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Identification of Ethnomathematics of the Toraja Tribe and Its Relationship with Mathematical Concepts in Elementary Schools

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Abstrak

Etnomatematika merupakan matematika yang ada dalam budaya. Tujuan dari penelitian ini untuk mendeskripsikan hasil identifikasi bentuk-bentuk etnomatematika suku Toraja dan memperoleh hasil analisis hubungan etnomatematika pada suku Toraja yang sesuai dengan konsep-konsep matematika di Sekolah Dasar. Metode yang digunakan adalah metode kualitatif dengan pendekatan etnografi. Teknik pengumpulan data yang dilakukan pada penelitian ini yaitu observasi, wawancara dan dokumentasi. Analisis data dalam penelitian ini meliputi reduksi data, penyajian data, serta penarikan kesimpulan dan verifikasi. Hasil dari penelitian ini adalah pada aktivitas dan artefak masyarakat suku Toraja terdapat bentuk-bentuk etnomatematika yang berelasi dengan konsep matematika di Sedolah Dasar yaitu *tombi',* jumlah *gayang* pada upacara adat berelasi dengan operasi bilangan bulat; *lola', bombongan, senuan, bingka', sokkong bayu*, pola gerakan *ma'bugi'*, pola *gerakan ma'badong* berelasi dengan konsep lingkaran; *liang batu, lamba-lamba, ale, la'pa',* kain tenun berelasi dengan konsep persegi panjang; kandaure dan motif *paruki'* berelasi dengan konsep belah ketupat; kue *jipang* berelasi dengan konsep balok; *suke, patti, suling, pompang, gandang, baka, buria'* dan *pa'piong* berelasi dengan konsep tabung; *sarong* berelasi dengan konsep kerucut; *unuran* berelasi dengan konsep prisma segi enam; *songko'* berelasi dengan konsep bola; *limbong pala', kutu', pongo'* berelasi dengan konsep pengukuran dan proses menenun berelasi dengan konsep teorema phytagoras.

***Kata Kunci**: Etnomatematika, Budaya suku Toraja, Konsep Matematika di SD*

Abstract

Ethnomathematics is mathematics that exists in the culture. The purpose of this study is to describe the results of identifying ethnomathematics forms of the Toraja tribe and obtaining the results of the analysis of ethnomathematics relationships in the Toraja tribe in accordance with mathematical concepts in elementary schools. The method used is a qualitative method with an ethnographic approach. The data collection techniques carried out in this study were observation, interviews, and documentation. Data analysis in this study includes data reduction, data presentation, as well as drawing conclusions, and verification. The result of this study is that on the activities and artifacts of the Toraja tribal community there are ethnomathematic forms that are related to the mathematical concept in elementary school, namely *tombi'*, the number of *gayang* in traditional ceremonies is related to integer operations; *lola', bombongan, senuan, bingka', sokkong bayu, ma'bugi'* movement pattern, *ma'badong* movement pattern related to the concept of circle; stone burrows, *lamba-lamba, ale, la'pa',* woven fabrics related to the concept of a rectangle; *kandaure and paruki'* motifs are related to the concept of rhombus; *jipang* cakes are related to the concept of cuboid; *suke, patti, suling, pompang, gandang, baka, buria'* and *pa'piong* are related to the concept of cylinder; *sarong* is related to the concept of cone; *unuran* is related to the concept of a hexagonal prism; *songko'* relates to the concept of the sphere; *limbong pala', kutu', pongo'* relates to the concept of measurement and the weaving process is related to the concept of the phytagoras theorem.

***Keywords**: Ethnomatematics, Culture of Toraja, mathematical concepts in elementary school*

Introduction

The development of science and technology in the 21st century is very rapid and in recent years the world has been hit by the Covid-19 pandemic where teachers and students are required to be able to take advantage of digital technology and online information systems in carrying out learning (Nafrin & Hudaida, 2021). On the other hand, the use of technology has a bad impact on children's values and attitudes at this time, namely the decline in children's ethical and moral values. One of the contributing factors is the use of gadgets in elementary school children where they are easily affected by the development of trends and socialization on social media (Ilga & Ria, 2020). In this case, the technology of the educational sphere is not only related to advanced tools and means. The use of technology in the field of education will be better if it includes the culture that exists in the student environment, namely the culture that exists in society.

Learning mathematics is a gradual learning process, namely from simple concepts, to more difficult concepts. In addition, mathematics learning starts from concrete to semi-concrete and finally with abstract concepts. To make it easier for students to understand mathematical concepts, it is necessary to integrate culture into mathematics learning called ethnomathematics. Ethnomathematics is an approach used to explain the reality of the relationship between environmental culture and mathematics when teaching (Kurumeh, 2004). D'ambrosio says The prefix ethno is today accepted as a very broad term that refers to the sociocultural context and therefore includes language, jargon, codes of behavior, myths, and symbols. The derivation of mathematics is difficult but tends to mean explaining, knowing, understanding, and doing activities such as ciphering, measuring, classifying, inferring, and modeling. The suffix tics is derived from *techné,* and has the same root as technique (Orton, 2004). This means that ethnomathematics is currently accepted as a very broad term that refers to the social-cultural context. Concrete objects that exist in the cultural environment of society can be used to help students concoct something abstract. This needs to be done to bridge mathematics in the everyday world that has the nuances of local culture with school mathematics.

Learning that relates the material to the cultural environment will encourage students to make connections between the knowledge possessed and its application in everyday life. The application of ethnomathematics in learning can develop an understanding of mathematics and can increase the absorption of mathematical concepts (Arisetyawan et al, 2014).

Indonesia is a country that is famous for its rich culture and diversity (Gunawan et al, 2019). The cultural diversity of the Indonesian people is no less than 470 ethnic groups, 19 customary law areas, and more than 300 regional languages spoken (Arwanto, 2019). Many cultures that can be explored, identified, and connected with mathematical concepts in elementary schools can even be integrated into teaching materials.

Baduy people in their daily lives or culture use mathematical concepts to keep their crops long time from rat pests without having to kill rats because they realize that killing rats are equivalent to damaging the ecosystem of the food chain. The Baduy people even though they do not go to school in the field of technology have no doubt about their abilities. This technology that is often used is called *geuleubeug* which is placed on the legs of the *leuit* which are generally measuring (1.5×1.5) m to (2×2)m and the legs are circular in slippery shapes so that rats are difficult to climb on the wood. in addition, to repel rats, they also use leaves that are plugged into their *leuit* such as *teureup, mara, kakandelan, cariang, rane,* and *tumbu esi* (Arisetyawan et al, 2014). Cultural wealth needs to be preserved in the midst of the rapid currents of changing times.

The Toraja tribe is one of the tribes located in the mountains of South Sulawesi. The life of the Toraja people is inseparable from the culture of the Toraja tribe. The society will more readily accept a person who has good manners so they can live in their community Hakpantria (2022). The life of the Toraja people is mostly farming, raising livestock, trading, and artisans. The Toraja tribe is still very thick with the culture adopted. Toraja people still know caste or social status. In addition, the culture that is still attached to the Toraja tribe includes traditional ceremonies, arts, buildings, livelihoods, wicker, special foods, and weaving products. One example of Toraja carving art is *pa'barre allo* (sun) as shown in Figure 1 below.

Figure 1. Toraja *Pa'barre Allo* carving (sun)

To show religious and social concepts, the Torajas made wood carvings and called them *passura'*. Therefore, wood carving is the embodiment of Toraja culture. Each motif symbolizes goodwill and has its meaning. Pa'barre allo is one of the Toraja carving motifs derived from the Toraja language, namely *Barre*: round or circle and *Allo*: sun. *Pa'barre allo* means an engraving that resembles a sun shining brightly, giving life to all the creatures that inhabit the universe. This carving is placed on a traditional house that is triangular in shape and leans upwards. Order and order are common characteristics in Toraja woodcarving besides that Toraja wood carvings are also abstract and geometric. Toraja ornaments are studied in ethnomathematics to reveal their mathematical structure even though the Toraja made these carvings based solely on their estimates. Mathematics learning activity is a process in which students are provided with learning experiences through a series of planned activities so that students gain knowledge of the material to be studied Sulastri (2021).

Ethnomathematics forms in the culture of the middle class on the North Coast of Central Java and West Java Provinces are in the form of (a) cultural heritage objects (The Holy Tower and the Great Mosque of Demak), (b) cultural non-cultural objects, (c) traditional food, (d) traditional equipment, (e) batik cloth motifs, f) traditional games and (g) various forms of ethnomathematics in community culture related to mathematical concepts, such as the sine rule and the cosine rule, the area and circumference of rectangles, squares, parallelograms, and rhombuses, surface area and volume of cubes, prisms, pyramids, and tubes, as well as sets, so that they can be integrated into mathematics learning, both at the elementary (junior high) and secondary (SMA / SMK) education levels (Zaenuri et al, 2014).

Other research related to ethnomathematics revealed that the kandaure motif in Toraja shows a pattern of arithmetic rows and sequences so as to facilitate the manufacture and determination of the shape, motif, and color of kandaure accessories which have their own meaning (Nasiruddin & Silalong, 2021). From several previous studies, it can be concluded that integrating ethnomathematics into learning can help students understand the concepts taught and cultivate the character of cultural love.

Method

This type of research is qualitative research aimed at identifying ethnomathematics forms in the culture of the Toraja people. The results of the identification are connected with mathematical concepts in elementary schools. Qualitative research is used because the problems studied in this study are related to social life or society that is complex, holistic, and full of meaning. This research was conducted from March to August 2022 in Tana Toraja and North Toraja districts, South Sulawesi Province. The number of sub-districts in these two districts is due to limited time, energy and costs, so this research was only carried out on the people of north Makale, GandangBatu Sillanan, Sa'dan, and Kesu' sub-districts to achieve the goal of identifying the ethnomathematics of the Toraja tribe. The culture identified is in the form of community activities and artifacts. The subjects in this study are traditional leaders, community leaders, and mathematics teachers in elementary schools.

The data in this study includes 2 (two) sources, namely humans (community leaders, traditional leaders, and teachers at each level of school at the research site) and nonhumans (activities and artifacts owned by the Toraja tribe). The data collection techniques carried out in this study were observation, interviews, and documentation. The instrument in this study is the researcher himself.

Data analysis in this study uses analytical techniques proposed by Miles and Huberman (Sugiyono, 2014) including data reduction, data presentation, as well as concluding, and verification. At the verification stage, a readability test is carried out. This readability test is intended to find out the extent of the correctness of the association between ethnomathematics forms and mathematical concepts. The first readability test uses a readability validation sheet validated by traditional leaders and local community leaders. The second readability test is validated by the local math teacher. Checking the validity of the data carried out in this study is the extension of observations, increasing persistence, using reference materials, and holding member checks.

Result and Discussion

Based on the results of the identification of ethnomathematics forms in the culture of the Toraja tribal community, it was found that the relationship between ethnomathematics forms and mathematical concepts in elementary schools, namely integer operations, geometry, measurements and Pythagorean theorems.

1. The Concept of Integer Operation

In the *ma'pasonglo'* process in the *rambu solo'* ceremony, *tombi'* is paraded. *Tombi'* is a traditional cloth tied to a small bamboo in the form of a pennant (see figure 2). *Tombi'* is the symbol of how many buffaloes are sacrificed in the traditional *rambu solo'* (death ceremony) ceremony. One tombi' symbolizes one buffalo. To find out how many buffaloes are sacrificed in a traditional *rambu solo'* ceremony' by looking at the number of *tombi'* installed used in the traditional ceremony of *rambu solo'*. This is related to the concept of number operations, especially on integers. An integer consists of a set of negative integers {..., −3, −2, −1}, zero {0}, and a set of positive integers {1, 2, 3, ...}.

Figure 2. *Tombi'*

In *rambu solo'* ceremonies, *gayang* is used as decoration in *lakkean* as well as in *lantang karampoan (*reception hut) in even number while in weddings (*rambu tuka'*) the *gayang* used is an odd number (see Figure 3). An even number indicates that a person's life is over while an odd number signifies starting a new life.

Figure 3. *Gayang*

2. The concept of a circle

A circle is the position of points that are equidistant to a certain point, namely the center point (Khon, 2003). This can be seen in the forms of *lola', bombongan, senuan, bingka', sokkong bayu, ma'bugi'* movement patterns, and *ma'badong* movement patterns. A circle is the position of points that are equidistant to a certain point, namely the center point. From the radius and diameter of the circle, it can be determined the area and circumference of the circle by the circumference of the circle is 2 π r and the area of the circle = πr^2 = π d.

Figure 4. *Ma'bugi'* movement pattern

3. Rectangular Concept

A rectangle is a parallelogram that has four equally large and right-shaped corners (Blistein et al, 2010). The forms of *liang batu, lamba-lamba, maa', ale, la'pa' dua' kayu,* and traditional woven fabrics (see Figure 5).

Figure 5. Square concept

In the *ma'pasonglo'* procession, the lambs are long red cloths that stretch and are tied to each other. During the process of parading the family's body holding this long red cloth. The stone burrow is a place to bury the body of the Toraja people. The surface of the stone burrow is rectangular. *Maa'* or long carved red cloth is used as a loud decoration in the performance of *rambu solo'* ceremonies. All the weaving results produced are in the form of a long cloth that has two pairs of sides facing equally large. The thread at the end of the weave is left dangling for the fabric and the shawl or scarf is sewn into a whole weave. The shapes of stone burrows, *lamba-lamba*, *maa', ale, la'pa'* two' wood, and woven fabrics are related to the concept of a rectangle. Find the area and circumference of a circle using the formula, as follows.

Rectangular circumference = (2 x length) + (2 x width)

= 2p + 2l

= 2 (p + l)

Area of the circle = length x width

= p x l

4. The concept of the rhombus

The Rhombus is a parallelogram that has the same side length and the opposite angles are equally large (Bilstein et al, 2010). The properties of the rhombus include 1) having two pairs of sides parallel; 2) all sides are equal in length; 3) having two diagonals dividing each other equally in length and intersecting each other perpendicularly; 4) the opposite corners are equally large. The shape of the kandaure motif and the shape of the *paruki* motif on Toraja woven fabric can be identified as rhombus based on existing properties (see Figure 6).

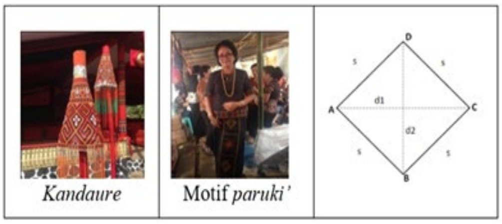


Figure 6. Concept of the rhombus

If the rhombus ABCD in Figure 6 has the length of the s side then the circumference of the rhombus is

K = AB + BC + CD + AD

K = s + s + s + s

K = 4s

ABCD rhombus in Figure 6 is formed by two triangles ABC and ACD. Therefore, the area of the rhombus ABCD = the sum of the area of the triangles ABC and ACD.

So, the area of the rhombus ABCD = the area of Δ ABC + the area of Δ ADC

= 1/2 AC x OB+1/2 AC x OD

= 1/2 AC (OB+OD)

= 1/2 AC x BD

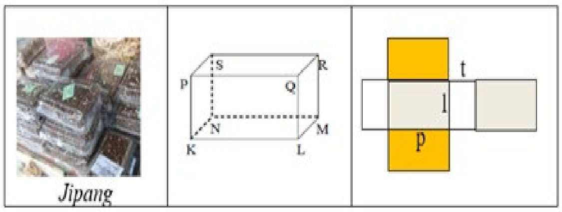
= 1/2 x diagonal x diagonal

5. The concept of cuboid

Cuboid is a construct of space bounded by six rectangles where each side of the rectangle is implicated exactly one side of the other rectangle and the rectangle that is in the same place is congruent. Based on this the *jipang* can be identified as a beam (see Figure 7).

Figure 7. Concept of cuboid

The typical food of the Toraja tribe processed with glutinous rice is jipang.



Black glutinous rice is steamed and mixed with thawed brown sugar with the addition of peanuts. This food is served at the rambutuka' and rambusolo' ceremonies. The cuboid has elements namely sides, ribs, and corner points. The sides are the planes that delimit the beams. As shown in the cuboid nets in Figure 7, the cuboids have 3 (three) pairs of congruent sides. One pair of sized rectangles (first rectangle), one pair of sized rectangles (second rectangle), and a pair of sized rectangles (third rectangle). The surface area of the cuboid is the sum of the area of all its sides.

Rectangle area I = (p x l) + (p x l)

= 2 (p x l)

Rectangle area II = (l x t) + (l x t)

= 2 (l x t)

Rectangle area III = (p x t) + (p x t)

= 2 (p x t)

So that the surface area of the beam is,

= 2 (p x l) + 2(l x t) + 2(p x t)

= 2 ((p x l) + (l x t) + (p x t))

Jipang cake that has been packaged in plastic consists of several *jipang* pieces in the form of cuboid of a small size (unit blocks). For example, the *jipang* consists of 4 small *jipang* pieces as the length, 3 small *jipang* pieces as the width and 2 small *jipang* pieces as the height (4 x 3 x 3 = 24 unit cuboid). It can be used to indicate that the volume of the cuboid is obtained by multiplying the size of the length, width and height of the beam. Thus the volume of the cuboid can be determined by the formula:

V = p x l x t

6. The concept of cylinder

A tube is a space construct bounded by two opposite, congruent, and parallel circular sides and one upright side in the form of an arched side (Herman, 2003). Based on this understanding, the forms of *suke, patti, flute, pompang, gandang, baka, buria', pa'piong* and poles on the reed *sura'* are related to the concept of cylinder (see Figure 8).

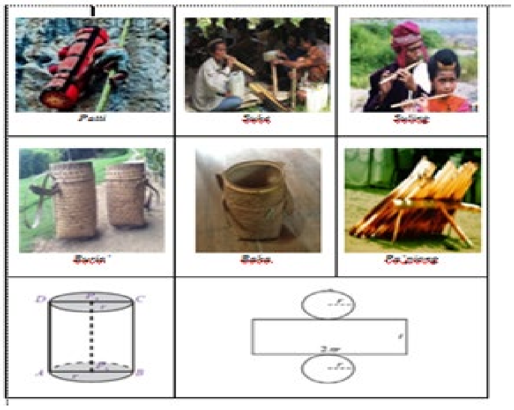


Figure 8. Cylinder concept

Based on Figure 8, the cylinder elements are the upper side, the circular and congenital side of the base, the diameter of the cylinder base indicated by the AB line, the height of the cylinder indicated by the BC and AD lines, the curved side called the cylinder blanket, and the tube surface, which is the plane that includes the upper sis, the lower side and the cylinder blanket. The base and cap of the cylinder are identical circles then it can be calculated the area of the cylinder blanket, the surface area of the cylinder, and the volume of the cylinder. Since the base and the cap of the cylinder are identical circles then,

Cylinder base = L circle

$= \pi r^2$

The cylinder blanket is rectangle then,

Blanket cylinder area = L rectangle

= p x l

= 2πr x t

= 2πrt

Thus,

Cylinder surface area = (2 x base area) + blanket area

$= 2\pi r^2 + 2\pi r$

= 2πr (r + t)

Cylinder volume = base area x height

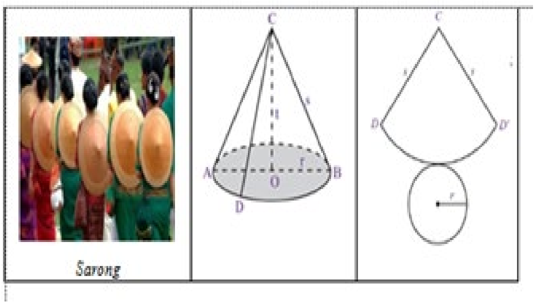
$= \pi r^2 \; x \; t$

$= \pi r^2 t$

7. The concept of cone

A cone is a special pyramid whose base is a circle (Khon, 2012). The typical Toraja hat or *sarong* is one of the webbings made of young bamboo slats, used by the Toraja people in the traditional *rambu solo'* and *rambu tuka'* ceremonies besides that it is used by farmers as head protection from the scorching heat of the sun. The use of *sarong* in the traditional ceremonies of *rambu solo'* or *rambu tuka'* is not arbitrary, it should only be used by descendants of nobles as a symbol of greatness. The shape of the *sarong* can be identified as a cone (see Figure 9).

Figure 9. C



one concept

Cones have elements including the curved side, which is called a conical blanket, and the lower side (base) in the form of a circle. The radius of the base is indicated by the AO and OB lines. The height of the cone is indicated by the OC line. The painter's line is shown by the AC and BC lines, which are lines connecting the top of the cone with the point at the circumference of the base. Judging from the conical nets in Figure 9, the conical base is circular and the blanket is circular jurying. A circle jurying is the area in a circle bounded by two circle radius and an arc flanked by both circle radius.

So that,

$$\frac{\boldsymbol{juring\ area}}{\boldsymbol{circle\ area}} = \frac{\boldsymbol{arc\ length}}{\boldsymbol{circumference\ circle}}$$

Juring area =

$$\frac{\boldsymbol{arc\ length}}{\boldsymbol{circumference\ circle}}\ \boldsymbol{x\ circle\ area}$$

Juring area = $\frac{2\pi r}{2\pi s}\ \boldsymbol{x}\ \boldsymbol{\pi r^2}$

= πrs

Then, the area of the cone blanket is πrs

Surface area of the cone

= base area x blanket area

= $\boldsymbol{\pi r^2 + \pi rs}$

= πr (r+s)

Cone volume = $\frac{1}{3}$ ***base area*** x ***height***

= $\frac{1}{3}$ x ***circle are*** x ***height***

= $\frac{1}{3}\boldsymbol{\pi r^2 t}$

8. The concept of a hexagonal prism

A hexagonal prism is a space that has a hexagon-shaped base and roof that is the same shape and size and has rectangular side parts. From these definitions, the *unuran* can be identified as a hexagonal prism (see Figure 10).

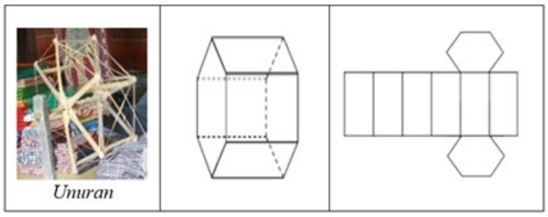


Figure 10. the concept of a hexagonal prism

Unuran is a traditional tool consisting of a series of bamboo, rattan and wood pieces in the form of a prism that serves as a cotton spinning tool into yarn. The process of spinning yarn looks easy but is difficult to work with because it has to balance between the rotation of the spun tool and the pull of the cotton so that the size of the thread is right and not interrupted. The nets of hexagonal prisms consist of 2 (two) hexagons and 6 (six) square or rectangular pieces. Hexagons are awakened from 6 (six) equilateral triangles. Thus, the surface area of the hexagon can be calculated using the concept of an equilateral triangle. From the hexagonal prism nets seen in Figure 10, the surface area of the prism can be determined by looking for the area of the nets.

Surface area of the prism = (2 x area of the hexagon) + (6 x the area of the rectangle)

$= (2 \times 6 \times \frac{1}{2} \times a \times t) + (6 \times pl)$

$= (2 \times 3 \times a \times t) + (6 \times pl)$

$= 6at + 6pl$

Volume = base area x height

= (6 x triangle area) x height

9. Sphere concept

Sphere is included in the construct of the curvilinear side chamber. A sphere is a set of all points equidistant from a certain point (the central point) in a three-dimensional space. Sphere has only one side and no angular point. *Songko'* which is used as an accessory in the *ma'randing* dance that exists in the Toraja tribal community can be identified as half a sphere (see Figure 11).

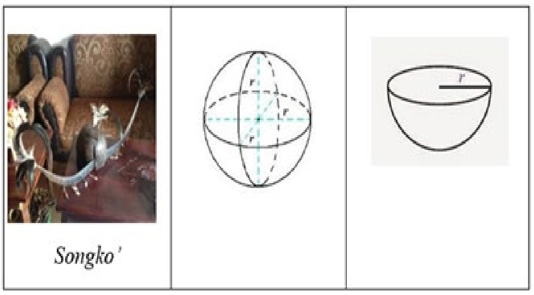


Figure 11. Sphere concept

Based on Figure 11, the sphere has a radius and a diameter.

Sphere area $= \pi d^2$

$= 4 \times \pi r^2$

Sphere volume $= 4 \times \frac{1}{3} \pi r^2 \times r$

$= 4 \times \frac{1}{3} \pi r^3$

$= \frac{4}{3} \pi r^3$

So,

Half sphere area $= \frac{1}{2}$ sphere area

$= \frac{1}{2} 4\pi r^2$

$= 2\pi r^2$

Similarly, for the volume of half a ball can be calculated by the concept of the volume of the ball.

10. The concept of measurement

Measurement is a process of giving numbers to the physical qualities of length, capacity, volume, area, angle, weight (mass), and temperature. There are several forms of ethnomathematics in the culture of the Toraja people that are related to the concept of measuring length and content.

10.1 Length Measurement

Length measurement is used to measure the length of an object. In elementary school mathematics, there is a material for measuring length with non-standard units. Non-standard measurements are measurements whose results vary because they use non-standard or non-standard measuring instruments. The measurement of the length of the buffalo horn is related to the concept of non-standard length measurement related to the measurement of non-standard length in the Toraja tribe community (see Figure 12).

Figure 12. Size of *limbong pala'*

In the Toraja tribal community, the buffalo was used as a means of social exchange in *rambu solo'* ceremonies. The number of buffaloes used is one of the benchmarks for the wealth or success of family members who are holding traditional ceremonies. Ancestral beliefs that embraced the religion of animism believed that the buffalo was a vehicle for spirits to go to *Puya* (the world of spirits/afterlife). *Saleko* buffalo is the most expensive buffalo of all types of buffalo in Toraja.

The high and low value of buffalo depends on its quality according to generally accepted assessments and has been used for generations since long ago. In addition to the shape of the body, the color of the skin and fur, the shape of the horns, and the markings on the body, the quality of the buffalo can also be seen from the length of the horns. For the Toraja people, measuring the length of the buffalo horn uses a non-standard measure, namely using the size of the limbs (hands). One of them is the size of the *limbong pala'*, which means that its size is equal to the length of half the palm of an adult's hand.

10.2 Content Measurement

Rice packing in the culture of the Toraja people uses the term *kutu'* (ikat) and coffee uses the term pekulu'. The harvest is pre-packed before being stored in *alang sura'* (granary). Usually, the rice harvest is tied using bamboo slats (as in Figure 13). In the picture, there is four *pongo'* (tie). If the workers can harvest as much as 5 *pongo'* of rice, 4 *pongo'* is given to the owner of the paddy field while 1 pongo' is given as his wages. One *pongo'* is estimated to be equivalent to one liter. The packing is related to the concept of content measurement as shown in Table 1 below.

Pengukuran Tradisonal	Pengukuran Isi
5 *kutu'* = 1 *pongo'*	1 L
Sang pekulu'	100 L

Table 1. Weight measurement

11. Concept of the theorem of Phytagoras

The Pythagorean theorem states that in a right triangle, the area of a square on the oblique side is equal to the sum of the square area on the other sides. The Pythagorean theorem is closely related to the quadratic form. The square of a number is the product of the multiplication of the number by the number itself. The theorem helps humans in many fields, for example in the culture of the Toraja people, making it easier for craftsmen the process of weaving.

This weaving process is related to the concept of Pythagoras because, during the weaving process, one end of the weaving device is tied to a rather high place while the other end is hooked to the waist. The weaving process carried out by the Toraja people is related to the concept of the phytagoras theorem (see Figure 14).

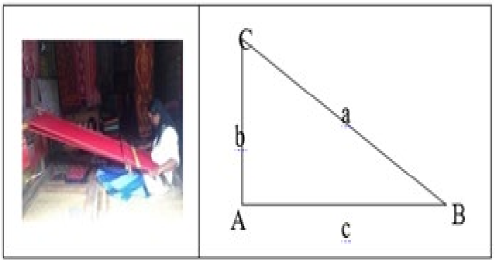


Figure 14. Concept of theorem Phytagoras

In each right triangle, the sides consist of a right side and an oblique side (hypotenuse). Figure 14 is the ΔABC whose elbows are at A. The sides that form the right angles, i.e. AB and AC are called the right sides. The side in the presence of a right angle is called the hypotenuse or hypotenuse side, that is BC.

$$\boldsymbol{base^2 + height^2 = hipotenusa^2}$$

To explain a particular concept, teachers should take examples that are often encountered in everyday life (Suherman, 2003). Using cultural heritage artifacts as props from the nature around students will be more internalized because it is an early conception that has been owned by the local cultural environment. The application of ethnomathematics can become a means of motivating, stimulating, and overcoming saturation and difficulties in learning mathematics for students.

The forms of ethnomathematics that exist in the culture of the Toraja people can be integrated into mathematics teaching materials. Based on this, ethnomathematics forms can be formulated with mathematical concepts at the elementary school education level as presented in Table 2.

Table 2. The Relationship of Ethnomathematic Forms with Mathematical Concepts in Basic Education

No	Ethnomathematic Forms	Mathematical Concepts
1	*Tombi'*, number of *gayang* at traditional ceremonies	Integer operations
2	*Lola', bombongan, senuan, bingka', sokkong bayu, ma'bugi'* movement pattern, *ma'badong* movement pattern	Circle
3	*Liang batu, lamba-lamba, ale, la'pa',* traditional woven fabrics	Rectangle
4	*Kandaure* motif, *paruki'* motif	Rhombus
5	*Jipang*	Cuboid
6	*Suke, patti, suling, pompang, gandang, baka, buria', pa'piong,* pole on *alang sura'*	Cylinder
7	*Sarong*	Cono
8	*Unuran*	Hexagonal Prism
9	*Songko'*	Sphere
10	*Limbong pala', kutu', pongo'*	Measurement
11	Weaving process	Theorem of Phytagoras

The application of ethnomathematics in learning also certainly has its drawbacks and weaknesses. From the mathematical concepts that have been described and explained in the discussion section, if not analyzed properly, will cause problems in the form of misconceptions in learning and eventually hinder the process of learning mathematics.

Conclusion

Mathematical concepts have been owned and lived by society for a long time. This is realized from the ethnomathematics form of the Toraja tribe which contains many mathematical concepts, especially in the fields of geometry and algebra. The geometric concepts recorded in the culture of the Toraja people are circle, rectangular, rhombus, cylinder, cuboid, cone, hexagonal prism, and sphere.

Integer operations, both addition, and multiplication can be found in traditional ceremonies owned by the community. This helps learners in learning counting operations. The concept of odds and arithmetic sequences and other concepts need to be analyzed in depth. All forms of ethnomathematics can be integrated into mathematics learning at the elementary and secondary school levels.

Keep in mind that although all forms of ethnomathematics that have been analyzed in general can be integrated into learning, if it is not packaged properly, it will hinder the process of learning mathematics. For this reason, it needs to be further analyzed and developed according to the appropriate context.

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