

## Ethnomathematic Value in Traditional Building in Kampung Budaya Bogor Jawa Barat

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### Abstract

Mathematic value in traditional building have been overdued typically for traditional building in sundaness tribe. The goal of this research to discover ethnomathematics value in some building of sunda in kampung budaya in Bogor West Java. This study uses a qualitative method. The sampling technique was carried out purposively, namely the head of kampung Budaya and the key person of kampung budaya sunda sindang Barang Bogor Jawa Barat. Data were collected by in-depth interviews. The sample was selected through a purposive technique. The results were carefully examined through triangulation and source triangulation techniques. The results show that in leuit as the place for saving paddies contain numerous ethnomathematical including in the leuit building, especially on the roof of leuit which is in front there are mathematical elements such as a triangle facing each other but in the middle between the two there is a square and there is an equilateral triangle. While in traditional Sundanese houses there is woven on the walls where the wicker contains mathematical values ranging from straight lines, parallel lines, perpendicular lines, and horizontal lines. Besides that, on the door, there are four right triangles where one pair is opposite, but the other pair is positioned upside down to the other.

**Keywords:** Ethnomathematic, traditional building, leuit, sundaness house

### Abstrak

Nilai matematis pada bangunan tradisional telah dilupakan biasanya untuk bangunan tradisional suku sunda. Tujuan penelitian ini menemukan nilai-nilai matematika pada beberapa bangunan di kampung budaya sunda Bogor Jawa Barat. Penelitian ini menggunakan metode kualitatif. Teknik pengambilan sampel dilakukan secara purposive yaitu kepala kampung budaya sindang Barang Bogor dan tokoh kebudayaan pada kampung budaya tersebut. Pengumpulan data dilakukan dengan wawancara mendalam. Sampel dipilih melalui teknik purposive. Hasilnya diperiksa dengan cermat melalui teknik triangulasi dan triangulasi sumber. Hasil penelitian menunjukkan bahwa Di leuit sebagai tempat menyimpan padi mengandung banyak etnomatematika termasuk pada bangunan leuit terutama pada bagian atap leuit yang di depannya terdapat unsur-unsur matematika seperti segitiga yang saling berhadapan namun di tengah antara keduanya terdapat unsur matematis. adalah persegi dan ada segitiga sama sisi. Sedangkan pada rumah adat sunda terdapat anyaman pada dindingnya dimana anyaman tersebut mengandung nilai matematika mulai dari garis lurus, garis sejajar, garis tegak lurus, dan garis mendatar. Selain itu, pada bagian pintu terdapat empat buah segitiga siku-siku dimana satu pasang berhadapan tetapi pasangan lainnya diposisikan terbalik dengan yang lain.

**Kata kunci:** Etnomatematik, Bangunan Tradisional, Leuit dan rumah sunda

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## INTRODUCTION

Ethnomathematics is defined as the way people from different cultures use mathematics in their daily lives (Fadhly & Muhammad, 2021). Ethno is related to culture, Mathema is concerned with mathematical activities including explaining and understanding, and Tics means art or technique. Referring to the definition of every word of ethnomathematics, it can be interpreted that ethnomathematics is a technique in the culture of the society that uses mathematical concepts (Darmayasa et al., 2020). Ethnomathematics is mathematics that can be associated with cultural

elements. Ethnomathematics is a form of mathematics that is influenced or based on culture (Kurniasari et al., 2018). Through the application of ethnomathematics in education in particular in mathematics education, it is hoped that later students will be able to understand better mathematics, and better understand their culture, and later educators better. It is easy to instill the cultural values in students. The cultural values which are part of the nation's character are embedded in us from an early age learner (Agustin et al., 2019). Ethnomatematika can provide an effective competency in the form of a sense of respect, nationalism, and pride in the heritage of tradition, art, and culture of the nation and (4) Ethnomatematika support the capabilities of students to the expectations of the implementation of the scientific approach (Richardo, 2017).

Ethnomathematics in geometry covers the explanation of buildings of cultural objects in Indonesia, such as temples which are composed of several basic forms of three-dimensional structure (Ristanti & Murdiyani, 2021). Mathematical concepts sometimes arise naturally through the culture of a particular society, through knowledge and views of certain ethnic groups or community groups, or individuals without a formal education. Mathematics with cultural nuances (ethnomathematics) will make a huge contribution to learning mathematics (Zayyadi, 2021). Where the mathematical activity is an activity in which there is an abstraction process from real experience in everyday life in mathematics or vice versa, including activities such as classifying, counting, measuring, designing buildings or tools, making patterns, counting, determining the location, play, explain, etc (Rachmawati, 2012). his ethnomathematical-based learning is very important to instill character values while at the same time fostering children's love for local culture which has been abandoned due to technological advances. This ethnomathematics-based learning is very important to instill values and character while at the same time fostering children's love for local culture which has been starting so far abandoned due to technological advances (Fauzi & Lu'luilmaknun, 2019).

There are 3 ethnomathematical aspects of the existing 6 aspects, namely the counting aspect, the measuring (measurement), and the explaining aspects (Patri & Heswari, 2022). Cultural values are important to be instilled in every individual from an early, so that each individual can better understand, interpret, appreciate and realize the importance of cultural values in carrying out every activity of life. Cultivation of cultural values This can be done through the family environment, education, and in the community naturally. Culture describes the characteristics of a nation, and Indonesia is a rich country in culture (Setiana et al., 2021). The ethnomathematics is a mathematics learning that raises local cultural themes conceptually, including habits carried out by students or the community around them. From here participants students are invited to understand and apply if the existence of mathematics is not only in the scope of the classroom and school but also in the surrounding environment and daily life (Yudianto et al., 2021). Ethnomathematics is Therefore, one alternative that can be used to learn mathematics is through culture, in mathematics, it is known as ethnomathematical terms. Utilizing culture in learning mathematics is a very important thing very possible because Indonesia is rich in cultural treasures, ranging from activities, buildings, and even everyday equipment (Putra et al., 2021).

Mathematics and culture are two things that are closely related. However, sometimes people think of mathematics and culture as something unrelated. Another assumption is that the mathematics obtained at school is different from the mathematics that children find in everyday life, so mathematics is difficult for students to understand (Rosita et al., 2020). Ethnomathematics objects are cultural objects that contain mathematical concepts in a particular society, one of which is a traditional house. A traditional house is a building that symbolizes the culture and the local community of a particular area (Kholisa, 2021). The Ethnomathematics approach will make it easier for students to understand the material because it is directly related to their culture in activities of daily living. Thus, it is conclusive that the ethnomathematics learning approach emphasizes more on how students can understand and build mathematical concepts based on the massively flourishing and developing culture in the local community to provide meaningful mathematics learning for students (Heriyanto & Astutik, 2021). Based on discovering above show that ethnomathematic are related to culture where the community practice mathematic value in life including applicating to building without involve in school like learning from teacher. It can assist the people to understand practically about the implementing immediately to real life instead of getting from school. It is strong different with this research as compare to previous research because in this research continue to investigate.

### Research Method

This research was conducted in the Bogor cultural village and the Urug village, Bogor, West Java. The research flow chart can be viewed in figure 1 below.

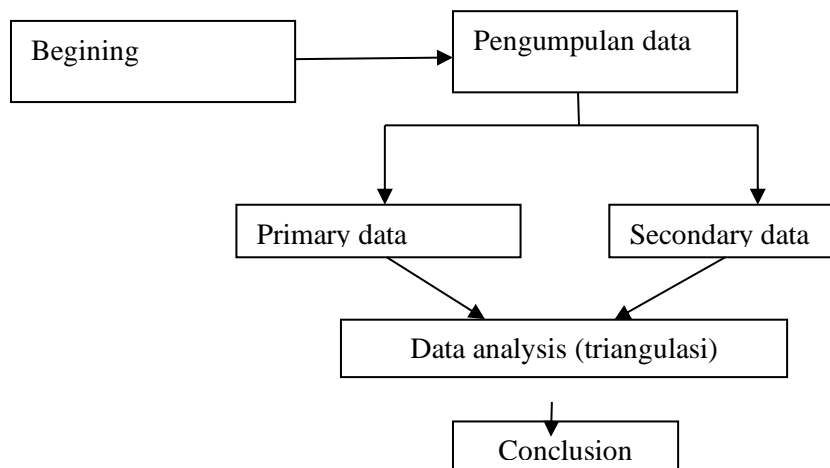


Figure 1. Flow Chart of Research

The research approach used is an ethnographic approach that is qualitative in nature. Ethnographic research is field research that captures the cultural and social values of a particular society. Ethnographic research includes field research that involves researchers directly in the field to meet respondents, but all social and cultural skills that will be investigated are community-based. Qualitative data are descriptive; they pertain to the “qualities” or characteristics of people, places, events, phenomena, and organizations (LeCompte & Schensul, 2013). Conducting ethnographic research involves realizing that an important basis of fieldworkers’ analyses is their own experiences of the situations within which

people construct meaning. Ethnographers, therefore, seek to not just embed themselves within their field sites to learn how people make sense of their lives. They also reflect on how being embedded influences and is influenced by the site and its people.

By immersing themselves ethnographers enter into the lives of their participants indirect and sometimes intimate ways (Ocejo, 2012). Meanwhile, the sampling technique was carried out purposively. This determination is based on the level of knowledge of the respondents used. In this study, there were two samples used, namely the head of the Bogor cultural village, namely Abah Maki Sumawijaya, and the customary village of Urug, namely Abah Ukat. These two respondents are considered able to explain the function of mathematics in every building in the cultural village. While abah ukat have knowledge related to the calculation of the day where they do not use the name of the day but use numbers. Data collection techniques were carried out employing observation, documentation, and interviews. Documentation was carried out by taking photos of every traditional building in the Sundanese cultural village, either Foro Leuit as a place for food deviation, photos of traditional rice milling tools, and photos of traditional Sundanese houses. Documentation in the form of photos is intended to find applications of mathematics in traditional buildings.

Meanwhile, interviews were also conducted on the two samples to find out the purpose of the application of mathematics in each building. Every mathematical object in the building has a meaning in the view of the key character. Another question is to ask about the meaning of the mathematical symbols on each building in the cultural village. While observation, namely direct observation is carried out to see the existence of each traditional building, both granary buildings, traditional tools, and also traditional houses. While the results of the study were analyzed using triangulation techniques. The data analysis technique used in qualitative research is the triangulation technique which consists of data condensation, data presentation, and conclusion (Sutarto et al., 2021). In this study, data reduction was carried out by changing the data in the form of images into narrative writing that explained the data in the image. At the same time select the data that is not needed. The combination of various methods including methods of observation, interviews, and documentation, including analysis, can produce valid data because it sees the consistency of respondents' answers. In the end, patterns were found from what was conveyed by the respondents.

## **RESULT AND DISCUSSION**

The measurement between customary society and modern community have significant differences. Modern people comprehend the calendar. It shows the day in each month and the number of the day every month. While in customary societies wield the number to show the days in each month. Another difference is in kolenyer, Urug people unknown about the day such as Sunday to Saturday. Urug people apply a number to indicate the day in a month. The information can see in this table 2. below.

Tabel 2. Application of number for each day base on local traditional of urug people

<b>Name of day base on Calender (in english)</b>	<b>Name of day base on Calender (in Indonesia Language)</b>	<b>Application number in each day base on indigenious of urug people</b>
Sunday	Minggu	5
Monday	Senin	4
Tuesday	Selasa	3
Wednesday	Rabu	7
Thursday	Kamis	8
Friday	Jumat	6
Saturday	Sabtu	9

From table 2 can explain that Urug people use number to indicate each day. For instance, the Urug community based on interview with abah ukat said that they use number 9 for Saturday and use number 6 for Friday. It is opposite with the calendar in modern era where the people use the word to show for each days. Meaning that chief of Urug societies have comprehended to imply number for the life like applying for indicating each days. The another application mathematic in life is utilize the symbol of mathematic in some building such as leuit. Based on observation and interview in kampung Budaya show that sundaness societies have recognized for using mathematical aspect when they build leuit. Leuit is one of the buildings in the past which played an important role in the life of the Sundanese people, especially for storing rice or grain. There are several applications of mathematical value to this building including the square shape, the triangular shape, the parallelogram, and the presence of woven bamboo for the walls. At the same time there is another shape that is round. For more details can be seen as shown below. In the leuit, it is seen that there is a combination of various mathematical objects to create the beauty of a Leuit wall. This proves that mathematics has been present in food management in the past. Leuit as a traditional food barn is equipped with mathematical symbols. Thus, the existence of mathematics is related to food management. With the incorporation of various forms of mathematical objects to support the food needs of the past.

At the same time as proof that mathematical ability is not based on calculations alone but is directly practiced in life in the past. Based on the leuit picture above, it shows that on the front wall of leuit there are triangles that are back to back or opposite but in the middle there is a square object where this square acts as an intermediary between the two triangles. Meanwhile, the one-sided triangle is placed on top of the three mathematical objects, both in the form of contradictory triangles and a square between the two triangles. The combination of geometry in the food barn building is not just putting it down, but also being part of the beauty on every wall of the leuit building. Architecture has strong ties to geometry because of its need for regularity and efficiency of construction, and the desire to create structures that are aesthetically satisfying. Form a triangle, square, circle, curve, cube, or sphere will be processed into beautiful works, both floor plans to facades, ornaments, the shape of columns, doors and windows shows the character of geometric shapes (Riogilang et al., 2015). The combination of

mathematical objects including geometry including values in architecture. Figure 1 below is a picture of leuit or traditional food barns.



Figure 1. Leuit Building



Figure 2. Leuit Building

From the picture above, it can be identified that there are various geometric buildings including equilateral triangles, right triangles, and squares as well as a combination of various geometric buildings giving rise to a very classic art element in the leuit building. There are several geometric buildings that can be identified on the roof of the leuit building and the leuit body building as shown in Figures 3 and 4 below.



Figure 3. The part of roof

There is a combination of equilateral triangle buildings, right triangles that are back to back, and there are square, rhombus and equilateral triangle buildings all at once to decorate the top of the leuit building roof frame. The figure can be seen in Figure 4

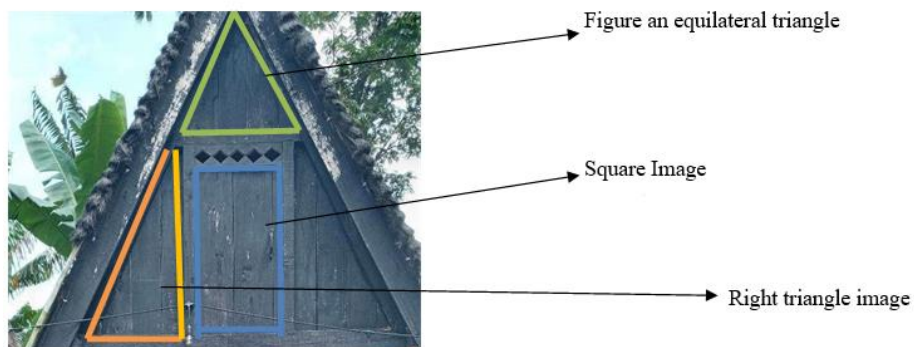


Figure 4. The Combination Of Mathematic Value In Leuit Building

The leuit roof as above illustrates that in the leuit building, the Sundanese people have traditionally been familiar with flat buildings which include geometric materials. Directly, geometric materials of various types are combined into one part of the roof so that there is an amalgamation. The purpose of the merger is to give beauty to each building so that it is not just to combine but to maintain the beauty of the building so that it appears to contain artistic value in each building. Geometry plays a big role in architecture because every geometric form that is present in space gives a different impression to humans who experience it (Pertiwi & Mahendra, 2017). A geometric shape plays a role in giving the appearance of nature. Geometry is part of architecture that plays a role in making people aware of the natural environment (Setyowati, 2009). The bottom of the leuit contains mathematical elements where there is an amalgamation of rectangles in the main frame and there is a combination of triangular shapes that are back to back each other. In this case, the shape of the triangle is a right triangle, but between the two right triangles it is limited by a square. While on the leuit wall there are many squares and the presence of woven bamboo which is used as the leuit wall. The bottom of the leuit which contains mathematical elements can be seen as shown in Figure 5 below.

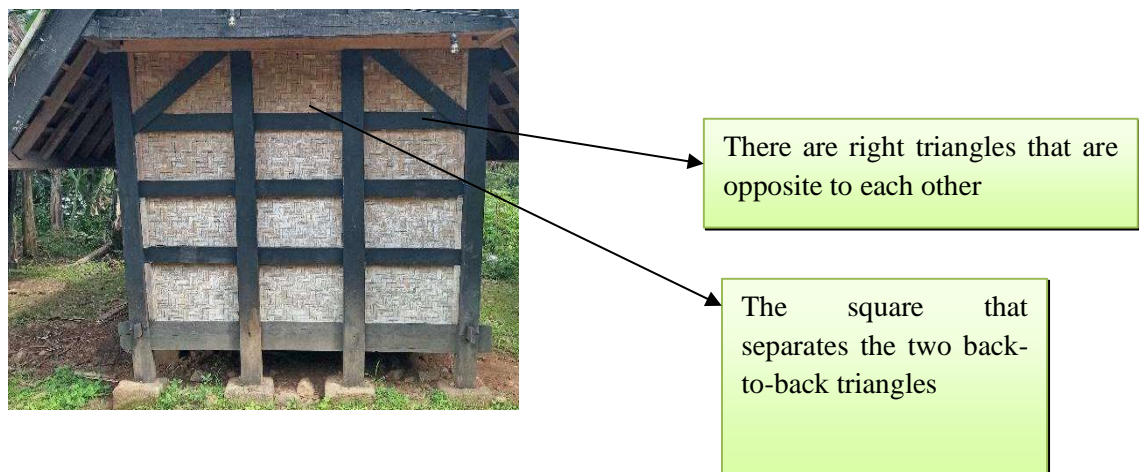


Figure 5. Leuit Which Contains Mathematical Elements

In addition to leuit buildings, traditional house buildings are also preserved in the cultural village in Bogor. In the traditional house door building there are 2 squares and 4 right triangles where each pair of triangles is positioned opposite the other while the other 1 pair of right triangles are positioned upside down with 1 pair of other triangles but still facing each other. In this door there is a combination of two squares with 4 right triangles at once. Where the position of the square is above and the right-angled triangle is below it. While on the windows of the house there are two rectangles and at the same time there are beam fins that are neatly arranged. While on the walls of the house there are woven bamboo and windows that also have rhombuses.

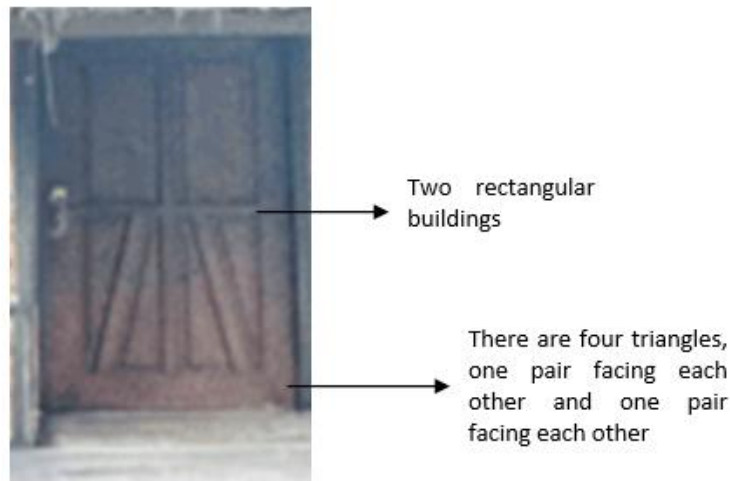


Figure 6. Mathematic value in the door

In addition to the door, in the building of the house there are walls made of woven bamboo. The wicker on the walls of this house combines various things related to mathematics, especially the game of perpendicular lines, horizontal lines, parallel lines and right angles. Besides that, there is a building space in the traditional house where each leg of the house is connected to a building block made of cement. Each lower corner of the house is in direct contact with the building blocks that have been built. The main purpose of the cube which is placed on the ground as a buffer for the main house building so that the building material does not rot easily if placed directly on the ground. In addition, the building blocks play a role in dealing with environmental disasters, including earthquakes because the house only sways to the rhythm of the earthquake because the house is not rigid but flexible and swings when the beams are hit directly with the ground. While brought to the house building, it will form the lower room of the house so that there is space under or under, the space in the house and the upper part of the house. The mathematical elements on the wall are shown in Figure 8.



The woven walls of houses made of woven bamboo contain mathematical value because there are straight, horizontal, perpendicular and straight lines that are parallel but become one part of the wall.

Figure 8. The wall of traditional house

The another culture physics is traditional equipment for producing the rise namely mortar. The appliance wield in previous era to processing paddy to rice. The paddy which is processed must be local paddy which has panicle. It show that there is specific paddy that it can be utilized to produce for rice



processing. Meaning that, the paddy which it doesn't possess panicle can't be processed in this tool culturally despite it enable to alter the paddy but it uncommon. Lesung has some meaning value where just women enable to operate the dimples. Man disallow to use it for producing the rice. There are some clues culture in mortar equipment. The traditional processing equipment can be viewed below in figures 9.



Figure 9. Applying Rectangle and Circle In Processing Paddies Appliances

The figure show that there are numerous parts of lesung comprises circle and rectangular form. It have a meaning where rectangular is women and circle is the man. It refer to the task of man and women in life. Women have pivotal position in producing the food quality through processing of paddy to rice. Meanwhile man unable to involve to conduct the responsibility of women. In mortar envisage the paddy which distinguish to paddy in general because the paddy where It will be changet must be included the panicle of paddies. On the contrary, in huller machine where the appliance for producing rice in modern community have eliminated panicle of paddies before the paddies is processed. Basically, in producing a food and the activity in the kitchen must be completed by man. It indicate that women doesn't regret in custory societies activity. It also show that women empower by the policy of custory societies where the role is implied in culture activity. As consequences as, the visitor from some of background status understand the value behind the tool of paddies processing. It is connected to the appliance for harvesting of paddies. as the panicle of paddies include, the appliance is Ani-ani. The equipment can be categorized as traditional tool where this kind of appliance still operate to harvest the paddies. In kampung Budaya, ani-ani are conserved. The another way to conserve the culture must be building the house of sundaness community.

## CONCLUSION

Based on this result can be concluded that Kampung Budaya in Bogor protects the traditional Sundanese building including leuit as the place for storing drying paddies, traditional houses of Sundanese, and traditional appliances for processing paddies to rice. All of the traditional buildings have mathematical value based on the culture of Sundanese. The previous generation has recognized the mathematical value in all of the buildings. In leuit as the place for saving paddies contain numerous

ethnomathematical including in the leuit building, especially on the roof of leuit which is in front there are mathematical elements such as a triangle facing each other but in the middle between the two there is a square and there is an equilateral triangle. While in traditional Sundanese houses there is woven on the walls where the wicker contains mathematical values ranging from straight lines, parallel lines, perpendicular lines, and horizontal lines. Besides that, on the door, there are four right triangles where one pair is opposite but the other pair is positioned upside down to the other.

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