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COMBINATION OF MATHEMATICAL LITERACY WITH ETHNOMATHEMATICS: HOW TO PERSPECTIVE SUNDANESE CULTURE

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ABSTRACT

Mathematical literacy and ethnomathematics are the two main approaches to understanding mathematics in everyday life. Research on the two aspects should be conducted in an integrated manner. It is expected to be a reference for the development of urban mathematics education based on the social requirements of mathematics and individuals' mathematical competence in a cultural group. The primary goal of this research is to describe the Sundanese people's mathematical literacy through an ethnomathematical perspective. The research is focused on living equipment systems and technology, which is one of the elements of the seven universal culture elements. The study employed phenomenographic and ethnomethodological approaches with a realist ethnographic design. Participant observations and interviews were chosen as data collection techniques, while content analysis, triangulation, and identification of patterns were chosen as data analysis techniques. Ethnomathematics in living equipment systems and technology consists of counting, measuring, explaining, discovering, designing, and explaining activities. The results show that the ethnomathematics of the Sundanese community are relevant to the aspects of mathematical literacy consisting of content, context, and mathematical processes. The study's results emphasize that mathematical literacy and ethnomathematics cannot be separated from daily life.

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1. INTRODUCTION

One of the most important aspects in mathematics learning is one's cognitive structure, which differs from one another. Mathematical knowledge is a person's proclivity to respond to mathematical issues by building mathematical actions, processes, and objects for problem and solution analysis in a social environment (Dubinsky, 2000). With regard to the individual's mathematical knowledge, the role of mathematics is to solve problems in the context of everyday life. The idea of mathematical literacy relates to the functional role of mathematics in everyday life which refers to an individual's capacity to adapt to societal requirements and barriers (Jablonka, 2003).

Sfard (Venkat et al., 2009) emphasizes that mathematical literacy exists between ordinary life and mathematics, implying that thinking is a sort of communication consisting of asking questions, hypothesizing, discovering reasons, and drawing conclusions in a scenario. Although it may limit the area in mathematics, the context of application and practicality is a virtue in mathematical literacy. For example, Dowling (North & Christiansen, 2015) states that exclusive or dominating engagement in contextual mathematics activities hampers mathematical cognition and gives only a limited amount of preparedness for life in particular circumstances. However, many people who do not have a literacy level that meets the standard can find comfort and happiness (Lawler, 2016). This can be seen as one of the obstacles to one's mathematical performance.

Mathematical performance can be seen from the stages of using mathematical concepts, facts, and procedures. Success in carrying out mathematical tasks can be realized if there are efforts to strengthen the function of mathematics in everyday life. The development of mathematics as part of knowledge cannot be separated from cultural development. Mathematics has an important value that involves the use of mathematics in the pursuit of knowledge. An examination of human progress, particularly in scientific domains, reveals that mathematics deals with many of humanity's endeavors to gain knowledge (Wahyudin, 2013). Meanwhile, the character of mathematics is formed by how mathematicians from varied cultural backgrounds produce mathematics (Bishop, 2007). Based on this, the perspective of equality and social justice must be developed in the teaching of mathematics that is culturally responsive (Cho, 2022). Both views provide the initial conclusion that mathematics and culture are integrated. The integration between the two is abstracted as ethnomathematics.

Ethnomathematical thinking is based on two things: the conceptualization of mathematics and culture as a result of human thought and information processing in individuals' cognitive structures, which are carried out to meet their needs, particularly in their social interactions. According to Anderson (Fouze & Amit, 2017), ethnomathematics generated by cultural groups and satisfying natural interests arising from their social contexts may be simply defined as the relationship between cultural anthropology and mathematics and the application of mathematical modeling (Orey & Rosa, 2006), but broader than the traditional concepts of mathematics, mathematical ethnicity, and mathematical multiculturalism.

Ethnomathematics as an avenue for research in mathematics education has an important role in studying mathematical ideas from the cultural roots given by an ethnic, social, or professional group. In other words, the study of ethnomathematics seeks to follow the study of anthropology and tries to discover mathematical problems based on an understanding of their structure and logic (Domite, 2004), so that it can be used to solve problems related to daily activities (Payadnya et al., 2021) and can be used as an alternative to introduce phenomena that exist to students to be closer (Ramadhani et al., 2022). Mathematics has long been seen and considered as a universal idea. Mathematics' universality may be defined as a cohesive notion that applies equally and consistently in every hemisphere. The fact that mathematics may be found all over the world, in diverse places and times, with little or no clear communication between its authors promotes the concept of mathematics' universality (Yusuf et al., 2010).

This view stems from the fact that some mathematical theorems may be extended such that they apply globally with ethnological borders, even if the generalizations are limited. On the one hand, these facts cannot be ignored, such as agreed-upon and widely recognized notations, symbols, principles, theorems, logic, and assumptions. As a result, in mathematics, one is frequently imprisoned in a formal process governed by stringent and inflexible rules (Umbara & Suryadi, 2019). Beliefs in the universality of mathematics have very solid underpinnings. For example, Wahyudin (Umbara et al., 2021b) believes that basic concepts and premises are identical to all corners of the world, which is one of the foundations of belief in in mathematics' universality.

As an antithesis to the belief in the universality of mathematics, anthropologists have presented various pieces of evidence of the typical mathematical activities performed by society, such as weighing, counting, measuring, sorting, and sorting which are performed in very different ways from matters taught in schools (D'Ambrosio, 1997). While the various propositions, assumptions, properties, and theorems are universal, the methods of application are influenced by certain cultures (Umbara et al., 2021b) so that they might serve as role models for children from their own culture (Lesser, 2006).

According to preliminary research, there are different ideas, procedures, symbols, and artifacts that incorporate mathematical activities in the daily lives of Sundanese people who reside in various places, such as: the use of the aboge (alif rebo wage) calendar to determine the time of day, Islamic holidays and traditional ceremonies at the Kasepuhan Palace (Syahrin et al., 2016), the Kanekes Lebak Regency Community which uses latent mathematical competencies which include: measuring, comparing, adding, subtracting, multiplying, and dividing in the process of making weaving (Turmudi et al., 2016), the use of units of measurement, mathematical modeling, and the use of hour symbols by the Cipatujah Community of Tasikmalaya Regency (Abdullah, 2017), the Cisayong Community of Tasikmalaya Regency carried out activities, namely estimating, measuring, and making patterns in several activities (Muhtadi et al., 2017), the agricultural system used by the Cigugur community of Kuningan Regency uses formal mathematical principles, such as: the concept of relationships and functions in tools known as *palintangan* (Umbara et al., 2019), mathematical concepts used by the traditional community of Cigugur, Kuningan Regency in determining direction in seeking fortune. consisting of: the concepts of ordered pairs, relations, addition, comparison, modulo, and congruence (Umbara et al., 2021a), the concepts of numbers, sets, relations, congruence, modulo, and mathematical modeling are used as a way to predict good days in farming by the traditional community of Cigugur, Kuningan Regency (Umbara et al., 2021c), and nd determining the best time to build a house carried out by the Cigugur traditional community of Kuningan Regency using the concepts of enumeration, integer operations, sets, relations, congruence, and modulo (Umbara et al., 2021b). In general, the results of these studies show that Sundanese people are used to doing mathematical activities that have been carried out for generations.

On the other hand, research on mathematical literacy generally focuses on assessments carried out in an academic environment, while mathematical literacy has emerged as a major issue that places the importance of mathematics as an individual basis for society. This indicates that mathematical literacy entails the capacity to comprehend and convey mathematical concepts. Mathematical literacy is a discipline that is driven by the use of mathematics in everyday life (Julie, 2006). Based on this, the researchers consider it important to conduct a study of mathematical literacy with the object of the general public, both people who use mathematical knowledge and abilities conceptually and practically in various social contexts.

Several studies on ethnomathematics and mathematical literacy have been carried out either partially or simultaneously, but no research has been found that integrates the two. Ethnomathematics and mathematical literacy are two major ideas about understanding mathematics in everyday life. Ethnomathematics emphasizes the competence of people in different cultural groups in everyday life, while mathematical literacy focuses on mathematical and social requirements that can reflect one's mathematical competence (Wedege, 2010).

On this basis, the researcher sees that there is an empty space to integrate the concepts of mathematical literacy and ethnomathematics in one study. The primary goal of this research is to explain the mathematical literacy of the Sundanese population from an ethnomathematics standpoint. Hence, the research questions are constructed as follows: (1) What are the forms of ethnomathematics in Sundanese society? (2) How is the mathematical literacy of the Sundanese people viewed from the perspective of ethnomathematics? This research focuses on the elements of living equipment systems and technology which are included in the seven universal elements of culture. The researcher considers the importance of this research to be carried out so that the unique values and forms of ethnomathematics can be used as evidence that mathematical literacy can be demonstrated as a process of applying mathematical concepts in groups by a cultural community.

2. METHOD

2.1. Research approach and design

Phenomenographic and ethnomethodological approaches were used in this study. The selection of the phenomenographic approach aims to describe the world from a cultural perspective through everyday life. Methods of collecting and analyzing phenomenographic data can be used to study various problems, including learning approaches, teaching approaches, understanding scientific phenomena studied in schools, or understanding common problems in society that are not related to the education system (Bowden, 2000). Meanwhile, the selection of ethnomethodology aims to explain reality through common sense studies that are carried out continuously in social interactions with the environment based on ideas and social interactions. Ethnomethodological researchers examine the way people apply abstract rules and common sense understanding in routine, explainable, and ambiguous situations and actions used in meaning (Bogdan & Taylor, 1975) that are reflexively related to the context (Garfinkel & Sacks, 2005). The principle of clear relevance from sociological descriptions has consequences that are oriented towards member understanding, interaction and action as well as data inspection (Francis & Hester, 2004). In this work, ethnomathematics is explored using six aspects of universal mathematical activities such as finding, explaining, calculating, measuring, designing, and playing (Bishop, 1988).

Based on the approach described in the previous section, the researcher then chose an ethnographic research design. Ethnographic design is a procedure for describing, analyzing, and dealing with a group that shares a culture over time through the study of patterns of behavior, beliefs, and language (Creswell, 2012), involving an in-depth study of cultural entities by the researcher's (etic) and research participants' (emic) perspectives (Gall et al., 2014) which may change education when viewed as a social activity that can influence societal change (Lincoln & Denzin, 2003).

The ethnographic research design used is the realist ethnographic category. Realist ethnography is an objective report written from a third point of view about the situation and information learned from participants in the location (Creswell, 2012). So that this research is more focused, clear concepts are needed to guide the research. A number of concepts that can guide the ethnographer's work are contextualization, cultural checking, emic perspectives, multiple realities, holistic views, bold descriptions, and impartial orientations

(Fraenkel et al., 2012). Ethnographic concepts are used by the researchers to report research results objectively.

2.2. Research subject

The research was conducted in Cigugur Village, Cigugur District, Kuningan Regency, West Java Province, Indonesia. This location is a place of residence for people who are members of the AKUR (Adat Karuhun Urang) community. The research subjects consisted of three types of informants, namely key informants, main informants, and supporting informants. All the three are used for the sake of the validity of the research data. The selection of informants is based on the following criteria.

a. Members of the community who frequently engage with one another in various activities;
b. Informants are who are well-versed in indigenous peoples' culture, customs, and habits;
c. Those who are willing to participate as an informant, have enough time, and supply thorough information as requested.

The researcher picked 5 informants who met these criteria, consisting of the Chair of the Cigugur Indigenous Community as the key informant, 2 traditional elders, or "Ais Pangampih," as the main informant, and 2 members of the Cigugur indigenous community. The traditional leader was chosen as the key informant because he has a variety of general and specific information about community customs and is seen as someone who knows conceptually about the living equipment systems and technology used by the community for generations. The researcher acquired information from these informants in a systematic manner, starting from important informants, major informants, and finally supporting informants.

2.3. Data collection techniques

The data collection technique used consisted of participant observation and interviews. This conforms to the standard ethnographic research design. Interviews were conducted in a systematic manner based on the types of informants, as shown in Figure 1.

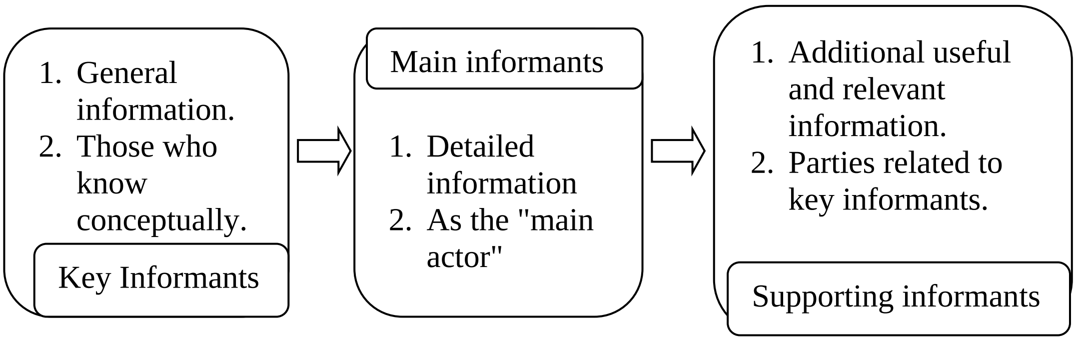

Figure 1. A sequence of data collection on informants with triangulation

Observation of the participants were conducted during traditional ceremonies called "Seren Taun" which means the closing ceremony of the year in their tradition. Open-ended interviews were conducted repeatedly over a relatively long period of time due to the researchers participating in the activities of informants. The open interview aims to give freedom to the informants so that they can provide the information asked by the researchers.

2.4. Data analysis technique

The techniques for analyzing ethnographic data include identification of key events, pattern finding, visual representation, crystallization, content analysis, triangulation, and use of statistics. Of the seven techniques, the researcher only used content analysis techniques, triangulation techniques, and found patterns in this study. Content analysis approaches were used to describe reliable facts on the culture and habits of study subjects at the research site in detail. Content analysis is a technique for studying human behavior indirectly through communication analysis (Cohen et al., 2013).

The data analysis was conducted interactively until the data was saturated (Miles et al., 2018), through the stages of data reduction, data display, and verification or conclusion drawing. The data analysis process began with an examination of all the data obtained from various sources, including the outcomes of interviews and observations recorded in interview notes, field notes, images, and others. Descriptive notes and reflective notes are two types of field notes. Descriptive notes describe events that occurred during the study (emic), whereas reflective notes emphasize the researchers' mind and thoughts (etic). After effectively reducing the data, the next stage was data abstraction.

Data abstraction is an attempt to distill the essence of a study. As the final phase of the data analysis process, data abstraction provides the organization of data one by one, and data categorization is used to evaluate the meaning of the data gathered. In ethnographic research, triangulation techniques may be used to establish the validity of an ethnographer's observations, which consists of the process of verifying what someone hears and observes by comparing information sources and cross-checking information sources (Fraenkel et al., 2012). Meanwhile, finding patterns is a way to check the reliability of ethnography to reveal data consistency (Fraenkel et al., 2012). Based on the three data analysis techniques and the types of informants used systematically, the researchers ensured the validity and reliability of the research data.

3. RESULT AND DISCUSSION

3.1. Results

3.1.1. The results of the ethnomathematics study

Ethnomathematics in living equipment systems and technology can specifically be seen in the geometric shapes of buildings which are shelters, places of residence, or centers of cultural activities. Typical buildings found in the area of the Cigugur indigenous community are called Pancaniti. Pancaniti is a building that is often used for discussions, sawala (Discussion or deliberations), and even chatting between communities. Pancaniti roof is circular with a diameter of 5 meters. Pancaniti is made of wood with a roof made of palm fiber. This building can accommodate up to ± 15 people. The pancaniti building is shown in Figure 2.

Figure 2. Pancaniti building

Based on the studies that have been carried out, the form of ethnomathematics carried out by the Sundanese people in living equipment and technology systems consists of counting, measuring, explaining, discovering, and designing activities. These activities can be seen in the following activities:

a. Counting activities can be seen in the following activities: calculating the need for wood for the construction of buildings, chairs, and tables, calculating the need for bamboo and ijuk (palm fiber) to build a roof and calculating other materials needed;
b. Measurement activities can be seen in the following activities: measuring the length of the construction wood and measuring the length of the bamboo used to clamp the roof of the fibers. Meanwhile, the elements that are not measured by the community are the length of the hexagon formed and the angles. People only use their intuition in forming the size of each corner and center corner in the hexagon construction as a sketch to create a circular pancaniti roof;
c. Explanation activities are shown in the following activity: explaining the causes of the slope and stiffness of the tip of the roof of the pancaniti which resembles a cone with an angle of ± 115°. Based on this context, it is known that the roof is designed not to accommodate the weight of water when it rains. This conical roof is designed to accelerate the fall of rainwater so that the roof can last longer. The water on the roof can damage the roof made of fibers;

d. Search activities can be seen in community activities in finding the concept of a hexagon which is used to sketch a circular roof so that the roof formed is close to a perfect circle.

Designing activities are seen in the activities of designing the shape of the building in accordance with the philosophical values that are believed by the community.

3.1.2. The results of the mathematical literacy from an ethnomathematics perspective

In this study, mathematical literacy was determined based on each indicator of the three mathematical literacy dimensions, which are content, context, and mathematical processes. Changes and relationships, as well as spatial and form content, are ethnomathematics forms related to the content components of mathematical literacy in the Pancaniti construction. Changes in content and relationships include changes in area/shape or the relationship in length to the sides of squares, square elements, and circles that have functional relationships in pancaniti construction. Meanwhile, the contents of space and shape in general are related to the ability to understand shapes and the properties of geometric shapes, transform and arrange shapes into various forms and representations of shapes, count and measure objects, reason quantitatively, estimate, and interpret forms in various settings.

Based on the context aspect, the results of the study show that the way to build a pancaniti building is relevant to the social and scientific context. The indicators utilized in identifying the social context categories include looking at various scenarios relating to the social context from the standpoint of the Sundanese people. Meanwhile, the indicators utilized in identifying scientific context categories include diverse scenarios linked to the application of mathematics in the real world, issues and themes related to science, and technology employed by the Sundanese people.

Aspects of context in mathematical literacy that are relevant to the ethnomathematics forms of Sundanese society involve construction into contextual elements and vice versa. This gives confidence that in contrast to Sundanese culture, mathematics grows and develops along with its use, ranging from uses in personal activities that intersect with work and social interactions carried out by every member of society, to science. Values that may not materialize include mathematical elements derived from the essence of mathematics. The nature of mathematics arises based on intuition against the need to examine cultural contextual values that arise based on aspects of the content and processes of mathematical literacy that have been grouped previously.

Furthermore, the ethnomathematics forms that appear based on aspects of the mathematical literacy process are described as follows.

a. Formulate. The process carried out by the community consists of:
   1) Recognizing the mathematical components of a real-world situation and identify key variables;
   2) Recognizing mathematical structures in issues or situations (including regularities, connections, and patterns);
   3) Simplifying a condition or problem such that it may be mathematically analyzed;
   4) Identifying the restrictions and assumptions behind each mathematical model, as well as the contextual simplifications;
   5) Presenting situations mathematically through the use of appropriate variables, symbols, diagrams, and standard models;
   6) Representing problems in many ways, including handling them mathematically and making suitable assumptions;

7) Recognizing and explaining the link between the problem's context-specific language and the symbolic and formal language required to describe it mathematically
8) Problems should be translated into a mathematical or representational language;
9) Recognizing components of the problem that correspond to recognized problems or mathematical ideas, actions, or methods.

b. Employ. The process carried out by the community consists of:
   1) Devising and implementing strategies to find mathematical solutions;
   2) Using mathematical tools, including technology, to help find exact or approximate solutions;
   3) Applying facts, rules, algorithms, and mathematical structures when finding solutions;
   4) Manipulating numbers, graphical and statistical data and information, algebraic expressions and equations, and geometric representations;
   5) Constructing mathematics and extracting information from it;
   6) Using and switching between different representations in the process of finding a solution;
   7) Making generalizations based on the results of applying mathematical procedures to find solutions reflecting mathematical arguments and explaining and justifying mathematical results.

c. Interpet. The process carried out by the community consists of:
   1) Interpreting math conclusions to real-world situations;
   2) Assessing the plausibility of mathematical solutions in the context of real-world challenges;
   3) Recognizing how the actual world impacts the outputs and computations of processes or mathematical models in order to make contextual decisions about how findings should be altered or implemented;
   4) Explaining why a mathematical solution or conclusion may or may not make sense in light of the problem's context;
   5) Recognizing the levels and boundaries of mathematical concepts and mathematical solutions, as well as criticize and identify the boundaries of the models utilized.

3.2. Discussion

3.2.1. The results of the ethnomathematics study

Based on the elements of universal culture, the Pancaniti building as a local genius owned by the Sundanese community is included in the system of living equipment and technology. Buildings are monumental evidence of civilization. Cultural diversity can produce different shapes, designs, constructions, sizes, and uses. This is influenced by several factors, including environmental conditions, weather, aesthetics, art, availability, accessibility, function, and operationalization of buildings as a basic need for humans, especially as protection and comfort. Architecturally, building construction is divided into two groups, namely: the foundation or the lower part of the building which functions as a support for the construction, and the construction or the upper part consisting of walls, ventilation, and roof. The roof is the topmost building construction which functions as a protection against the weather, such as hot sun or raindrops.

The ability of the community to make buildings is one of the abilities that the community must have, as described previously. Based on a study of the elements of universal culture (Koentjaraningrat, 1985), the activities and abilities of the community in making the building belong to the system of living equipment and technology. Meanwhile, based on the form of culture, the building is classified as an artifact system. The form of culture as an artifact system is the most tangible form of culture because it can be visually seen and touched directly by the five senses. In this study, it can be seen in particular on the geometric forms, structures, models, and building forms. The building forms reflects a culture resulting from the system level of ideas or thoughts as well as human activities that have special and exclusive patterns.

Visually, the roof structure of pancaniti is in the form of a circular area with a diameter of ±5 meters. The building is made of wood, bamboo, and fibers. Meanwhile, based on operational aspects, this building can accommodate up to ±15 adults. The roof structure and foundation of the Pancaniti building are in the form of a complete circle area. One of the most interesting things to look at is the way the circular roof is made. Through observations and interviews, it was found that mathematical concepts were widely used in the process of building. The construction of the pancaniti begins by making a truss which is located in the middle of the building (which is the center point). This truss serves as the main pillar structure that supports the roof of the pancaniti. The pole is made using teak wood with a diameter of ± 80 centimeters. The use of wood with a large diameter to support the roof is based on the overall process of building a pancaniti. From the process of constructing a pancaniti roof in the form of a circular area, it can be seen that the community made it first before making a circular roof.

The polygonal approach is the rule used to make it easier to form a circle. The larger the diameter of the circle to be constructed, the more sides of the polygon that will be used. Based on ideas and thought processes, organizational development reflects contextual mathematical activities and practices. Ideas can be described based on the selection of approaches or methods used by the community in constructing circles. Ideas that are not elemental, among them are the use of polygon elements and circle elements. Their idea lies in that the more sides of the polygon produced, the more bowstrings will be produced, making it easier to sketch a circle.

Based on the process they explained, the construction of the pancaniti was carried out according to the stages of making a tetragon, octagon, and hexadecagon. The process emerged through experiments carried out by trial and error. They tried to make a circle by first making a tetragon, but they experienced difficulties because the desired diameter of the circle was quite long. In the second stage, they added diagonals to form an octagon, but they still found it difficult to need a long wooden plank to make the sides of the octagon. In the third stage, they added the diagonals to form the hexadecagon. The hexadecagon that has been formed can finally be used to make a circular roof. The side of the hexadecagon that is used as the bowstring of the circle makes it easier for them to sketch a circle because it does not require a long wooden plank to make the side of the hexadecagon.

Hexadecagon was also chosen for strengthening the construction of the roof of the building which will be covered by coconut fibers. Strong construction is needed to meet reliability, maintainability (formed, maintained, or managed easily), usability (easy to use and simple in steps), and unity (the resulting form is harmonious and intact). The results of this study confirm that ethnomathematics is the application of mathematical ideas and practices to problems faced by people in the past or encountered in today's contemporary culture (D'Ambrosio, 2016). To explore mathematical ideas and thought processes used in certain cultures, ethnomathematics studies can be used by exploring mathematical concepts and applications that may have different forms from other cultures (Umbara et al., 2019).

Based on the six dimensions of fundamental universal mathematical activity (Bishop, 1991), the ideas and processes carried out by the Sundanese people fulfill these elements. They used the elements of the hexadecagon and the circle. They carefully counted the number of sides of the hexadecagon, the arc, and the chord. They placed the sides of the hexadecagon as bowstrings so that they could make circular arcs easily. The activity of measuring can be seen from the way they measure the length of each cross and bowstring which is the length of the side of the hexadecagon. The design activity looks comprehensive in processing their idea of constructing a circle by first making a regular polygon with the shape of 2^n.

Based on the experimental process carried out, the Cigugur indigenous community was able to find the easiest way to construct a circular roof by trying out designs starting with the stages of making tetragons, octagons, and hexadecagons. In the process of designing the building, they explained verbally so that their ideas and thought processes could be well understood by the researchers. Based on this, the six dimensions of basic universal mathematics activities are fulfilled in the process of building a committee. People in the Cigugur indigenous group may not have studied academic mathematics, but they have ideas and can apply mathematical concepts to begin their work in community development.

Conceptually, mathematical ideas underlie practice through communication between people in their culture (Turmudi et al., 2016). Ethnomathematics is the use of mathematics to assist the functioning of a cultural group, with complex and dynamic representations impacted by socio-cultural elements (Umbara et al., 2019). The broader view of mathematics (ideas, procedures, processes, methods, and practices) offered by ethnomathematics is rooted in different cultural environments (Rosa et al., 2016). An ideal and applicable understanding of mathematics in the concept of ethnomathematics should lead to the principle of unity in diversity through communication and respect. This is done to facilitate the mental processes that take place when someone interprets and applies mathematical concepts in everyday life. Based on the Freirian perspective (Aslan Tutak et al., 2011), ethnomathematics is a way that can be used to reconstruct mathematics and mathematics education that can empower culture through the use of authentic mathematics from their lives that emphasizes demythologizing (describing a way), the use of history, and people's culture to empower them.

The method of constructing the roof of the building by the Sundanese in the form of a circle is different from the method employed by builders in the Sofala Province of Mozambique in constructing a circle. The people of the Sofala Province of Mozambique call it Nsukuli for a roof that is circular or square in shape but not rectangular. To construct a circular roof, they use two short sticks and a long rope. One stick is stuck into the ground (functions as a center point) while the other stick is used to make a circular area as a sign of building a house. This method is used to determine the base area of the circle of the house (Soares, 2009).

This concept is similar to how fishermen on the coast of Mozambique discovered the concept of a circle using two sticks and a rope through their experience (Gerdes, 1985). Furthermore, what was done by the carpenters in Sofala Province and the fishermen on the coast of Mozambique turned out to be similar to the way Mitchell constructed the Penobscot Lodge in The Great Salt Bay in Maine, USA (Shockey & Mitchell, 2017). Mitchell stuck a pole and attached a thread to make fingers by cutting a thread, then he walked around the center post holding the thread to make a loop. The variation in how this circle is constructed reinforces the belief that the advent of ethnomathematics is mirrored in the number of mathematicians who come from other cultures and use mathematics in a variety of ways (Gerdes, 2001).

Different cultural groups have developed their own way of doing mathematical processes with different mathematical tools to identify and describe mathematical ideas or practices in their reality through the process of mathematization (Bassanezi, 2002). The way to make a circle done by the Cigugur indigenous people does not fully adopt the concept of academic mathematics because there are several mathematical procedures that are carried out such as overriding the use of the central angle of a circle and the angles in regular polygons. However, as local geniuses, this can be recognized as the knowledge that grows, develops, and is maintained so that "cultural mathematics" i.e. mathematical practice used in a socio-cultural practice cannot be blamed in giving terms to the ideas and practices they do. The mathematics involved in the construction of traditional houses can be categorized as "folk mathematics" or "oral mathematics" because it is passed down orally from generation to generation (Soares, 2009).

The results showed that the method used by the Sundanese people in constructing a circle was closely related to the concept, definition, circumference, and elements of a regular polygon, especially the hexadecagon. In other words, without having adequate knowledge and understanding of the basic concepts of geometry, they are able to apply the concept of geometry by representing a geometric shape into representations of different shapes. The study's findings support the concept that ethnomathematics is a mathematical activity carried out by cultural groups (D'Ambrosio, 1989) which contradicts the belief that mathematics is solely generated by mathematicians (Borba, 1992b).

3.2.2. The results of the mathematical literacy study

The needs of the Sundanese community, especially the Cigugur indigenous community for a place to gather, discuss, deliberation, and interact are realized through the construction of pancaniti building facilities. The circular pancaniti roof is a cultural manifestation that contains elements of technology, which has been confirmed as a form of ethnomathematics. Conceptually, without realizing it, they have used geometric concepts consisting of the concept of a circle and the concept of a regular polygon. The effort was made to construct the roof to suit the philosophical values.

Based on the emic, it can be described that the simple process, ease of work, and the value of usability are the main references for the community in constructing pancaniti buildings. People are not aware of the use of some mathematical concepts in their activities because of the limited knowledge of mathematics they have. Nevertheless, their desired goal was finally achieved. They understand the concept of a circle and are familiar with circle elements such as center, diameter, and radius. The concept of a rule polygon is only a tool for them to make circular arcs. Although restricted, this demonstrates a comprehension of mathematical material and ideas that may be employed constructively. Citizens in the contemporary world must have a strong comprehension of mathematical content as well as the capacity to use varied mathematical knowledge as a solution to critical contextual challenges (OECD, 2019).

As explained in the previous section, pancaniti buildings are included in the content of change and relationship, and the content of space and form. Some interesting relationships emerge from geometric measurements, such as how the circumference, area, and/or the relationship between the lengths of the sides of a square involve knowledge of the type of fundamental change in applying suitable mathematical models to describe and predict shape changes (OECD, 2019). Mathematically, change and relationship content is content that can be used as a basis for describing, creating, interpreting, translating, and using various symbolic and graphic representations. The content ultimately has a functional relationship that can be used in the development of the committee.

Meanwhile, the contents of space and form are generally related to the concept of complex geometry because it has functional connectivity and changes in the representation of various forms. Mathematical literacy in spatial and form content involves systematic activities such as understanding perspectives, converting forms both with technology and without technology, defining three-dimensional views from various perspectives, and constructing various phenomena encountered in the visual and physical world into various representations of forms (OECD, 2019). Mathematically, the content of space and form in this study is used as the main tool used by the Sundanese community in constructing the pancaniti roof. The general pattern that is formed in the activity of building a community provides an understanding of the nature and continuous principle of the content of space and form. These properties and principles are clearly illustrated in the connectivity between the concept of a circle and the concept of a regular polygon that is structural and functional.

Structural properties can be seen from the use of circle elements and regular polygonal elements, while functional properties can be seen from the relevance of the two elements used in the effort to construct a circle. At first, the functional properties of the two may be understood as something discrete which is not related to each other. In this regard, it must be realized in this case, that geometry serves as an important foundation in space and form. The category goes beyond traditional geometry in terms of content, meaning, and method, but it can describe the elements of other fields of mathematics such as spatial visualization, measurement, and algebra (OECD, 2019).

Aspects of the mathematical literacy used by the Sundanese people are carried out by bringing together the context of the problem with mathematics. This is reflected in their desire to construct a circular roof. The process of formulating mathematical situations consists of identifying and recognizing mathematical aspects and their constraints, recognizing mathematical structures to simplify situations, and representing situations mathematically in various ways. This process is carried out to make the correct assumptions when performing analysis of mathematical problems, as well as the symbolic and formal language required mathematically to identify aspects of the problem that are consistent with known mathematical problems, concepts, facts, or procedures.

The process of applying concepts, facts, procedures, and mathematical reasons consists of developing and implementing strategies using facts, rules, structures, algorithms, and mathematical tools. This process is used to help find the right estimate or solution and generalize mathematics so that standard mathematical procedures can be used and confirm the correctness of the results. Meanwhile, the process of interpreting mathematical results is demonstrated by the process of interpreting and evaluating mathematical solutions in the context of real-world problems by understanding how the real world influences the results and computational procedures or mathematical models to make contextual judgments and to explain the conclusions of the mathematical processes carried out in accordance with the level and limits of the concept and the mathematical modality.

The real support of mathematics can be realized in everyday life and gradually affects the development of technology (Shang et al., 2018). The results of the research are relevant to another study of folk mathematics among women in rural Tamil Nadu in India who have skills on how to count to create sophisticated geometric patterns in rice paste designs (UNESCO, 2008). In this regard, the context of mathematical literacy in community development activities consists of a social context and a scientific context.

The social context can be seen from the function of the building which is intended for the activities of community members, especially for socializing activities. The development process carried out together is a social process with the principles of togetherness and mutual cooperation among community members. The need for pancaniti development based on the process and philosophical values is a community perspective that believes in meaning based on the name and form of the pancaniti building. Meanwhile, the scientific context can be understood in the use of several mathematical concepts. These mathematical concepts are actively employed in solving the problems carried out. The scientific context is made up of objects related to mathematics, with all of the parts involved being included in the world of mathematics (OECD, 2019).

The use of the context aspect reflects the various uses of mathematical concepts ranging from social contexts to scientific contexts. Literacy as an important aspect in the functional context of mathematics must be based on the conception of mathematics itself (UNESCO, 2008). This provides an understanding that people carry out the process of mathematizing concepts based on contextual problems to find truth in the process. This is in accordance with what is stated in the notion of certainty in mathematics. The notion of certainty in mathematics promotes tremendous power in application because mathematics can be applied to real problems and has many applications; however, mathematics can become uncertain when applied to situations involving social relations (Borba, 1992a).

The development of a committee that uses mathematical concepts provides an understanding of the role of mathematics which is not culture-free. For example, Africans use mathematical principles to build large buildings and simpler houses, and use geometry to design beautiful clothes and other works of art (Zaslavsky, 1994). This demonstrates that ethnomathematics researchers tend to focus on how people learn and use mathematics in different cultures and in everyday situations so that we can think of culture as the knowledge that is acquired and transmitted between a group's cultures (Martin, 2006). The focus of ethnomathematics is on natural notions and procedures employed by cultural groups rather than mathematical theories that may be present (Barton, 1985). Intercultural interaction with mathematics is natural, where culture and mathematics are integral parts that support each other. The development of various mathematical knowledge through interaction within the same cultural group is instinctive between adults and children (Gilmer, 2001), because the concept of mathematical literacy is a manifestation of integrated mathematics and the surrounding culture (Jablonka, 2003).

Pancaniti built based on the needs of the Sundanese community is a form of social practice that plays a role in facilitating interaction and socialization between community members. Knowledge in the process of building a pancaniti is self-taught and passed down from one generation to the next. In culture, mathematical concepts and practices are often taught outside of formal mathematics yet are actively transmitted to the next generation (Martin, 2006). Therefore, ethnomathematics and mathematical literacy may be seen as examples of lifelong learning that recognizes informal knowledge obtained in everyday practices while also arguing for formal schooling (Wedege, 2010).

The circular roof shape which contains philosophical and functional meanings is a form of a relation between cultural conceptions and mathematical conceptions. Ethnomathematics is time-oriented and mathematical ideas are applied constantly in society so that ethnomathematics is considered as having the potential to extend knowledge of what mathematics is and who produced it (Martin, 2006). This conception is seen as a concept relevant to mathematical literacy in social practice. Literacy competencies and needs cannot be understood in terms of absolute skill levels but are relational concepts determined by social and communicative practices between individuals involved in various domains of their lives so that literacy is historically and socially located (Hamilton, 2002).

The requirement for individuals in a cultural group to apply mathematics in everyday life is dynamic, in line with the evolution of the functional context of mathematics. Therefore, disparities in mathematical perspectives are feasible. The idea of mathematical literacy in relation to socioeconomic demands might be deemed functional in the sense that it simply relates to an individual's capacity to adapt to societal needs and limits (Jablonka, 2003). Consequently, functional mathematical knowledge cannot be reduced to pure mathematical knowledge (Wedege, 2010). de Lange (Gatabi et al., 2012) demonstrates that, pure mathematics is essential for performing mathematical operations. However, sometimes it is insufficient for doing similar activities in the actual world

From a cultural perspective, mathematical literacy will depend on where and for what purpose the practice of mathematics is carried out. Mathematics is deeply integrated into living equipment systems and technology, industry, military, economics, and politics as the material basis for its progress (D'Ambrosio, 1998). This is a logical consequence that must be accepted because each culture is bound by philosophical values that are believed to be a belief system. The results of the study show that pancaniti cannot be separated from philosophical values in the form of teachings about the stages in seeking, finding, and implementing knowledge holistically. Mathematical literacy for cultural identity begins with differences that arise in the type of mathematics used (Baker, 1996), where the practice of mathematics differs in its type and purpose of use relates to beliefs about the nature and value of mathematics itself (Jablonka, 2003).

Based on the arguments above, the researchers hold the view that mathematical literacy in its development in society will always intersect with the concept of mathematical modeling. In other words, it is closely related to the process and components of mathematization (de Lange, 2006). The mathematization process is concerned with how to convert real-world issues into mathematical ideas in order for them to be solved as mathematical problems, and then mathematical solutions may be understood to offer answers to real-world problems (Stacey, 2011). Based on this, it is very important to define mathematical literacy as a topic that is initiated by the application of mathematics to real life situations (Julie, 2006). This can facilitate the development of abilities and beliefs of individuals who are in the midst of a dynamic society to be able to think mathematically in interpreting and critically analyzing various situations encountered in everyday life.

Understanding one's mathematical knowledge is the way how one describes ideas and performs mathematical procedures. Functionally, it is influenced by the fulfillment of their needs both individually and in groups. Mathematical literacy as an individual mathematical ability is closely related to the individual's own actions in using mathematical concepts. Mathematical literacy helps individuals recognize the role that mathematics plays in the world and helps them make judgments and decisions required by constructive, engaged, and reflective citizens (OECD, 2019).

The functional role of mathematical literacy becomes very important for someone in solving practical problems encountered through the use of mathematical literacy components. An undeniable important component of mathematical literacy in today's society consists of the ability interpret quantitative information, numeracy (Jablonka, 2003), and does not imply detailed, high, and complex mathematical concepts (Ojose, 2011) so that individuals can have the ability to see the world through mathematics (Jablonka, 2003). Mathematical literacy can finally be interpreted as knowledge of mathematical concepts that continue to develop in everyday life along with the development of a dynamic society.

Every thought to know mathematics is founded implicitly or explicitly on one of the two definitions of the daily knowledge, namely information that develops or knowledge needed in everyday life (Wedege, 2010). Knowledge of mathematical concepts is the knowledge that develops in everyday life by individuals in their daily practice, while the desired knowledge in everyday life is knowledge of mathematical concepts needed and useful in the practice of everyday life. In this case, mathematical knowledge is inherent in human life activities (Nurhasanah et al., 2017).

Knowledge of mathematical concepts that are developed and desired in everyday life, manifested as awareness of the socio-cultural and educational aspects of mathematics that began in the 1970s and 1980s (Gerdes, 1996). It is believed that the conceptuality of culture and mathematics is integrated in human life which is difficult to separate (Umbara et al., 2019). Knowledge of mathematical concepts has implications for the understanding of mathematics between individuals.

The understanding of mathematics may differ from one another. However, based on a functional perspective, it seems that understanding of mathematics is at the same point (UNESCO, 2008), in various situations and domains such as education, economics, culture, science, democracy, and others (Wedege, 2010). The similarity of these domains raises confidence in mathematical knowledge which is claimed to be functional. When it is stated that mathematical knowledge is useful, it is vital to identify where (in school or in everyday life) and for whom (society or individual) mathematics is employed (Johansen, 2004).

With regard to functional mathematics, it is believed that social and cultural interests are influenced by mathematics (Noyes, 2007). So, it is undeniable that mathematics plays a role as a solution to problem and a tool in meeting the needs of individuals and society in the context of activities and social relations (Umbara & Suryadi, 2019), particularly in researching technology and scientific activities in human resource development (Aikpitanyi & Eraikhuemen, 2017). The functional terms of mathematical literacy in a community group must be identified based on the prevailing situation in which the knowledge is used. Literally, the general public may not realize that mathematical concepts are often used in everyday life because of their abstract nature. Individual action will be seen if the individual is able to separate the types of complex skills needed to create mathematical models, generalize, and extend the results of mathematical actions (Kenney & Hancewicz, 2005).

The ambiguity of the concepts used to separate various mathematical ideas and procedures has implications for the emergence of a tendency to empower mathematics in everyday life which is not realized as a conception of simultaneous lifelong learning in both cultural and individual frameworks. This means that the application of mathematical techniques is not institutionalized in the practice, although the mathematical components can be identified from the point of view of the observer, people who are involved in daily activities do not always think that what they are doing involves various mathematical ideas and procedures (Jablonka, 2009).

Based on the emergence of the unconscious tendency to empower mathematics in everyday life, it is important to investigate the relationship between daily activities that include components of mathematics and academic mathematics from the point of view of literacy in an exclusive cultural framework. Therefore, cultural values should be used in mathematics education and teaching because of solidarity and respect for all cultures including to maintain their future existence (Shirley, 2001). The results showed that mathematical literacy and ethnomathematics are intersecting concepts. The intersection of the two concepts lies in the conceptual and functional empowerment of mathematics.

Mathematical literacy and ethnomathematics have functionalities in everyday life that are always a priority to be used and developed as problem-solving tools. All ideas of ethnomathematics and mathematical literacy have the attribute of functionality, which refers to the characterization of contexts in which mathematical knowledge is employed or acquired (Wedege, 2010). Ethnomathematics helps them solve more complex problems (Powell & Frankenstein, 1997). Meanwhile, mathematical literacy is seen as a prerequisite in assessing mathematics (Jablonka, 2009), which must include a critical attitude (Fitzsimons, 2002).

Conceptions of mathematical literacy and ethnomathematics provide a reference for researchers in describing mathematical concepts and abilities produced and used by the Sundanese community. Ethnomathematics emphasizes the competence of people developed in different cultural groups in their daily life, The notion of mathematical literacy mainly focuses on the mathematical and social requirements for the competence of people (Wedege, 2010). This provides strong evidence that when communication is built with one another using mathematical modeling, the patterns of interaction between the world of mathematics and the world of mathematics education do not completely overlap (Burkhardt, 2006), in anticipation of conceptual ambiguity (Lesh & Fennewald, 2013), despite researchers' disagreement on the modeling process and how to conceptualize mathematical modeling (Zawojewski, 2013).

The study's findings demonstrate that mathematical literacy and ethnomathematics are inextricably linked to Sundanese daily life. Mathematical concepts and models, in general or particular, are so intertwined with human existence that they are impossible to separate as a mathematical practice. Mathematical literacy focuses on the use of mathematical knowledge in real-world circumstances to communicate information about mathematical ideas in verbal and visual formats. Meanwhile, ethnomathematics may be considered as a scientific study that connects multicultural practice with mathematical conception.

4. CONCLUSION

The research findings show that mathematics influences people's social activities. Mathematics has a central role in solving problems, both personal problems and problems of community groups. Mathematics has shown its capacity to support the formation of social orders toward a more advanced civilization. Mathematics has long been acknowledged as a fundamental intellectual tool for research and technology, particularly in the validation of social, political, and academic issues through data manipulation (Abbas, 2000). However, research on mathematical literacy using an ethnomathematics perspective carried out by researchers still leaves various aspects that need to be studied more deeply.

Despite the findings, this research still has some limitations. The limitations of the study which must be addressed by further research included, the seven elements of universal culture that anthropologists refer to in exploring a cultural system, the researchers only explored elements of culture, systems, living equipment, and technology. This provides an opportunity for other researchers to conduct studies on other universal elements of culture.

In addition, the results of the research that utilized the interpretative paradigm only present a study of the meaning of a situation or object without producing new didactic products or designs that can be used in learning mathematics. However, the researchers believe that the research results can be used as a basis for the development and implementation of didactic situations in sets of teaching materials for mathematics learning that prioritize cultural aspects based on research results identified as ethnomathematics ideas and mathematical literacy.

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