



Ethnomathematics Exploration of Jong Sailboat Shape As a Traditional Game in the Riau Islands

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Article Info	Abstract
Article History Received: 16-04-2020 Revised: 25-10-2020 Accepted: 16-11-2020	The Jong Sailboat is a traditional game of the Riau islands' Malay culture. This game developed in various areas whose territories have beaches. In the Jong Sailboat game, mathematical elements can be explored, especially in the Jong Sailboat's shape. Mathematical practice in culture is known as ethnomathematics. Ethnomathematics studies can be obtained through exploration, exploring the field to get more knowledge from a situation. Through Jong Sailboat's exploration, mathematical concepts and elements are found in it. So this research aims to explore ethnomathematics in the shape of a Jong Sailboat as a traditional game in the Riau Islands. This type of study is qualitative research with an ethnographic approach. The subjects in this study were makers of traditional game crafters and the shape of the Jong Sailboat. Data collection is done by interview, observation, and documentation, with the main instrument of study, are the researchers themselves. The data is then analyzed by referring to Miles and Huberman's design by reducing data, presenting data, and conclusions/verification. The results found a mathematical practice in geometrical shapes in triangles, rectangles, and mathematical concepts in the way of translations, acute angles, right angles, trigonometry, straight lines, and slope. This exploration can enrich ethnomathematics science, which is also found in the form of Jong Sailboats.
Keywords:	
Ethnomathematics; Exploration; Perahu Layar Jong; Traditional Game	

INTRODUCTION

Indonesia is the largest archipelagic country globally, consisting of approximately 17,508 islands with 1,904,569 km², which stretches between the Asian Continent and the Australian Continent. The thousands of islands that are owned by Indonesia make Indonesia known as a maritime country. Ethnicities and diverse cultures and their uniqueness have made Indonesia's government increasingly recognized by other countries. Especially neighboring countries are directly adjacent to the Indonesian State, such as Malaysia, Singapore, Papua New Guinea, Timor Leste, Brunei Darussalam, and other adjoining.

One of the provinces that have the most islands in Indonesia is the Riau Islands Province. Almost all areas of the Riau Islands Province are directly adjacent to neighboring countries; there are 11 entry points and cross-border between Indonesia and Malaysia, and Singapore [1]. It is a challenge for people in the Riau Islands Province, often eliminating the local border area's culture with these two neighboring countries. However, it depends on the people who take advantage of this kind of situation. If a culture is well preserved and developed, this can be a good selling point and become one of the attractions for tourists abroad. So we need to know one of the changes in intercultural relations between local and foreign cultures [2].

Understanding of cultural diversity does not grow by itself in the order of people's lives. Still, it must be socialized through statutory regulations, an interactive dialogue involving all nation components, mass media, and multicultural education to create a teaching and learning process without cultural differences [3]–[5].

The Riau Islands have various kinds of cultures; especially, the majority of the population has a Malay culture. Culture is defined as knowledge that includes beliefs, traditional arts, morals, customs, and human thinking abilities. Culture can also be interpreted as the whole thought, work, and work of humans who have no sense of their instincts and are only triggered by humans after the learning process that can create ideas or ideas in the human mind [6]. A form of a cultural way of life-related to creativity, taste, and intention grows and develops in a society owned by a group of people. It is passed on continuously from the top generation to the lower generations [7].

Culture is formed from many elements, elements of Malay culture, which have many works and arts. One form of work and skill that is still preserved is traditional games. The regular game that is always held in the Riau Islands is the Jong Sailboat. Jong Sailboat is a small Sailboat made of wood, shaped as best and as good as possible by the maker to sail by itself following the wind.

Jong Sailboat is one of the cultures of the Riau Islands community. On this Jong Sailboat, there is an indication that it is part of ethnomathematics. Ethnomathematics is a unique method used by a specific cultural group or community group in mathematical activities [8]. It can be interpreted that mathematical activity is a process of abstracting the real experiences in the form of mathematics or vice versa, which includes activities, counting, measuring, designing buildings or tools, making patterns, counting, determining the game's location, explaining, and so on. Ethnomathematics has a broader meaning than just ethno (ethnicity), but ethnomathematics is defined as the cultural anthropology of mathematics and mathematics education [9]. In other words, ethnomathematics is mathematics that appears due to the influence of activities in an environment influenced by culture [10]. Thus the culture of mathematics can take different forms and develop following the community's development who wears it [11].

This definition provides information; the results of ethnomathematics studies can be obtained through exploration, which is field exploration to gain more knowledge (about a situation). It can be concluded that ethnomathematics raises cultural wisdom to motivate students to learn mathematics. In learning mathematics, several abilities affect students' learning achievement, including mathematical ability, which is the literacy of mathematics itself. Mathematical literacy can be defined as knowledge of applying basic mathematics in everyday life. Mathematical literacy includes a person's ability to formulate, apply, and interpret mathematics. It is divided into various contexts, including mathematical reasoning, using concepts, procedures, and facts or phenomena [12].

Not only that, interest in learning is very influential on the quality of students. A study reveals that students will interact and connect mathematical ideas if the effort to solve each mathematics project's problems is impressive. It connects mathematical ideas with imagination and the real world as learning objectives by linking local culture as objects [13]. So with this explanation, ethnomathematics can be found through exploration of the Jong Sailboat form, which has mathematical concepts and mathematical elements in it that can be used by educators to teach mathematics as well as introduce culture to students.

Many research types on ethnomathematics exploration were carried out before this, including the investigation in traditional Javanese games [14]. Ethnomathematical exploration of the Marawis musical instrument style as a source of learning mathematics [15]. Ethnomathematics exploration of Cirebon Trusmi batik reveals philosophical values and mathematical concepts [16], and ethnomathematics in traditional games of Engklek and Gasing, typical of the Sundanese culture [17], development mathematics learning devices Pugung Raharjo Archaeological Site [18]. From these researchers, it can be seen that there are activities that contain mathematical concepts and practices in every culture in a place. Likewise, the objects that will be examined in this study indicate mathematical concepts and techniques.

The study to be carried out is different from previous research that the researchers have described. The difference from this research is the research object, where the item of this research object is the Jong Sailboat's shape. The researcher took this object because there was no ethnomathematics study on the Perahu Layar Jong shape. The researcher took this object because there was no ethnomathematics study on the form of the Jong Sailboat. In the research on Jong Sailboat's record, apart from the researchers exploring the ethnomathematics, the researchers also introduced Indonesia's Malay cultures, namely the traditional Jong Sailboat game.

Therefore, researchers are interested in exploring the Jong Sailboat form's mathematical concepts or practices, with the research title "Ethnomatic Exploration of the Jong Sailboat Forms as Traditional Games in the Riau Islands". Educators in the learning process can use the ethnomathematics exploration results in the form of Jong Sailboat. Educators can think of mathematical material by the results of this exploration; with this, the cultural elements of Jong Sailboat can be packaged in such a way as to the learning process of mathematics.

The research problem's formulation explores and describes the Jong Sailboat's ethnomathematics as a traditional game of the Riau Islands, a traditional game of Riau Islands.

METHOD

This type of research is qualitative with an ethnographic approach. The research subjects chosen were makers or crafters of the Jong Sailboat traditional game. Selection of research subjects using purposive sampling, namely determining the sample with specific considerations [19]. Its research was conducted in Penyengat Island, Tanjungpinang City, Riau Islands province.

Data collection was carried out by interview, observation, and documentation with the leading research instrument. Researchers go directly to the field to collect data. The data were then analyzed by referring to Miles and Huberman's design by reducing the data, presenting the data, and concluding/verification [20]. Furthermore, domain analysis and taxonomic analysis were carried out in the data reduction process, so that the domain in this study was chosen, namely the design domain.

In collecting data, the following stages were carried out;

1. In determining the data source, the selected data source is a reliable data source that can provide valid research data.
2. After finding the source of the data, they were followed by conducting interviews. In this study, the type of interview used is semi-structured interviews, where the implementation follows the interview guidelines, but the questions can develop according to the circumstances. The interviewed informants were also open in expressing their opinions on any items to be asked.

3. In conducting observations, observations made are participatory in type; namely, the researcher is directly involved with the activities carried out by the informants. In this research, the action referred to is assembling and assembling the parts of the Jong Sailboat.
4. In doing documentation, documentation is carried out by interview and observation. The documentation meant here is that the researcher takes photos of the research subject, namely the forms of Jong Sailboats that are deemed necessary.
5. They were writing field notes, written field notes containing the results of interviews, observations, and documentation that the researcher obtained while in the field.
6. Making data reduction, in this process, the researcher summarizes the results of interviews, observations, and documentation so that they can focus on things that are important and by the research objectives.
7. Perform data presentation, data presentation in the form of pictures, and short narrative descriptions. The content of presenting the data is discovering mathematical concepts in Jong Sailboat, the Riau Islands' traditional game.
8. Withdrawing conclusions, conclusions are obtained based on the data presented in the form of mathematical concepts found from the results of ethnomathematics exploration in the way of Jong Sailboats.

RESULTS AND DISCUSSION

At present, there has been a lot of research on ethnomathematics, as the researchers have described in the introduction, namely exploration in traditional Javanese games where mathematical concepts have been found, namely in the form of number operations, flat shapes, congruence, number comparisons, and relations [14], ethnomathematics exploration of the musical instrument style of the marawis art as a source of learning mathematics where mathematical concepts have been discovered, namely in the form of flat plane geometry and mathematical concepts which include the concepts of translation, reflection, folding symmetry, rotating symmetry, acute and obtuse angles, and circular planes [15], exploration of Cirebon Trusmi batik ethnomathematics to reveal the philosophical values and mathematical concepts that have been found in mathematical concepts, namely the concepts of symmetry geometry, transformation (reflection, translation, and rotation), and congruence [16], and ethnomathematics in traditional games of cranks and tops typical of a Sundanese culture where mathematical concepts have been found, namely in conventional cranks games there are flat geometric concepts, namely square, rectangle, semicircle, and the idea of counting, while for tops there are mathematical elements in the form of tubes [17]. It can be concluded that various cultures from various regions as objects of research. There are many mathematical elements such as the concept of field geometry, transformation (reflection, translation, and rotation), points, lines, folding symmetry, rotational symmetry, acute and obtuse angles, number comparisons, relations, and congruence.

In referring to this research, innovations have emerged to conduct ethnomathematics research in the Riau Islands Province. Riau Islands has a traditional game, namely the Jong Sailboat game, which indicates a mathematical element or concept in its shape. This can be done through ethnomathematics exploration in the body of Jong Sailboats. The following are the results of the ethnomathematics exploration of the Jong Sailboat form.

Based on the results of an interview conducted on November 1, 2019, at the residence of Mr. Muhammad Yuzir, whose address is on Penyengat Island, Jalan Istana Laut RT.002 RW.004, Tanjungpinang City. Information regarding the form of Jong Sailboat, the traditional game of the Riau Islands, is as follows:

According to the informant, the Jong Sailboat is a small, uncrewed Sailboat made of wood, shaped and carved as best and as attractive as possible by the maker to sail following the winds directed by the player. Jong Sailboat games used to be just a game for the people on the coast to relieve fatigue when they finished fishing in the afternoon. Jong Sailboat is also a game for the coastal people when they cannot go to sea because of the waves and strong winds. However, in the Riau Islands, especially in the City of Tanjungpinang, Jong Sailboats competed in the competition on certain big days and have become games that are contested every year.

Jong Sailboats have several types of sizes, namely the small ones, measuring 80-129 cm, for the medium ones, 130-149 cm, while the large Jong Sailboats are 150-190 cm. The Jong Sailboat made by Mr. Muhammad Yuzir is 120 cm in size, with a sail height of no more than 2 meters. According to the informant, Jong Sailboat has several parts, namely the body of the boat (Jong), kate, kate rod, kate house, Sauk, and sails.

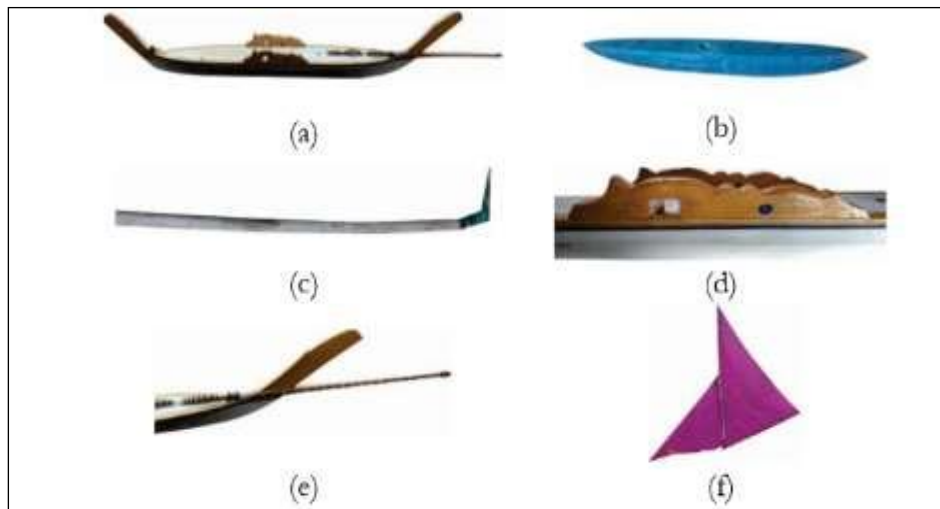


Figure 1. The shape of Jong Sailboat

(a) Canoeing Agency (jong); (b) Kate; (c) Trunk Kate; (d) Kate's house; (e) Sauk; and (f) Sail

The following is an explanation of the Jong Sailboat section:

1. The Body of the Boat (Jong)

In the Jong Sailboat competition, the one that determines the most victory is the boat body. The Jong body's manufacture must have expertise in choosing wood and carving wood because if it doesn't fit, it will result in a defective jong Sailboat. When it is disabled, the Jong Sailboat will not sail.

Wood materials usually used are dry, lightweight, and durable wood, such as Pulaui and Mentangoh wood. Pulaui wood is very light and resistant to water. However, Pulaui wood is quite suitable to be obtained, so if you do not have Pulaui wood, Mentangoh wood is used. However, Mentangoh wood is not as light as Pulaui wood.

The people around Penyengat Island, Riau Islands Province, are more dominant in using Pulaui wood as jong body wood because this Pulaui wood is found in many Riau Islands.

2. Kate

Kate serves as a counterweight to Jong's Sailboat so that Jong doesn't sink or fall. Kate is also made of Pulai wood. Kate is made smaller than Jong's body.

3. Ganda Kate

The Ganda Kate is a straight piece of wood that functions as a link between the kate and the kate house, located in the middle of Jong's body. Ganda kate is made of wood, which is strong and straight. Ganda kate always follows the direction of the wind. If the wind is from the south, double kate is entered from the left. If the wind is from the north, a double kate is entered from the Jong's right.

4. Kate's house

Kate's house functions to tie and hold the kate as a unit of the Jong's kate and body. The kate house is made of Pulai wood. Kate's home is in the middle of the Jong's body.

5. Sauk

Sauk is made of Pulai wood, which is located at the front and back of the body of the Jong. Sauk serves as a barrier for the Jong's body from collisions and as a water breaker.

6. Sail

The sail is also very decisive for the victory at the Jong Sailboat race. The primary mover of the Jong Sailboat is the sail. The function of the sail is to change the wind rotation so that Jong Sailboat is directed. Jong's Sailboat speed depends on the sail. Usually, the material used in coastal communities for sail-making uses plastic. With the times, plastic is rarely used and is replaced by cloth and parachutes. This cloth and parachute have better resistance than plastic. The advantages of material and parachute are that they are varied in color. The color of the fabric and parachute can beautify and add to the Jong Sailboat's appearance. The screen has two parts, namely the front sail (jeep) and the rear sail.

Ethnomathematics exploration of the traditional Jong Sailboat game is carried out only in its shape. It is because, in the form of Jong Sailboat, there is a mathematical practice in it. The figure of Jong Sailboat describes a concept and mathematical skill that is applied by accident by the craftsmen or activists of Jong Sailboats. The following is the exploration of mathematical activities in the shape of the Jong Sailboat:

1. Boat Body (Jong)

The jong boat parts that will be explored are the upper and lower parts of the Jong's body. Mathematical concepts are found at the top and bottom of the Jong's body, namely the idea of reflection and angle.



Figure 2. Concept of Reflection on Jong's Upper Body

The concept of reflection on the Jong Sailboat is on the Jong body, between the left and right sides having the same shape and contradicting each other. The reflection concept used by the Jong Sailboat maker aims to make the Jong's body shape balanced when placed on the water.

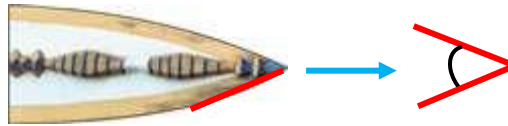


Figure 3. The concept of a sharp angle on the upper back of the Jong's body

The corner concept is at the top of the Jong, precisely at the Jong body's front and back ends. The idea of the angle contained in the body of the Jong used by the jong Sailboat maker aims to break the water when the Jong is moving.

2. Kate

At the top of the kate, there is a mathematical concept, namely the idea of reflection.



Figure 4. Kate Upper Reflection Concept

The concept of reflection in the Jong Sailboat kate is on the upper body of the kate, between the left and right sides having the same shape and contradicting each other. The jong Sailboat maker's reflection concept aims to make the Jong's body shape balanced when placed on the water.

3. Ganda Kate

Ganda kate from the Jong Sailboat has a mathematical concept, namely the idea of straight lines.

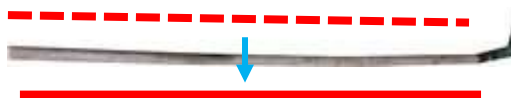


Figure 5. The concept of straight lines at Ganda Kate

The concept of straight lines on the Ganda kate is used by the jong Sailboat maker to connect the kate and the Jong's body so that kate can support and secure the Jong's body when Jong's Sailboat is placed on the water through the Ganda kate so that there is a balance.

4. Kate's House

The kate house of Sailboat Jong has a mathematical concept, namely the rectangular concept. The idea of a rectangle is found in the holes where the double supports or kate supports.



Figure 6. The Rectangular Concept at Kate's House

The rectangular concept used by Sailboat makers aims to allow the kate house to be inserted or connected to the Ganda kate.

5. Sauk

On the Sauk, there is a mathematical concept, namely, right angles. Right angles are at the end of the side of the jong Sailboat.



Figure 7. The Concept of Right Angle at Sauk

6. Sail

Seen from the side, the front sail of Jong Sailboat contains mathematical concepts, namely the concepts of trigonometry, acute angles, right angles, and tilt. Sharp and right angles are found at the corners of the Sailboat Jong Jong.

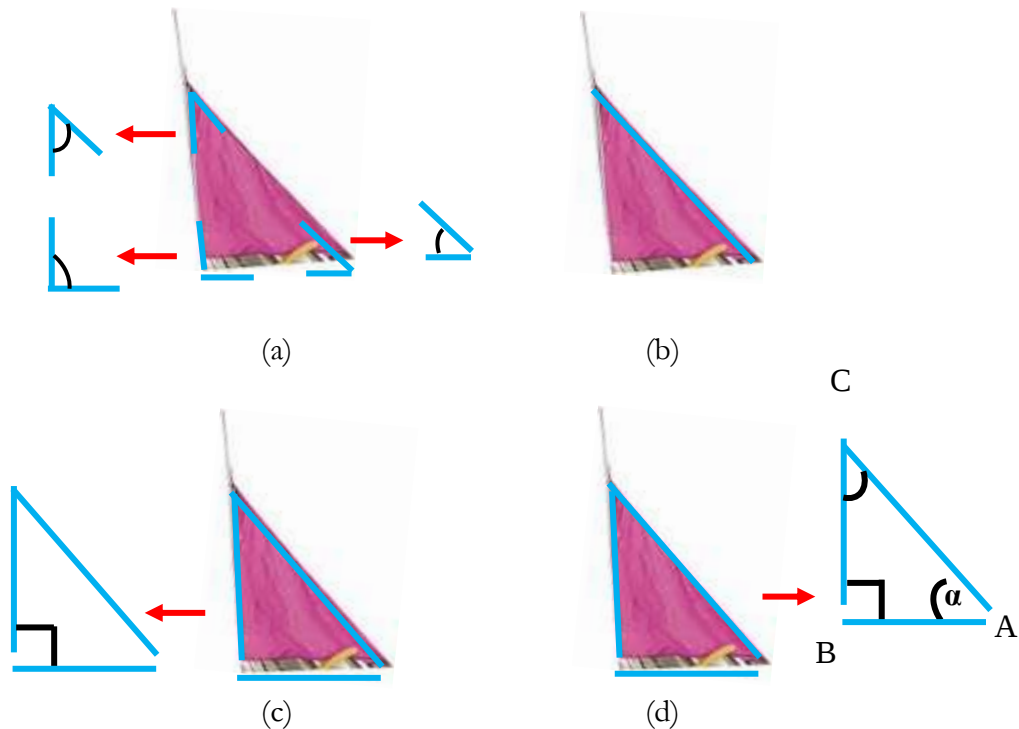


Figure 8. Mathematical Concepts on Jong's Home Sail

- (a) The concept of acute angle and right angle; (b) Slope/gradient concept;
 (c) The idea of a right triangle; and (d) trigonometric concepts

Figure 8a shows the image of acute and right angles; acute and right angles are found on the top and front of the jong sail. The idea of sharp angles and right angles on the front of the Jong's screen aims to connect the front screen with the mast and the Jong body so that the Jong's front sail can change the Jong's rotation when Jong Sailboat is played.

Figure 8b shows the slope's concept; the idea of a pitch is found in connecting the Jong's front end, and the Jong's top pole. This tilt concept aims to keep Jong's front sail tense so that the direction of the Jong Sailboat remains consistent.

Figures 8c and 8d found the concept of right triangles and trigonometry. This concept aims to calculate the significant size of the Jong's front sail so that the bottom, upright, and slanted sides are correct where the right side is more significant than the bottom side.

Next is the back of the Jong Sailboat.

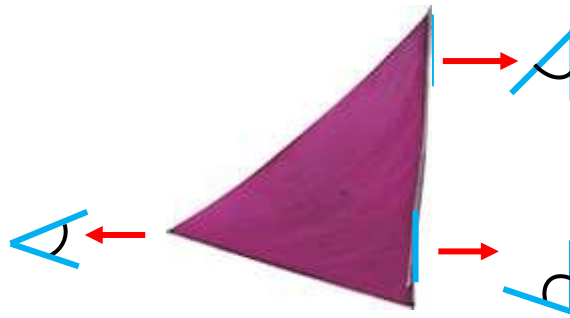


Figure 9. Concept of Acute Angle on the Back Sail of the Jong's Sailboat

The Jong Sailboat's rear sail has a mathematical concept, namely the acute angle concept. Sharp angles are found at the corners of the Sailboat Jong. The critical angle concept found on the back of the jong screen aims to connect the back sail's intersections with the mast and the Jong body.

Based on the exploration results described, several mathematical concepts and practices were found in geometric shapes in triangles, rectangles, and mathematical concepts in the way of reflections, acute angles, right angles, trigonometry, straight lines, and slopes. The shape of the Jong Sailboat contains different mathematical concepts, but there are also similar mathematical concepts. The mathematical concepts and practices found have similarities from previous studies that the researchers have described. Still, there are several different concepts: right angles, trigonometry, straight lines, and slopes. The results of this exploration can enrich ethnomathematics science, which is also found in the form of Jong Sailboats.

Educators in the learning process can use mathematical concepts and practices that have been obtained through this exploration. Educators can choose the mathematical concepts and techniques needed in learning as a learning resource. In addition to educators providing mathematics learning, educators can also introduce local culture to students by linking mathematics learners with the culture they have acquired.

CONCLUSIONS AND SUGGESTIONS

Based on the research results, it can be concluded that in the form of Jong Sailboat, there are mathematical concepts, mathematical concepts are found in almost all parts of Jong Sailboats such as the jong body, kate, Ganda kate, kate house, Sauk, and sails. In Jong Sailboat, mathematical concepts include geometric ideas in triangles, rectangles, and mathematical concepts in the form of reflections, right angles, trigonometry, straight lines, and slopes. Educators can use the results of this exploration as a source of learning mathematics at various levels of education, both in elementary and junior and high schools. In its development, it can be further explored to find the whole mathematical concept of Jong Sailboat, not only in its shape but in its entirety, such as in the making and way of playing.

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