Ethnomathematics Vs Ethomodeling: how does cigugur traditional community determines the direction of the wind to seek fortune based on month

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Abstract. This study discusses the way of Cigugur indigenous community in predicting the direction in seeking fortune. It uses a phenomenological approach with a realist ethnographic design through observation techniques, in-depth interviews, documentation, and field notes. The findings of this study indicate that the system of knowledge and livelihood which are included in the universal element of culture are implemented by the community using formal mathematical principles. Ethnomathematics as a research genre tries to reveal the dimensions of basic universal mathematical activities, while ethnomodeling as a methodology is used to represent the ideas and practices of community mathematics into academic mathematics through ethical, emic and dialectical approaches. The combination of naktu weton lahir, naktu pasaran, naktu tahun and naktu bulan, the time of one's birth month can be used to predict a good direction in seeking fortune. Based on the study of ethnomathematics, the community determines the direction in seeking fortune, the mathematical concept used by the traditional Cigugur community is the concept of sequential pairs, relations, summations, and comparisons. Meanwhile, based on ethnomodeling, the community uses the concept of modulo and congruence. Ethnomathematics and ethnomodeling provide a different perspective on the conceptual mathematics that is inherent with the universal element of holistic culture.

1. Introduction

Literally culture is a value and norm that exists, carried out and maintained for generations from generation to generation. Ethnic diversity owned by Indonesia makes Indonesia has a rich cultural diversity with a variety of ideas, practices, languages, traditions and customs. Ideas are cultural forms that are abstract while practices, languages, traditions and customs are concrete. However, abstract ideas can be explored based on concrete cultural forms. The form of culture as a system of ideas is very abstract because it is present in the minds of individuals of adherents to culture, but can be felt in daily life that is reflected in the social activities that are patterned from individuals in a society in a continuous manner with others [1]. Culture is seen as a manifestation of the lives of every person in a
group that always adapts to natural changes as an effort by humans to struggle in determining the future and face the challenges of every change that occurs [2]. One form of community culture that can be explored is culture that is associated with ideas, activities and mathematical procedures that are integrated as a social behavior in social life. The act of exploration referred to is known as ethnomathematics.

Ethnomathematics as a program studies aspects of mathematical culture which are carried out through an investigation of the ways in which a cultural group understands, articulates, and applies ideas, procedures, and techniques identified as mathematical practices [3] which assumes that mathematics is cultural knowledge that is born and develops according to human needs [4]. Mathematics developed by a group of people can be identified based on various mathematical practices that they do mainly because of the role of mathematics as a tool of reasoning and problem solving. Ethnomatematics is a tool for acting in the world because it provides insight into the social role of academic mathematics [5].

The form of mathematics identified in a cultural group is the originality of mathematical ideas, procedures and practices that are produced and developed based on their needs. This is in accordance with the main foundation of ethnomathematics as a program and genre of mathematics research and mathematics education. Awareness of the diversity of ways of knowing and doing mathematics related to values, ideas, procedures, and practices in the contextual environment diversity is the main foundation of the ethnomathematics program [3], which is done by considering the appropriation of academic mathematical knowledge and different modes in which different cultures negotiate mathematical practices developed by various sectors of society [6]. This foundation provides a space on how to understand naturally integrated mathematical and cultural concepts.

Based on this, it can be understood that mathematics has a role in various contexts such as personal, work, social and scientific contexts. The main role of mathematics, which has become unique in learning it, is that it can be a solution for solving the problems of everyday life contextually through the transformation of thinking skills from concrete to abstract or vice versa [7], in the future should be the focus of thought about mathematics needed so that it can function in a variety of social roles rather than its limited role in mathematics class so it is necessary to consider mathematical concepts to be learned in school and how to teach them [8]. This conception can be understood as two things that might clash with each other. On one hand it supports the applicative mathematical concepts in social roles, on the other hand it is academically restrictive.

However, the academic nature of this restrictive nature can be disproved reciprocally by ethnomathematics as a program and genre of research. This is in accordance with several definitions that have been submitted by experts and previous researchers. Ethnomathematics is a study of mathematics in the cultural context of society related to mathematical ideas and activities [9], by recognizing the uniqueness of traditional culture that highlights aspects of their knowledge systems that are complex, dynamic, valuable, and valid in their own terms and contexts [10]. The exclusive form of mathematics becomes a distinct feature, from the mathematics that lives and continues to develop in accordance with the needs of a group of people. This conception opens study space for someone especially in learning mathematical concepts that are important in their lives as social creatures [2], because ethnomathematics focuses on the relationship between mathematics and culture [11].

Ethnomathematics has seized the attention of mathematicians since it was first proposed by Ubiratan D’Ambrosio in 1977 [12]. The idea of ethnomathematics is based on mathematical practices carried out in social practice. This then becomes the basis for identifying the historical development of knowledge as a chain that never breaks and continues to develop as an internal revolution in society. The internal revolution in ethnomathematics is the result of a change in society as a whole [13]. In subsequent developments, anthropologists also paid serious attention to ethnomathematics as a field of study that intersects with anthropology. Anthropologists suggest that mathematical knowledge must be based on the stigma of mathematical consistency obtained through exploration, discovery, use of symbols, transmission, and sharing between cultures [14]. Meanwhile, Barton believes that
mathematics is closely related to socio-culture and suggests describing mathematical knowledge as a system of human knowledge for the purpose of understanding numbers, relationships, and spaces faced daily [15].

On the other hand, ethnomathematics may be less satisfying when research results provide limitations in describing results related to mathematical modeling. So for this need, the concept of ethnomodeling was introduced as a methodology in bridging ethnomathematics with mathematical modeling. Ethnomodeling is an alternative methodological approach that can be considered as a practical application of ethnomathematics [16], so as to be able to provide a complete understanding of mathematical practices developed in a cultural group [17]. Ethnomodeling was allegedly able to bridge the ideas and practices of community mathematics practice with academic mathematics, thus contributing in eliminating the blurring of mathematical concepts. Based on this, this study aims to describe integrally the two concepts with the hope of producing a comprehensive study based on fundamental concepts of mathematics, cultural anthropology and mathematical modeling.

Based on the results of the initial study, it is suspected that there are several ideas, procedures, symbols, and processes that involve mathematical activities in the daily life of the Cigugur indigenous community. The results of this study were allegedly able to enrich previous ethnomathematics studies conducted by farmers of the Cigugur indigenous community who practiced ethnomathematics in determining good days for planting rice [2], exploration of the woven cloth process of the Baduy community of Banten Province in Indonesia [18], the use of the Aboge calendar at the Kasepuhan Palace in Cirebon, West Java Province of Indonesia [19]. All three studies were carried out in areas included in the Sundanese tribe. Based on this, this study then focused on mathematical activities in the life of the Cigugur Indigenous community, especially in the economic system / livelihoods that holistically intersect with the belief system. Therefore, this article will reveal: (1) The way people do calculations to determine the direction in finding fortune; (2) Dimensions of basic universal mathematical activities; and (3) mathematical modeling that can be used in the process of determining the direction of fortune.

2. Methods

The study was conducted in the Cigugur data community using a phenomenological approach with a realist ethnographic design through observation techniques, in-depth interviews, documentation, and field notes. Realist ethnography is an objective report about the situation written in the perspective of a third person so that it can objectively report information learned from participants at the site [20]. Ethnomathematics exploration in this study uses six basic dimensions of universal mathematical activities: counting, finding, measuring, designing, playing, and explaining [21], meanwhile, the data collection adopted the design of ethno-mathematical studies conducted by Alangui, through the actions of Generic Questions, Initial Answers, Critical Construct Specific Activity [19]. Content analysis techniques, triangulation and discovery patterns are analytical techniques used to analyze research data. This technique is carried out interactively and continues until the data is saturated.

3. Results and Discussion

The Cigugur indigenous community is geographically located in Cigugur, Kuningan Regency, Indonesia. This community is one of 9 traditional villages in West Java that still uphold the Sundanese ancestral custom (Karuhun Sunda). The results of other studies show that in general Sundanese people are accustomed to doing mathematical calculations, modeling, and predicting phenomena [22]. These habits can also be found in the Cigugur indigenous community, especially in determining the direction of finding fortune based on the parameters of the month and year. In this article, we try to describe their activities in determining the direction of finding fortune based on the month, while activities in determining the direction of finding windfall by year will be discussed in the next article. The results showed that this calculation activity used basic mathematical concepts.

Mathematically, the formula used by the Cigugur indigenous community to determine the direction of finding fortune based on the moon is as follows.
\[ a = \frac{nwl + np + nb}{4} \]

**Ket:**

A : Arah (wind direction)
nwl : Naktu Weton Lahir (day of birth)
Np : Naktu Pasaran
nb : Naktubulan (month)

The determination of the direction in this calculation is intended to provide guidance and determination to the community in starting the activity to start work. The rule that applies is that they must set foot in the direction specified, for example when the results of the calculation show the north then they must move to the north. This direction determination is usually used by people who work as traders. The hope of the results of determining this direction is that they will be able to sell many of their merchandise so as to produce maximum profit. Based on the formula above, there are three parameters used including the time of birth, time of naktu weton lahir, naktu pasar, and naktu bulan. Time is the value that is attached to the, month, day, and pasar [23]. Naktu weton lahir is the value attached to the birthday of the person who is going to do the calculation, the market time is the market value that is attached to the day of birth. Every day has a certain market that forms a cycle. This cycle always repeats every day, for example: ahad manis, senen pahing, salasa puhun, rebo wage, kemis kaliwon, jumaah manis, saptu pahing, and so on. To understand the pair between the day cycle and the market cycle can be seen in our writing in the previous article, see [2]. The cycle is a relation of two consecutive sets. So that we can define, for example A is a set of hari dan B is a set of pasar then it can be written down \( A = \{ \text{Ahad, Senen, Salasa, Rebo, Kemis, Jumaah, Saptu} \} \) and \( B = \{ \text{Manis, Pahing, Puhun, Wage, Kaliwon} \} \). More formally, we have a definition for example A and B is a set. Cartesian products from A and B are sets \( A \times B = \{ (a, b) | a \in A, b \in B \} \).

As explained earlier, every day and the market has a certain time or value that is used to do the calculation. The time of day is shown in table 1 below:

| Name of Hari | Naktu or “Value” |
|----------|----------------|
| Ahad (as Sunday) | 5 |
| Senen (as Monday) | 4 |
| Salasa (as Tuesday) | 3 |
| Rebo (as Wednesday) | 7 |
| Kemis (as Thursday) | 8 |
| Jumaah (as Friday) | 6 |
| Saptu (as Saturday) | 9 |

Meanwhile, naktu pasar shown in table 2, below.

| Name of Pasaran | Naktu or “Value” |
|----------------|----------------|
| Manis | 5 |
| Pahing | 9 |
| Puhun | 7 |
| Wage | 4 |
| Kaliwon | 8 |

Examples of the use of the two tables, for example if someone was born on a sweet Sunday, the value is 5 + 5 = 10. The third parameter used in calculating the direction in finding fortune is the time of the month. The time of this month can be defined as the month when the count is made. The number of months is equal to the number of months in the Islamic calendar and hijriyah which is 12
months. The names of the months used are almost the same as the names of the months used by the Javanese people and if you pay attention to the determination is the same as the hijri calendar, which is based on the moon revolution so that in one month consists of 29 or 30 days. On the other hand, the naming of the moon used by the Cigugur indigenous community is also different from the Sundanese calendar system which consists of three systems, namely based on the circulation of the moon called *kala candra caka sunda*, based on the so-called solar circulation *kala surya saka sunda*, and *kala cakracakasunda*. With the names of the months as follows: *kartika, margasira, posya, maga, palguna, setra, wesaka, yesta, asada, srwana, badra*, and *asuji*. We suspect the naming of the month used by the Cigugur indigenous community is an acculturation between the Javanese calendar system and the Hijri calendar system, because there are several names of the same month with the two calendar systems. The names of the months used by the Cigugur indigenous community and their *naktu* are shown in table 3 below.

| Name of Month | Naktu or “Value” |
|---------------|------------------|
| Sura          | 7                |
| Sapar         | 2                |
| Mulud         | 3                |
| Silimbulud    | 5                |
| Jumadil awal  | 6                |
| Jumadil akhir | 1                |
| Rajab         | 2                |
| Rewah         | 4                |
| Puasa         | 5                |
| Sawal         | 7                |
| Hapit         | 1                |
| Rayagung      | 3                |

The *naktu* attached to each day, market and month are then operated into a formula that was written down earlier to find out the remainder of the distribution results. The residual value of the results of this division is then used to determine where the right direction to look for fortune. The direction in finding fortune is determined based on the criteria shown in table 4 below.

| Direction | Remaining of Distribution |
|-----------|---------------------------|
| North     | 0                         |
| East      | 1                         |
| South     | 2                         |
| West      | 3                         |

Based on table 4 above, it is clear that the wind direction criteria used in finding sustenance consist of 4 direction criteria. Therefore, it is obtained modulo 4 because each calculation is divided by 4. So that it can be formulated with the formula:

\[ a \equiv c \pmod{n} \text{ or } a = 4q + c \]

The formula can be used to determine variations in numbers included in one of the predetermined wind direction criteria. If specified a is the direction and c is the remainder of the division. Suppose b is the direction for someone's good day, then:

a. For those who do not have left shares (northward), then:

\[ b \equiv 0 \pmod{4} \text{ or } b = 4q + 0 \]

The direction that fulfills one's good day is

\[ b = 4q \]
If \( q = 1 \), then \( b = 4 \) (1) \( \rightarrow b = 4 \)
If \( q = 2 \), then \( b = 4 \) (2) \( \rightarrow b = 8 \)
If \( q = 3 \), then \( b = 4 \) (3) \( \rightarrow b = 12 \)
If \( q = 4 \), then \( b = 4 \) (4) \( \rightarrow b = 16 \)

b. For those with 1 remaining (east), then:

\( b \equiv 1 \mod 4 \) or \( b = 4q + 1 \)

The direction that fulfills one’s good day is

\( b = 4q + 1 \)
If \( q = 1 \), then \( b = 4 \) (1) + 1 \( \rightarrow b = 5 \)
If \( q = 2 \), then \( b = 4 \) (2) + 1 \( \rightarrow b = 9 \)
If \( q = 3 \), then \( b = 4 \) (3) + 1 \( \rightarrow b = 13 \)
If \( q = 4 \), then \( b = 4 \) (4) + 1 \( \rightarrow b = 17 \)

c. For those with a remainder of 2 (south), then:

\( b \equiv 2 \mod 4 \) or \( b = 4q + 2 \)

The direction that fulfills one’s good day is

\( b = 4q + 2 \)
If \( q = 1 \), then \( b = 4 \) (1) + 2 \( \rightarrow b = 6 \)
If \( q = 2 \), then \( b = 4 \) (2) + 2 \( \rightarrow b = 10 \)
If \( q = 3 \), then \( b = 4 \) (3) + 2 \( \rightarrow b = 14 \)
If \( q = 4 \), then \( b = 4 \) (4) + 2 \( \rightarrow b = 18 \)

d. For those with 3 shares left (west), then:

\( b \equiv 3 \mod 4 \) or \( b = 4q + 3 \)

The direction that fulfills one’s good day is

\( b = 4q + 3 \)
If \( q = 1 \), then \( b = 4 \) (1) + 3 \( \rightarrow b = 7 \)
If \( q = 2 \), then \( b = 4 \) (2) + 3 \( \rightarrow b = 11 \)
If \( q = 3 \), then \( b = 4 \) (3) + 3 \( \rightarrow b = 15 \)
If \( q = 4 \), then \( b = 4 \) (4) + 3 \( \rightarrow b = 19 \)

The concept used by the Cigugur indigenous community is relevant to the concept of congruence:

*Let be a fixed positive integer. Two integer a and b said to be congruent modulo n, symbolized by \( a \equiv b \mod n \). If n decides the different a \(-\) b; that is, provided that a \(-\) b = kn for some integer k. So that it can be defined as: integers a and integers b is said to be congruent in modulo n if and only if both give the remainder for the same when divided by n, where \( a, b, n \in \mathbb{Z} \). Symbolically stated with \( a \equiv b \mod n \). Thus, a mathematical model can be formulated as previously described for each formula produced from the concept of modulo 4. Based on this study, it can be understood that the Cigugur indigenous community uses number operations, especially the addition and division concepts after they previously used the concept of sequential pairs and relations. The use of these concepts can be judged as a dimension of basic universal mathematical activities, namely: counting, finding, measuring, designing, and explaining. So that the activities they do can be classified into the form of ethnomathematics.*

On the other hand based on cultural aspects, this activity is a form of culture in the economic system/livelihood. However, the results of the study show that this activity fulfills holistic principles in universal cultural elements. This holistic concept usually characterizes anthropological research, which means understanding the interrelationship of one element with other elements in a unified universal cultural element. The interconnectedness of cultural elements based on the holistic concept shows the richness of a culture that has a role in influencing the social life of the community. Based on the results of ethnographic analysis, the activity in determining the direction of finding fortune is closely related to a belief system (religious). The origin of the religious function that arises in society is the question of why humans believe in supernatural or supernatural powers that are considered
higher than humans so that humans do various ways to communicate and seek relationships with these forces [24].

This means that the calculations can be binding or flexible, meaning that it can be done or not depends on the trust of each individual. However, most people believe and carry out the results of these calculations. The high confidence of the Sundanese people in the calculation in the hope that they will get the results that they want and provide happiness physically and defeated rational considerations [23], this is the basis of this habit is hereditary from one generation to the next. The growth of knowledge in this community is local knowledge that plays a key role in understanding its unique culture and environment. Activities like this become a body of knowledge that is built by people over time and across generations that live and interact with their own historical, social, cultural and natural environment [25] realized or not almost all human activities are carried out based on calculations that are in accordance with the natural conditions of their residence [26].

The results of studies conducted support the view that ethnomathematics is mathematics practiced by cultural groups including indigenous peoples and many other groups that can be identified through the objects and traditions of the group, imbued with ethics, and focused on restoring the dignity of human culture [27] which can help to explain the nature of mathematics from a cross-cultural, anthropological, and political perspective, not philosophical [28]. Based on this, then it is important to understand the two elements needed in expressing ethnomathematics, namely people from a culture who do not understand mathematics and researchers who are experts in mathematics [29]. Meanwhile, based on ethnomodeling, the community uses the concept of modulo and congruence. Ethically the Cigugur indigenous community uses a standard formula to determine the direction in finding fortune. They use the term symbolization as the time of each day, market, and month. Emically the researcher gives a judgment that some mathematical concepts used are in accordance with the concepts of number, set, relation, congruence and modulo operations. So based on ethical and emic communication, the standard formula for determining good days can be made in mathematical modeling that meets the concepts of sets, relations, modulo and congruence.

Meanwhile, based on a dialectical approach, researchers make mathematical modeling that is based on the concepts of modulo and congruence, making it easier to determine the direction criteria in finding fortune to be used by the community. A dialectical approach that serves to bridge the dialogue between ethics and emics [17]. The results showed that the study of ethnomathematics which was continued through ethnomodeling approach was able to produce a more comprehensive study and improve the performance of ethnomathematics research, especially in aspects of mathematical modeling. Thus ethnomathematics add a cultural perspective to the modeling process through ethnomodeling [30]. So that it can become a role model in elevating mathematical modeling based on cultural aspects into academic mathematics. The results of the study were reinforced by previous studies conducted by other researchers, who stated that since the days of Sundanese ancestors mathematics had existed and was still used in everyday life, especially by rural communities [22] conducted for generations including doing estimations, activity making patterns, and building geometric patterns [31].

The results of the study provide a different perspective on the conceptual mathematics inherent in the universal element of holistic culture through ethnomatematics as a program and ethnomodeling academic approach. Ethnomodeling can give consideration in a variety of processes that assist in the construction and development of scientific knowledge and cultural mathematics. In this case, ethnomodeling has a role to facilitate the workings of popular mathematics and becomes a bridge for popular mathematics to be used contextually in school mathematics. In other words, ethnomathematics and ethnomodeling can be integrated into the school mathematics curriculum. Likewise, the results of research among Mozambican farmers who analyzed the possibility of adding ethnomatematics to the mathematics curriculum [32]. The main aspects of the ethnomodeling approach function to solve problems and understand alternative mathematical systems [33], help students gain a better understanding of the important role of mathematics in society [34].
The application can be an object for students to get involved in school mathematics. Practical application of ethnomodeling based on folk mathematical activity. The results of the study show that future mathematics learning can be carried out by involving social and cultural activities. In this context, the need to examine mathematical concepts and forms in culture is illustrated by means of producing knowledge into the mathematics curriculum [35], so that the goal of mathematics education under a multicultural perspective can be achieved [36] which is based on the capacity to model and find solutions to situations that can serve individuals in everyday life [37], so individuals can build new knowledge or reconstruct the knowledge they have acquired [38]. In this case, it is important to provide understanding to school mathematics teachers so that they can integrate mathematics found around the student's residence into academic mathematics. Teachers who are able to see and analyze the right activities from different cultural backgrounds and integrate them into the classroom can create a rich learning environment and inspire students to develop their potential [9]. The didactic situation developed by the teacher based on the study of ethnomathematics and ethnomodeling is expected to be a solution in the development of materials for the purpose of reforming long-term mathematics learning.

4. Conclusion
Based on the universal elements of culture, the determination of direction in finding fortune by the Cigugur indigenous community belongs to the economic system / livelihood that is holistically in line with the belief system. Meanwhile, based on the concepts of ethnomathematics and ethnomodeling these activities can be used to express mathematical ideas and practices used in cultures that bridge non-academic systems to academic mathematical systems. The form of ethnomathematics in these activities fulfills the fundamental dimensions of mathematical activities through the application of the concept of a set of sequential pairs, relations, and number operations. Meanwhile, based on community ethnomodeling the use of the modulo and congruence concepts can be used to make mathematical modeling. Thus, the results of the study can be claimed to provide a broader perspective in an effort to describe the universal elements of culture that intersect with school mathematics.

References
[1] Koentjaraningrat K, 1985 Kebudayaan, Mentalitas dan Pembangunan Jakarta: PT. Gramedia.
[2] Umbara U Wahyudin and Prabawanto S, 2019 Ethnomatematics: how does cigugur traditional community use palintangan on farming in Journal of Physics: Conference Series 1265, 1 p. 12025.
[3] Rosa M et al., 2016 Current and future perspectives of ethnomathematics as a program Springer.
[4] Knijnik G, 1993 Ethno-Mathematical Approach in Mathematical Education: a Matter of Political Power Learn. Math. 13, 2 p. 23–25.
[5] Orey D C, 2000, The ethnomathematics of the Sioux tipi and cone, in Mathematics Across Cultures, (Springer), p. 239–252.
[6] D’Ambrosio U, 2001 General remarks on ethnomathematics ZDM 33, 3 p. 67–69.
[7] Umbara U and Suryadi D, 2019 Re-Interpretation of Mathematical Literacy Based on the Teacher’s Perspective. Int. J. Instr. 12, 4.
[8] Noyes A, 2007 Rethinking School Mathematics 1 London: PCP Sage Publications Company.
[9] Gerdes P, 2001 Ethnomathematics as a New Research Field, Illustrated by Studies of Mathematical Ideas in African History Sci. Cult. Divers. Filing a gap Hist. Sci. Cuad. Quipu, 5 p. 10–34.
[10] Adam S Alangui W and Barton B, 2003 A Comment on: Rowlands & Carson’’Where would formal, academic mathematics stand in a curriculum informed by ethnomathematics? A critical review’’ Educ. Stud. Math. 52, 3 p. 327–335.
[11] Albanese V Perales Palacios F J and others, 2015 Enculturation with ethnomathematical microprojects: From culture to mathematics.
[12] Vasquez E L, 2017 Ethnomathematics as an Epistemological Booster for investigating Culture and Pedagogical Experience with the Young Offender or Prison School Communities *J. Educ. Hum. Dev.* 6, 2 p. 117–127.

[13] D’Ambrosio U, 1985 Ethnomathematics and its place in the history and pedagogy of mathematics *Learn. Math.* 5, 1 p. 44–48.

[14] Gerdes P, 1996, Ethnomathematics and mathematics education, in *International handbook of mathematics education*, A. J. Bishop, M. A. (Ken) Clements, K. Clements, C. Keitel, J. Kilpatrick, and C. Laborde, Eds. (Dordrecht: Kluwer Academic Publishers), p. 909–943.

[15] Turmudi T, 2018 Kajian Etnomatematika: Belajar Matematika Dengan Melibatkan Unsur Budaya in *Prosiding Seminar Nasional Pendidikan Matematika Etnomatnesia*.

[16] Rosa M and Orey D C, 2011 Ethnomodeling: a pedagogical action for uncovering ethnomathematical practices *J. Math. Model. Appl.* 1, 3 p. 58–67.

[17] Rosa M and Orey D C, 2012 The field of research in ethnomodeling: emic, ethical and dialectical approaches *Educ. e Pesqui.* 38, 4 p. 865–879.

[18] Syahrin M A Turmudi and Puspita E, 2016 Study ethnomathematics of aboge (alif, rebo, wage) calendar as determinant of the great days of Islam and traditional ceremony in Cirebon Kasepuhan Palace in *AIP Conference Proceedings* 1708, 1 p. 60009.

[19] Creswell J W, 2012 *Educational Research: Planning, Conducting and evaluating Quantitative and Qualitative Research* (4th ed) Boston USA: Pearson education, Inc.

[20] Abdullah A S, 2017 Ethnomathematics in perspective of sundanese culture *J. Math. Educ.* 8, 1 p. 1–16.

[21] Koentjaraningrat, 2002 *Pengantar Ilmu Antropologi* 8th ed. Jakarta: Rineka Cipta.

[22] D’Ambrosio U, 1999 Literacy, matheracy, and technocracy: A trivium for today *Math. Think. Learn.* 1, 2 p. 131–153.

[23] Fu Y and Zhang W, 2005 Estimation of endless roots: From a multicultural viewpoint *Math. Teach. Middle Sch.* p. 63–64.
[37] Cai J et al., 2014 Mathematical modeling in school education: Mathematical, cognitive, curricular, instructional and teacher education perspectives in Proceedings of the Joint Meeting of PME 38 and PME-NA 36 1 p. 145–172.

[38] Van Den Heuvel-Panhuizen M, 2003 The didactical use of models in realistic mathematics education: An example from a longitudinal trajectory on percentage Educ. Stud. Math. 54, 1 p. 9–35.

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