous education in a rural Australian city. *Journal of Mathematics Teacher Education*, *18*(1). https://doi.org/10.1007/s10857-014-9271-x

Peters, G., De Smedt, B., Torbeyns, J., Verschaffel, L., & Ghesquière, P. (2014). Subtraction by addition in children with mathematical learning disabilities. *Learning and Instruction*, *30*, 1–8. https://doi.org/10.1016/J.LEARNINSTRUC.2013.11.001

Roosita, K., Kusharto, C. M., Sekiyama, M., Fachrurozi, Y., & Ohtsuka, R. (2008). Medicinal plants used by the villagers of a Sundanese community in West Java, Indonesia. *Journal of Ethnopharmacology*, *115*(1), 72–81. https://doi.org/10.1016/J.JEP.2007.09.010

Rosa, M, Orey, D. C., Rosa, M., & Orey, D. C. (2015). Ethnomathematics: Connecting Cultural Aspects of Mathematics through Culturally Relevant Pedagogy. *Proceedings of the Eighth International Mathematics Education and Society Conference, Vols 1-3*.

Rosa, Milton, & Orey, D. C. (2010). Culturally relevant pedagogy : an ethnomathematical approach. *Horizontes*, *28*(1).

Rosa, Milton, Shirley, L., Gavarrete, M. E., & Alangui, W. V. (2017). *Topic Study Group No. 35: Role of Ethnomathematics in Mathematics Education*. https://doi.org/10.1007/978-3-319-62597-3_62

Rudi, R., Suryadi, D., & Rosjanuardi, R. (2020). Teachers' Perception as a Crucial Component in the Design of Didactical Design Research-Based Teacher Professional Learning Community in Indonesia. *European Online Journal of Natural and Social Sciences*, *9*(3).

Salinas, P., González-Mendívil, E., Quintero, E., Ríos, H., Ramírez, H., & Morales, S. (2013). The Development of a Didactic Prototype for the Learning of Mathematics through Augmented Reality. *Procedia Computer Science*, *25*, 62–70. https://doi.org/10.1016/J.PROCS.2013.11.008

Setyanti, K. E., Apriliawati, D., Latif, M. H., & Sumintono, B. (2022). Satisfaction of Indonesian Health Promotion and Academic Services in Higher Education. *Health Education and Health Promotion*, *10*(1).

Shirley, L. (2001). Ethnomathematics as a fundamental of instructional methodology. *Zentralblatt Für Didaktik Der Mathematik*, *33*(3). https://doi.org/10.1007/bf02655699

Simon, M. A., Placa, N., Kara, M., & Avitzur, A. (2018). Empirically-based hypothetical learning trajectories for fraction concepts: Products of the Learning Through Activity research program. *The Journal of Mathematical Behavior*, *52*, 188–200. https://doi.org/10.1016/J.JMATHB.2018.03.003

Sum, E. S. W., & Kwon, O. N. (2020). Classroom talk and the legacy of Confucian culture in mathematics classroom. *Teaching and Teacher Education*, *88*, 102964. https://doi.org/10.1016/J.TATE.2019.102964

Supriadi, S. (2019). Didactic design of sundanese ethnomathematics learning for primary school students. *International Journal of Learning, Teaching and Educational Research*, *18*(11). https://doi.org/10.26803/ijlter.18.11.9

Supriadi, S. (2020). Pre-service elementary teachers: Analysis of the disposition of mathematical modeling in ethno mathematics learning. *Elementary Education Online*, *19*(3). https://doi.org/10.17051/ilkonline.2020.730747

Supriadi, S., & Arisetyawan, A. (2020). Didactical design of Sundanese ethnomathematics learning with Endog-endogan and Engklek games in primary school. *Journal of Physics: Conference Series*, *1567*(2). https://doi.org/10.1088/1742-6596/1567/2/022087

Supriadi, S., Susilawati, S., & Tristyanto, B. (2019). Ethnomathematics in mathematics, social and physical education. *Journal of Physics: Conference Series*, *1318*(1). https://doi.org/10.1088/1742-6596/1318/1/012126

Turk, Y., & Arslan, S. (2012). Examining Creative Drama Based Mathematics Course with Respect to Theory of Didactical Situations in Mathematics. *Procedia - Social and Behavioral Sciences*, *46*. https://doi.org/10.1016/j.sbspro.2012.06.334

Verner, I., Massarwe, K., & Bshouty, D. (2013). Constructs of engagement emerging in an ethnomathematically-based teacher education course. *The Journal of Mathematical Behavior*, *32*(3), 494–507. https://doi.org/10.1016/J.JMATHB.2013.06.002

Weber, E., & Lockwood, E. (2014). The duality between ways of thinking and ways of understanding: Implications for learning trajectories in mathematics education. *The Journal of Mathematical Behavior*, *35*, 44–57. https://doi.org/10.1016/J.JMATHB.2014.05.002

Whitacre, I., Azuz, B., Lamb, L. L. C., Bishop, J. P., Schappelle, B. P., & Philipp, R. A. (2017). Integer comparisons across the grades: Students' justifications and ways of reasoning. *The Journal of Mathematical Behavior*, *45*, 47–62. https://doi.org/10.1016/J.JMATHB.2016.11.001

Zaslavsky, C. (2020). In My Opinion: Ethnomathematics and Multicultural Mathematics Education. *Teaching Children Mathematics*, *4*(9). https://doi.org/10.5951/tcm.4.9.0502