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ETHNOMATHEMATIC EXPLORATION: DECORATIVE VARIETIES OF METHODOLOGICAL DELICATIONS

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Abstract
Ethnomathematics is a mathematical science that continues to grow and develop, because cultural influences make learning mathematics no longer boring. Ethnomathematics has become a trend in the field of educational culture, besides that ethnomathematics also preserves the existence of cultural values in the future. This research aims to describe the exploration of the Malay Deli ornamental variety. In Deli Malay culture there are knick-knacks as Deli Malay ornamental varieties, such as tepak betel, balai, and pending. The results of this study found that mathematical concepts were found in the Deli Malay Decorative Variety. This means that Tepak Sirih, Balai, and Pending can be used as teaching aids in learning mathematics. The mathematical concepts contained in the study are the concepts of flat and spatial shapes, namely trapezoids on betel nut packs and balai, rectangles on betel nut packs, balai, and pockets on cekak musang clothes, circles on the head circumference for tanjak, as well as the concept of a prism with an isosceles trapezium base on betel nut packs.

Keywords : Ethnomathematics, Deli Malay Culture

INTRODUCTION

The term ethnomathematics was introduced by a Brazilian mathematician named D'Ambrosio. He believes that the prefix ethno is currently known as a very broad term that refers to the socio-cultural context and therefore includes language, jargon and codes of behavior, myths and symbols. Mathematical derivation is difficult, but tends to mean explaining, knowing, understanding, and carrying out activities such as encoding, measuring, classifying, inferring, and modeling. The suffix *tics* comes from *techne* , having the same root as technique. Ethnomathematics was originally known as *ethnomathematics* , the word *ethno* means socio-cultural, while *mathematics* includes all activities related to explaining, knowing, understanding, identifying and formulating problems, measuring, classifying, concluding and modeling. Meanwhile, *tics* means technique (Astuti et al., 2019). Another opinion of Rahtwo's ethnomathematics is a research project in the history and philosophy of mathematics with pedagogical aims, focusing more on the art and technology of explaining, understanding and overcoming different social cultures. Ethnomathematics is a mathematical science that continues to grow and develop, because of cultural influences, learning mathematics is no longer boring (Rahtwo & Budiyono, 2022).

Culture is an important part of human life. Culture is a term that refers to the way of life of a group of people, that is, the way they do things. A culture is passed on to the next generation through learning, including language, religion, cuisine, social customs, music and art. Indonesian culture includes ancient and original cultures that exist as regional peaks throughout Indonesia (Kusherdyana, 2020). Culture is reflected in various areas of community life throughout Indonesia. Each region has different cultural

characteristics, for example, cultural rituals are a form of custom that is passed down from generation to generation, taking place regularly, in an orderly manner, in accordance with cultural norms. Ritual prayer activities as an expression of gratitude. This includes rituals of birth, marriage, death, burial, and more. Geographic conditions and location also influence local culture, thereby creating cultural and ethnic diversity for Indonesia (Aprianti Muthia et al., 2022). According to Kamaludin, the culture developed by humans will influence the environment in which that culture develops. By analyzing the influence of culture on the environment, we can see that each region has a different culture so that cultural diversity will be created (Kamaludin, 2021). Melayu Deli is one of the Malay tribes in North Sumatra located in Medan City and Deli Serdang Regency. The distribution includes Medan City, Old Deli, coastal areas, the edge of the Deli river, and Labuhan. In the city of Medan, the Deli Malay tribe occupies many suburban areas (Izar et al., 2021).

The diversity of Malay decoration is often called Malay motifs or ornaments. Malay ornaments are Malay handicrafts. According to Tengku Luckman, Malay ornamental rays are only a small part of Malay art, but in general at that time many Malay people did this in their free time, even in previous times, since the megalithic culture, the skill of the Malays in carving is undoubted, an example that we can see the temples in Muara Takus, the remains of a monastery in Padang Lawas, as well as the remains of statues and monasteries in Palembang, Jambi and Ciba City (Labuhan Deli, Medan) as well as the calligraphy found on the tombs of kings and prominent figures, as well as on mosques and pulpits, houses and weapons (Wahyuni & Pertiwi, 2017). In Malay Deli culture there are knick-knacks as Malay Deli decorations **,** such as tepak betel, balai, and Pending.

Tepak betel is a symbol of Malay culture, Tepak Sirih is a Malay communication medium used to convey the desired message in various Malay activities (Haryati, 2017). There is a purpose and objective in the message, there are many things that must be conveyed or information to be conveyed, so it is called the phrase "Setepak Sirih Million Messages". In betel palm generally there are betel, areca nut, gambier, tobacco and lime, each of these components has a different meaning, and the way it is arranged also has a different meaning (Singarimbun & Putri, 2023). According to Yunus, quoted by Kesuma, there are two general forms, namely the cembul which is made of brass and the pyramid shape which is made from plywood (Raja & Haji, 2023). Bale or Pulut Bale is a way of providing food among the Malay tribes (Langkat, Deli, Serdang, Batubara, Asahan and Siak) on the east coast of Sumatra. It is called pulut bale because the main food is yellow rice and is made from pulut rice. The place used to serve rice is called Bale. Made of board/wood, rectangular and layered. In general, pulut bale is a form of fertility which is included in the fertility of the hen. Pending is an accessory used by men and women when wearing traditional Malay deli clothing. Pending is usually made of gold or gold. For this reason, researchers are interested in conducting ethnomathematics research regarding Deli Malay decoration. According to (Mohamad Zawawi et al., 2019) Pending is a type of jewelry made of gold, silver, copper or wood that is worn on the chest or on a belt. Pending was originally formed from bengkung or cloth that was folded and then used as a belt. Pending is used as a belt head. Pending is used as a hook on the sarong or side cloth so that it is sturdy and does not come off easily.

There are several previous studies relating to Deli Malay decoration (1) Khairunnisa & Siti Salamah Br Ginting (2022) in their research they studied the ethnomathematics exploration of Malay Traditional Halls, in this research there are mathematical concepts including measuring the wood that will be used to form the hall , designing the right building to arrange each level of the hall, the concept of assemblage in the filling of the hall, as well as the geometric concept of the hall and the supporting ornaments of the hall. (2) Mestria Cicilia Panjaitan, et al (2022) who researched the Ethnomathematics Study of Melayu Deli Songket Motifs Based on Frieze Patterns and Crystallographic Patterns, in this research it was found that there were 2 Frieze patterns, namely patterns III and VII, and 3 Crystallographic patterns, namely patterns p1, pm and p4m. (3) Astri Damayanti (2023) in her research entitled *Design of Teaching Tools for Spatial Ability in Stuffed Space Building Materials* , in this research it was said that betel palms are suitable for use as teaching aids in building space materials to improve students' special abilities. What differentiates this research from previous research is that the scope of the focus of this research is broader, namely regarding betel palms, balai, and pending.

M ETHOD

This research uses descriptive qualitative research methods to obtain in-depth, extensive and comprehensive information using an ethnographic approach, because the object studied is a culture. According to Yusanto, ethnography is an empirical and theoretical method that aims to obtain an in-depth description and analysis of a culture based on intensive field work. Mr. H. betel, balai, and pending. The data collection techniques used are observation, interviews, library data and documentation. Researchers made observations by observing the shape and details of the betel palm, balai, and pending. Interviews were conducted with Malay Deli cultural activists who live in the Medan Labuhan area. Researchers obtained library data by reviewing previous research related to Malay decoration. Researchers took documentation in the form of photos at the interview and observation stages. The data processing technique in this research uses the triangulation method. Researchers compare the results of interviews and documentation then combine them to reach a conclusion. Based on the results of interviews conducted by researchers with several Deli Malay cultural activists, results were obtained regarding the history of Malay betel palms. According to Mr. Herman, as a Malay cultural activist, Deli tepak betel has been around since the founding of the Deli sultanate. The Deli Sultanate, which was once part of the Siak Kingdom, then spread into several Malay kingdoms in Indonesia, Malaysia and Brunei. Tepak in Melayu Deli is divided into 3, namely tepak opening words, tepak offering and tepa kemas. The opening palm for words is usually used for people to ask for a hand in marriage, the offering palm is usually used for offering dances, and the golden palm is a palm for dowry and its shape is different from the opening kata and offering palm, the golden palm is slightly round in shape. According to Mr. H. Arifsyah, the use of betel palms by the Deli Malay community for important cultural events has been used since the time of the Deli Sultanate. Nowadays the use of betel palms is not only for traditional events, but has been widely used for important events such as welcoming guests, officials, and also as an opening act in a performance. According to Mr. Herman and H. Arifsyah, betel palms are usually made from carved wood and have motifs such as flowers, calligraphy or symbols of a kingdom.

RESULTS AND DISCUSSION

Results

Based on the results of interviews conducted by researchers with several Deli Malay cultural activists, results were obtained regarding the history of Malay betel palms. According to Mr. Herman, as a Malay cultural activist, Deli tepak betel has been around since the founding of the Deli sultanate. The Deli Sultanate, which was once part of the Siak Kingdom, then spread into several Malay kingdoms in Indonesia, Malaysia and Brunei. Tepak in Melayu Deli is divided into 3, namely tepak opening words, tepak offering and tepa kemas. The opening palm for words is usually used for people to ask for a hand in marriage, the offering palm is usually used for offering dances, and the golden palm is a palm for dowry and its shape is different from the opening kata and offering palm, the golden palm is slightly round in shape. According to Mr. H. Arifsyah, the use of betel palms by the Deli Malay community for important cultural events has been used since the time of the Deli Sultanate. Nowadays the use of betel palms is not only for traditional events, but has been widely used for important events such as welcoming guests, officials, and also as an opening act in a performance. According to Mr. Herman and H. Arifsyah, betel palms are usually made from carved wood and have motifs such as flowers, calligraphy or symbols of a kingdom.

Based on Mr. Herman's explanation, the Melayu Deli hall was built in the 4th year since the founding of the Melayu Deli Sultanate. At that time a boy was born who would become the successor to the Kingdom. So with that a hall was made for the birth of the child. According to Mrs. Rifka, at the Melayu Deli hall there are fillings in the form of pulut, core, grilled chicken, there are also decorations in the form of 17 flags and 8 eggs. According to Mr. H. Arifsyah, there is no special pattern to the construction of the hall, the motif is sometimes similar to betel palms. Mr. Herman and Mr. H. Arifsyah agree that pending is a type of Malay Deli jewelry made from gold, copper or silver. Often used as a complementary decoration when wearing traditional Malay Deli clothing. This pendant is often used as

a hook on sarongs and sampins. Some pending also have gems in the middle. In the exploration of ethnomathematics, there are several people who know about it, such as Mr. Herman, who said that tapak betel is related to the concept of spatial shapes and flat shapes in mathematics. Regarding the exploration of the ethnomathematics of Deli Malay decoration starting from Deli Malay culture. Culture is the entire system of ideas, actions and results of human work in social life which are made into human property by learning (Akbar, 2021) .

1. **Betel Palm**

   Tepak betel is a container generally used by the Deli Malay community as a place to place betel and flavoring (Mulyani & Sihombing, 2020) . Apart from being used as a container for placing betel, in ancient times Deli Malay people often used tepak betel as a medium of communication and a symbol of respect for the person they were talking to, in this case tepak betel was the opening word at every banquet (Singarimbun, 2023) . Therefore, the beauty of the shape of the betel palm must be arranged in such a way that it is beautiful to look at. The filling of betel palm is generally adjusted based on its function and use. Generally, when used at merisik events, the ends of the betel leaves are arranged to meet and meet disputes in betel farming (YUSCAN, 2007) . This has its own meaning, namely the flower you want to go to. As for the proposal ceremony, the arrangement remains the same but is decorated more beautifully by carving the areca nut and forming it like a chain link or what is often called "Chain Pinang". Both men and women usually arrange the betel leaves face down. The method for handing over betel palms is that the areca palm is placed on the front side, the lid of the palm is opened and then placed on the mat in the direction of the left hand of the hander. Betel palms are generally made of wood, betel palms are generally trapezoidal in shape, and have a rectangular base in their presentation. If we look at the front of the betel palm, it has a shape similar to a trapezoid, but when viewed from above, the cover of the betel palm has a rectangular surface as does the base of the betel palm. The mathematical concepts in betel palm are as follows:

   - Front look

     When viewed from the front side, the betel palm has a surface that corresponds to an isosceles trapezium

Figure 1. Betel Palm Front View.

   - Top view

     When viewed from the top, the betel palm has a surface that corresponds to a rectangle.

Figure 2. Betel Palm Seen From Above

Figure 3. Betel Palm and Alas .

2. Deli Malay Hall

Balai has been known to the Deli Malay community since the beginning of the Deli Sultanate. The hall is considered to have traditional values as well as artistic and cultural values. Generally, the hall contains pulut, consists of three levels and has 4 legs as supports (Darussamin, 2019) . The pulut used to fill the hall is divided into two colors with different functions and meanings. White pulut is generally used in religious events such as reciting the Koran, circumcisions, as well as sending off and welcoming Hajj pilgrims, as well as several other religious events. Meanwhile, yellow pulut is generally used at social events and symbolizes splendor such as weddings, name-raising and welcoming guests from official circles (Matondang, 2016) . Initially, the level of the hall indicated the level of social strata. For example, the hall for the king has nine floors, the king's children and descendants use the seven-story hall, for nobles it is usually a five-story hall, while for ordinary people the hall has three levels. Each part of the hall also has a different meaning. Bunga kemuncak means that a Malay leader must be able to be fair and protect his people. This kemuncak flower cannot stand firmly without pulut, nor can Malay leaders stand firmly without the support of their people. Yellow pulut or white pulut, meaning attached, that is, having a sense of unity and oneness. The Merawal flag means unity in culture. Grilled eggs and chicken, wrapped eggs symbolize cleanliness and development, and grilled chicken symbolizes struggle and sacrifice. The mathematical concepts in the Melayu Deli hall are as follows:

- Side view

  If we look at the shape of the Melayu Deli hall from the side, this hall also has a shape that is found in mathematical concepts, namely an isosceles trapezoid.

Figure 4. Tepak Sirih side view

- Top view

  If we look at the Melayu Deli hall from above, the Melayu Deli hall has a square shape:

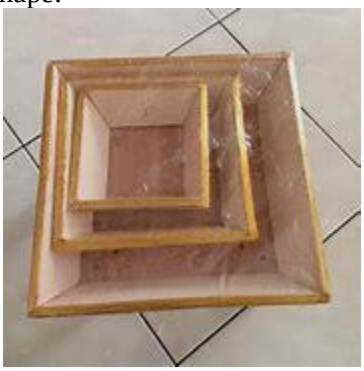


Figure 5. Deli Malay Hall

3. Pending

Pending is one of the complementary accessories in traditional Malay clothing, used as a headband or belt buckle (Hermira et al., 2021) . Pending has various motifs and shapes. However, what is often found nowadays is an oblong shape that resembles the shape of the human eye, round, rectangular, and others. Generally used by men and women to tie fabric or sides. Usually those who use this pending are Malay officials or kings. Pending is made of gold or silver, but there are also those who make it of silver or copper. The pending used by the king is called the king's pending which is made of gold and decorated with eleven red gemstones and in the middle is carved the Royal coat of arms. If we pay attention, the pending has a shape resembling a rhombus.

Figure 6. Pending

If we look and observe, Pending has a shape that matches a rhombus.

4. Mathematical Concepts

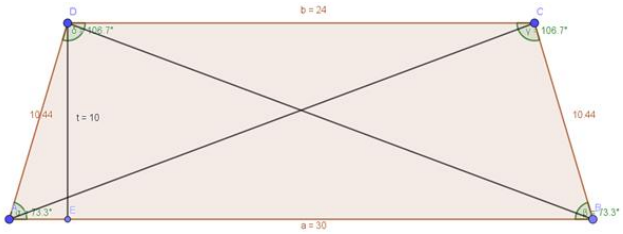
Isosceles Trapezium

An isosceles trapezoid has several special properties, including the following:

1. Has two legs of the same length AD=CB
2. Have the same diagonal: AC=BD
3. Has two adjacent angles of equal measure: $\angle\alpha = \angle\beta;\angle\gamma = \angle\delta$
4. Opposite angles are equal:$\angle\alpha + \angle\gamma = 180°$; $\angle\beta + \angle\delta = 180°$
5. The diagonal divides it into equal segments.

Based on the formula and measurement results, we can calculate the perimeter and area of the tepak and hall as:

Slap



Perimeter of Tepak = AB + BC + CD + AD

= 30 + 10.44 + 24 + 10.44

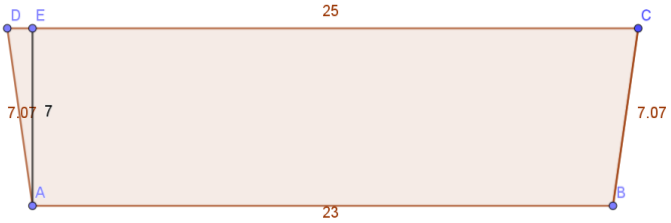
= 74.88cm.

Square Area $= \frac{a+b}{2} \times t$

$= \frac{30+24}{2} \times 10$

$= 270\text{cm}^2$.

Level 1 Hall



Level 1 Hall Tour = AB + BC + CD + AD

= 23 + 7 + 25 + 7

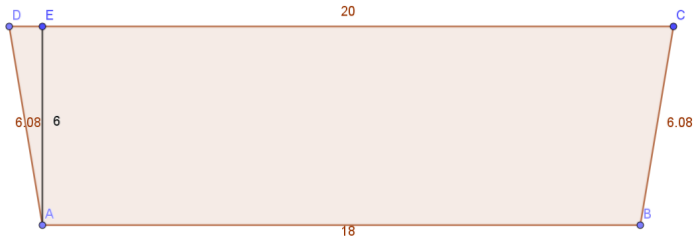
= 62cm

Level 1 Hall Area $= \frac{a+b}{2} \times t$

$= \frac{23+25}{2} \times 7$

$= 168\text{cm}^2$.

Level 2 Hall



Level 2 Hall Tour = AB + BC + CD + AD

= 18 + 6 + 20 + 6

= 50cm.

Level 2 Hall area $= \frac{a+b}{2} \times t$

$= \frac{18+20}{2} \times 6$

= 114cm ^{2}.

Level 3 Hall

Level 3 Hall Tour = AB + BC + CD + AD

= 15 + 4 +16 + 4

= 39cm.

Level 3 Hall area $= \frac{a+b}{2} \times t$

$= \frac{15+16}{2} \times 4$

= 62cm $^{2.}$

Rectangle

The properties of a rectangle are as follows:

1. Has 4 sides: AB, BC, CD, DA.
2. Sides opposite each other are the same length and parallel: $\| CD; BC \| AD$.
3. It has 4 angles, where each angle is a right angle: $\angle\alpha = \angle\beta = \angle\gamma = \angle\delta = 90°$.
4. If the four angles are added together they add up to 360 °.
5. Has 2 diagonal lines of the same length.
6. Has 2 lines of symmetry
7. Has 2 rotational symmetries.

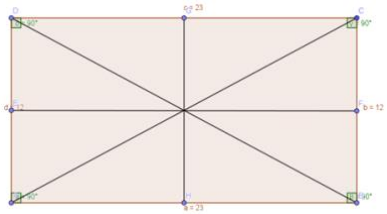
Formula for Perimeter of a Rectangle:

Perimeter of Rectangle $=2 \times (p + l)$

Area of a Rectangle
Area of Rectangle $=p \times l$

Object	Object Length (p)	Object Width (l)
Upper Side of the Foot	23cm	12cm

Upper Side of the Foot



Circumference of the Upper Side of the Foot $=2 \times (p + l)$

$=2 \times (23 + 12)$

= 70cm.

Area of Upper Side of Foot $=p \times l$

$=23 \times 12$

= 276cm ^{2}.

Rectangle

1. Has 4 sides
2. Every angle is the same size $\angle 90°$
3. All four sides are the same length.
4. Each diagonal is the same length.
5. Each diagonal intersects perpendicularly and bisects the same length.

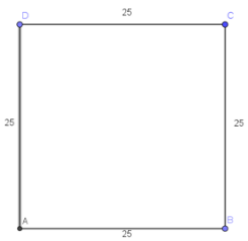
Square Perimeter Formula

Perimeter = 4 x sides

Square Area Formula

Area = side x side = s ^{2}

Level 1 Hall



So the perimeter of the hall at level 1 is:

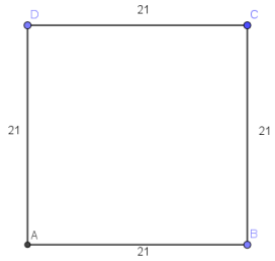
Perimeter = 4 x sides

Perimeter = 4×25 =100cm.

So, the area of the hall at level 1 is:

Area = $s^2 = 25^2$ = 625cm ^{2}.

Level 2 Hall



So the perimeter of the hall at level 2 is:

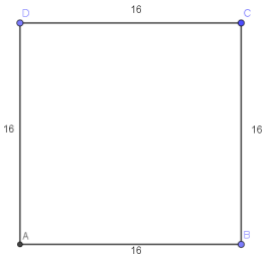
Perimeter = 4 x sides

Circumference = 4×21 =84cm.

So, the area of the hall on level 2 is:

Area = $s^2 = 21^2$ = 441cm ^{2}.

Level 3 Hall



So the perimeter of the hall at level 3 is:

Perimeter = 4 x sides

Circumference = 4×16 =64cm.

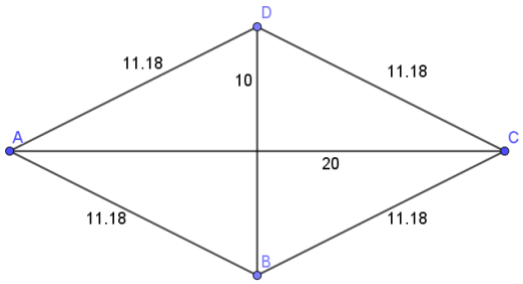
So, the area of the hall at level 1 is:

Area = $s^2 = 16^2$ = 256cm ^{2}.

Cut the rice cake

Rhombus has the following properties and characteristics:

1. It has 4 corner points, each corner point has the same value.
2. It has 2 diagonals, each of which is a different length.
3. It has 2 axes of line symmetry and rotational symmetry.
4. There is a pair of adjacent angles equal to 180°.



Part	Long
Side	11.18 cm.
Diagonal $_1$	10 cm.
Diagnostics $_2$	20 cm.

Rhombus Perimeter Formula:

Circumference = $s \times s \times s \times s = 4 \times s$

So, the pending perimeter is:

Circumference $= 4 \times s$

$= 4 \times 11{,}18$

= 44.72 cm.

Rhombus Area Formula:

Area $= \frac{1}{2} \times d_1 \times d_2$

So, the pending area is:

Area $= \frac{1}{2} \times d_1 \times d_2$

$= \frac{1}{2} \times 10 \times 20$

= 100 cm ^{2}.

Discussion

Based on the research results, it is known that tepak betel and balai are also suitable for use as teaching aids in mathematics learning. By observing the shapes of betel palms, we can also find several mathematical concepts in flat shapes, including trapezoids, rectangles, squares and rhombuses. By observing objects or things related to culture and then relating them to mathematical concepts, you can train students' creative thinking abilities. Objects or things related to culture can be used as references for mathematics learning media, so that learning is not monotonous. This is in line with research (Faiziyah et al., 2022), the results of which state that ethnomathematics can improve students' creative thinking abilities so that students are also able to solve mathematical problems with alternative solutions.

The findings in this research are supported by (Annajmi et al., 2024) where in this research it is said that there is an isosceles trapezoidal concept and a rectangular concept in betel palms. Through ethnomathematics theory, learning feels more interesting and students can gain contextual meaning based on their experiences as part of society. Learning can also attract more students' attention so that they respond well to learning activities. The atmosphere created can increase opportunities for improving student academic achievement because students' psychological comfort during the learning process increases their absorption capacity (Hartanti, 2021) . By exploring culture as a learning medium, it is hoped that students can more easily understand learning and are also able to develop a love of culture and preserve culture through learning at school.

CONCLUSIONS AND SUGGESTIONS

This research uses an ethnomathematics approach. Ethnomathematics aims to explore mathematical knowledge in cultural concepts that are closely related to people's lives. Based on the results of this research, mathematical concepts were found in the Malay Deli Decorative Variety. This means that Tepak Sirih, Balai, and Pending can be used as teaching aids in mathematics learning. The mathematical concepts contained in this research are the concept of flat shapes and spatial shapes, namely trapezoids in tepak betel and balai, rectangles in tepak betel and balai, rhombuses in Pending, as well as the concept of a prism with an isosceles trapezoidal base in tepak betel.

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Raja, M., & Haji, A. (2023). *Mathematics Education, Faculty of Teacher Training and Education, University INTRODUCTION Tepak betel is a container for placing betel sekapur tools, namely betel, lime, gambier, tobacco and areca nut. Betel palms can be found at traditional ceremonies, one of which is the traditional wedding ceremony. There are two forms of betel palm itself. The first shape is shaped like a cembul whose base material is brass, and the second is shaped like a pointed pyramid with a base material of plywood (Yunus, 1987). The betel palm that is still being developed and still exists today is the betel palm shaped like a sharp pyramid. Gonggong is a marine biota typical of the Riau Islands, especially the city of Tanjungpinang (Irawan, 2015). Besides* . *9* , 56–66.

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