

A stylized human figure composed of white and yellow lines, with a green dot for a head and yellow leaves for hair. The figure is surrounded by a network of white and yellow lines, suggesting a digital or technological theme. The background is a dark blue gradient with a faint network pattern.

EMBRACING SOCIETY 5.0 WITH HUMANITY

Editor: Diah Karmiyati

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Embracing Society 5.0 with Humanity

Editor : Diah Karmiyati
Desain Sampul : Ruhtata
Lay out/tata letak Isi : Tim Redaksi Bildung

Perpustakaan Nasional: Katalog Dalam Terbitan (KDT)
Yogyakarta: CV. Bildung Nusantara, 2022

x + 1115 halaman; 15 x 23 cm
ISBN: 978-623-6225-67-7
Cetakan Pertama: Maret 2022

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Universitas Muhammadiyah Malang

***Embracing Society 5.0
with Humanity***

Embracing Society 5.0 with Humanity

Society 5.0 is a concept presented by the Japanese as a core concept of their economic system. They believed that technology should not surpass the intelligent of men. As such, in society 5.0 the Japanese government would like to ensure that all technological things are designed to be a human-centered design. In fact, their ministry of education in 2018 has also been readily prepared the future generation through a change in their education system. For example, the minister explains that in Japan, or many parts of the world, university entrance are divided into two main concentrations, which are science and social science. The minister thought of changing the system, as society 5.0 is about creating a technology that is human centered. For instance, they gave an example on designer babies. If, people from hard science learn about philosophy, ethics, and humanities, they won't face such ethical concern when developing a product. This is what is being envision by the Japanese government for their younger generation. Collaboration between science and social science is necessary to build a better environment for our future children. Another example is the companies in Japan, such as Hitachi and Fujitsu has already been implementing this 5.0 by designing product that relied fully on technology but puts human at its center (Hitachi, 2017).

Likewise, it is currently a hot topic in Indonesia. Indonesia as a country with the 4th largest population in the world has not been implemented this concept. Our country is still on the industry 4.0. Yet, with the rising interest in AI, Blockchain, NFT, number of unicorn start-up. and all recent technological changes, our country are ready to compete with any other countries in Southeast Asia. Society 5.0 is coming, and we need to embrace it. To prepare with the society 5.0, It is not only the technological side. It is necessary for us to have a strong principle at hearts that based on our belief system. We, as an Indonesian have known to be religious that most of us believed in God. We also commonly practice our religion and tend to be kind to people because we know God would love our good deeds. I personally think that this will help us to move forward and live together with advanced technology.

Technology begets a very important leap in human's life journey. It is important to keep valued of the benefit but it's more important to look out for the human itself. As its purpose is smarter than us, to help us, it will be very ideal if we embrace the technology using our ability to be kind.

Malang, 21 Maret 2022

Diah Karmiyati

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Learning Geometry and Values from the Begalan Tradition: Ethnomatematic in Begalan Culture of Banyumas, Indonesia

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Introduction

Mathematics cannot be separated from cultural development so that mathematics learning must respect the cultural context [19]. Therefore, in order for students to learn mathematics effectively, they need a bridge between mathematics and culture in the form of ethnomathematics [25]. This is in line with the opinion of [6];[27] that the more relevant mathematics lessons to real life, the less correlation there is between mathematics and student understanding. Studies related to ethnomathematics are currently being carried out by researchers from all over the world. For example, examined the effect of using ethnomathematical ornamentation to study the congruence of triangles in Palestine. Examines insights about teacher awareness of the use of ethnomathematics in geometry learning in South Africa [27]. Researched ethnomathematics in the Beskalan Putri Malang Dance in Indonesia. Researching ethnomathematics in the Temple of Heaven, one of the famous heritage sites in Beijing, China [31]. Investigated the enculturation of mathematics in Ethiopia to help develop a culture-responsive mathematics education curriculum. Furthermore, emphasized that the Ethnomathematics-based curriculum helps students demonstrate a consistent mathematical process as they reason, solve problems, communicate ideas, and choose appropriate representations through the development of everyday mathematical practices.

The results of the research that have been discussed indicate the importance of developing teaching materials for mathematics education curriculum from cultural heritage artifacts, but the

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pedagogical values of cultural heritage which are very important for the formation of students' character have not been touched. Therefore, this study focuses on the ethnomathematical aspects that contain pedagogical meanings, especially in the Indonesian Banyumas Begalan Tradition. Thus, this study aims to explore mathematical concepts, especially geometry and pedagogical values in the Indonesian Begalan Banyumas tradition. The results of this study have at least 2 important contributions, firstly enriching teaching materials for school mathematics education in the field of geometry that are closer to student culture, and as a vehicle for strengthening national character education.

Ethnomathematics is the study of the relationship between culture and mathematical concepts. The main idea that mathematics is a product of socio-historical and cultural processes has developed with contributions from various cultures in society, and has given rise to what we now understand as school mathematics [4]. In addition, that ethnomathematics is related to how mathematics is produced, transferred, disseminated, and specialized in diverse cultural systems [31]. Knowing and understanding the value of pluralism, social aspects, economic, political and cultural aspects of diverse societies is a necessity in order to innovate learning that is more contextual and meaningful. According to the main goal of ethnomathematics is to build a civilization free from violence, arrogance, intolerance, discrimination, injustice, bigotry and hatred. In addition, to understand the relationship between mathematics and culture, so that students and society's perceptions of mathematics become more precise and easy to understand [24] and to rebuild individual dignity, acknowledge and respect their cultural roots [21]. In ethnomathematics there are cognitive, conceptual, educational, epistemological, historical and political dimensions. An understanding of aspects of ethnomathematical studies can be a new perspective for adopting culture-based learning [20]. Revealed that the ethnomathematical approach requires students to use everyday experiences in building their understanding [3]. S stated that through ethnomathematics students can take lessons easily and recognize their own culture [17]. Through ethnomathematics students can carry out the process of abstraction, idealization, and generalization about geometric objects [16].

Suggests that ethnomathematics is a relatively new field of study that is supported by many researchers in the field of mathematics education [7]. Recently, research in the field of

ethnomathematics is growing rapidly. Examined the habits of the Kabihug community in the Philippines in carrying out simple calculations, encoding [11], classifying, sorting, inferring and modeling patterns that arise from the environment to develop learning in schools. Examined the Hatam language related to the addition of sums in Abacus [8]. Examines the Balinese I traditional house with the concept of similarity, shift and reflection [28]. Researched the Kudus tower related to spatial structures [30]. Researched Javanese primbon about matchmaking predictions to develop residual and modulo theorem material [29]. Examined the activities of cocoa farmers in Temusari Sempu Banyuwangi village and succeeded in finding the concepts of comparison and social arithmetic as teaching materials for students' mathematics [5]. Researched the Borobudur Temple in Magelang Indonesia to explore data geometry materials and fractal geometry [13]. Using ethnomathematics as an approach and teaching method may vary depending on the culture of the students. Studied the Ornaments of the Great Mosque of Bandung to explore Geometry transformation material [22].

Recommend ethnomathematics to develop school mathematics curriculum [26]. This is intended so that mathematics is closer to their culture so that it is more realistic and more meaningful. Based on the results of research, ethnomathematics-based mathematics teaching materials have been proven to be effective on students' mathematical problem solving and critical thinking skills [10]. In addition, the mathematical understanding of students who are ethnomathematically oriented is higher than students who are not ethnomathematically oriented [9]. According to [18], learning geometry in schools is more effective and meaningful if it is associated with experiences and activities found in the students' own cultural environment. Teachers' awareness of cultural examples and activities that can be integrated into geometry teaching, has the potential to influence their understanding of how students acquire geometric concepts

Indonesia is a multicultural country [14];[1];[2] because Indonesia has 17,481 islands and 718 regional languages, and a very diverse cultural wealth, one of which is the Begalan art which is the cultural wealth of Banyumas Indonesia.

The Begalan tradition during the wedding ceremony, is a cultural characteristic of the Indonesian Banyumas people which is very important to be inherited. Because many traditional cultures in Indonesia are now almost forgotten by the younger generation [23].

Begalan is a form of ritual as well as art that is very important in the wedding ceremony in Banyumas because in addition to having a function as a means of repelling reinforcements, it contains da'wah values, educational values, and social values that are intended for the bride and the community who attend the ceremony. Begalan performing arts not only discuss marriage advice but also provide teachings that must be carried out in the process of socializing social life and obligations that must be carried out to God [15]. Begalan art performance is a medium for transferring educational values that is useful as a demand for human daily actions, both as God's creatures and as members of society. The Begalan tradition in its implementation uses *ubo rampe* or equipment consisting of household utensils as teaching aids to explain how married life is, because each piece of equipment brought has its own meaning. Explained that Begalan is a combination of dance and folklore that involves humor accompanied by traditional musical instruments which usually occurs in the front yard of the bride and groom [12]. In their performance, the two dancers engage in dialogue containing important advice for the bride and groom. The two dancers each play a role as *Gunareka* (representative of male friends) and *Rakaguna* (representative of female friends). The conversation between *Gunareka* and *Rekaguna* [15] discussed the use of each property as well as their symbolic meaning. After the conversation ended, *Rekaguna* broke the *kendhil* containing the coins as a symbol that the obstacle had disappeared.

Results and Discussion

Begalan is an artistic tradition of the Indonesian Banyumas people, to give advice about domestic life to the two friends which is expressed in the form of dance art using household utensils called *Brenong Kepang* which has pedagogical meaning. Data collection in Karangwangkal Village, Banyumas Regency at the wedding of Tedy Agus Permana bin Samiran Sokaraja Banyumas with Amalia Sufia Khajar bin Adi Suryanto Karangwangkal Banyumas. The *Brenong Kepang* brought as *ubo rampe* (equipment) from Begalan were (1) *Pikulan* (2) *Ian* (3) *Iilir* (4) *Steam* (5) *Siwur* (6) *Cething* (7) *Kekeb* (8) *Tampah*, and (9) *Kendil* contains *Cirri*-covered coins, and all of which will be explained later. All of the utensils are made of bamboo except for the *kendil* and *cirri* which are made of earth. *Brenong Kepang* is very closely related to the philosophy of human life, especially for the

bride and groom who will live a new life. The complete picture of Brenong Kepang can be seen in Figure 1 below:



Figure 1. Begalan Scene in Karangwangkal Banyumas Indonesia

In the *Begalan* ritual there are textual meanings, contextual meanings and symbolic meanings. The textual meaning is in the form of household advice to the bride and groom about what should be done and what should not be done when starting a married life. The contextual meaning of *begalan* is a request for salvation in the world for the life of the bride and groom in navigating their new life. While the symbolic meaning is related to the philosophy of *Brenong Kepang* whose picture is presented in Figure 2 below.

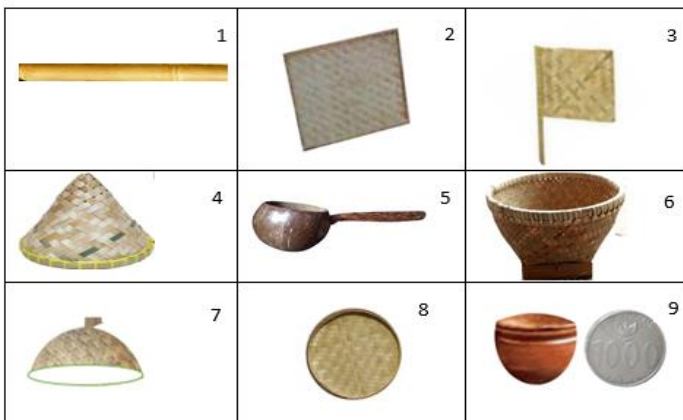
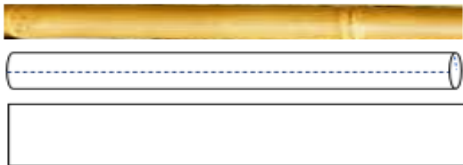


Figure 2. Brenong Kepang (household utensils) Begalan equipment

From the recorded dialogue between Gunareka and Rakaguna during Begalan and matched with the results of interviews, field notes and geometric mathematical concepts, the meanings of Brenong Kepang can be explained as follows:

Pikulan

Pikulan is a tool to carry two balanced loads, in the tradition of begalan pikulan gives a message that in the household there must be a balance between male and female brides known as sekufu which means equal. *Pikulan* also hints at the meaning of mikul duwur mendem jero, meaning that some household burdens are heavy and some are light, therefore all things must be shared. *Pikulan* is made of bamboo in the form of a tube. *Pikulan* can be used to teach students on tube material, both the area of the tube blanket and the volume of the tube.



A *Pikulan* with radius r and height t then:

(1) Volum of *Pikulan* = $\pi r^2 t$

(2) Area of *pikulan* blanket = $2\pi r t$

Figure 3. *Pikulan* is tubular

Ian

Ian is a woven bamboo that serves as a base for spreading rice to cool quickly. In the Begalan tradition, *Ian* is used to describe the universe which has four cardinal directions, namely east, west, north and south. Humans who are given the gift of creativity, taste and intention are given the mandate to take care of the universe so that life in the world can be safe, peaceful and peaceful. The way to take care of the universe is to establish brotherhood between *sedulur tuwo and sedulur nom* (older and younger siblings). *Ian* is a geometric figure in the form of a rectangular area. *Ian* can be used to introduce plane material such as the area and perimeter of a rectangle.



An *Ilan* with length p and width l units, then:

- (1) *Ilan's* area is $p.l$
- (2) *Ilan's* perimeter is $2(p+l)$

Figure 4. *Ilan* is a rectangular area

Ilir

Ilir is a fan made of woven bamboo that functions as a rice cooler. In the tradition of Begalan *Ilir*, it is often referred to as *Susuhing Angin*, which means the source of the wind which serves to give a message that someone who is married can distinguish between good and bad deeds so that they can make wise decisions. *Ilir* can also mean big universe small universe. Home life has just entered a small universe. *Jagad in ilir* includes 4 angles which means that the bride and groom must be able to provide coolness to 4 things, namely father, mother, father-in-law, and mother-in-law. The function of *ilir* is to be able to cool fellow partners if there is chaos. In addition, *ilir* can also eliminate unpleasant odors. *Ilir* is in the form of a rectangular area that has a handle, so it can teach students about the perimeter and area of a square.



An *Ilir* whose side length is s then:

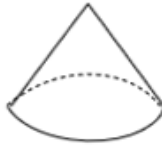
- (1) *Ilir* area is s^2
- (2) Circumference of *Ilir* is $4s$

Figure 5. *Ilir* leaves in the form of a square area

Kukusan

Kukusan is a household appliance made of woven bamboo and serves to cook rice. *Kukusan* gives a message that people who are married must struggle to make ends meet as much as possible. *Kukusan* also gives a strong message in holding to the principles of (1) *metu*, which is to go out for *bebrayan* (building togetherness), (2) *mengkurep*, which is to remember both parents, (3) *mlumah*, which is to remember the Almighty, and *modot*, which is to be critical, creative and innovative in realizing one's dreams. wish. *Kukusan* is in the form

of a cone that can be used to teach students, especially the volume and area of the cone blanket.



A *kukusan* with radius r , height t and painter's line s then:

- (1) Volum of *kukusan* = $\frac{1}{3}\pi r^2 t$
- (2) Surface area of *kukusan* = $\pi r(r+s)$

Figure 6. Cone-shaped *kukusan*

Siwur

Siwur is a household appliance made of coconut shell and serves to fetch water. *Siwur* (Javanese) means not to be inconsequential (not at will). In the *Begalan siwur* tradition, it conveys the message that in household and social life, a person cannot live as he pleases himself, but must always follow the applicable rules in order to be able to coexist with other people in his environment. *Siwur* also gave a message that people who are married must be able to control their lusts, don't easily spread feelings of love to others. *Siwur* is in the form of a hemispherical shape that can be used to teach students to calculate the volume of a half sphere and the surface area of a half sphere.



Siwur with radius r then:

- (1) Volum of *Siwur* $\frac{2}{3}\pi r^3$
- (2) Surface area of *siwur* = $2\pi r^2$

Figure 7. Half -ball -shaped *siwur*

Cething

Cething is a household utensil made of woven bamboo and serves as a rice container. In the *Begalan* tradition, *cething* describes a container or organization in society that has certain rules. *Cething* is also called a *wakul* in the form of an ellipsoidal beak that is hollow so that the air can circulate properly to keep the rice from going stale quickly.



Cething with major axis a and minor axis b then
 Volum of *cething* is
 $\frac{4}{3}\pi ab^2$

Figure 8. *Cething* as half ellipsoid

Kekeb

Kekeb is a household utensil made of woven bamboo and serves as a cover for the *kukusan* when cooking rice. In the *Begalan* tradition, *kekeb* gives a message that in domestic life husband and wife must be able to cover each other's shortcomings. *Kekeb* is a geometric shape in the form of a half ball



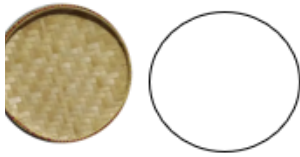
Kekeb with radius r
 then:

- (1) Volum of *kekeb*
 $\frac{2}{3}\pi r^3$
- (2) Surface area of
kekeb $2\pi r^2$

Figure 9. *Kekeb* in the form of a half ball

Tampah

Tampah is a household utensil that serves to *nyunggi* (carrying things over the head). In addition, winnowing also functions as a sieve, namely selecting between the rice to be cooked and the dirt that must be removed. In the *Begalan* tradition, it symbolically appears to give a message to protect the disgrace from the shortcomings of both parties. In addition, it also gives a message that people who are married must be able to select good and bad words and actions. *Tampah* is in the form of a circular area that is surrounded by bamboo so that it is strong and can be used to carry a number of items. *Tampah* can be used to teach students about the area and circumference of a circle.



- tampah* with radius r then:
- (1) Wide of *tampah* = πr^2
 - (2) Perimeter of *tampah* $2\pi r$

Figure 10. *Tampah* as a circle area

Kendil, Cirri and Coin

Kendil is a household appliance made of soil and serves as a place to store goods/food. Usually the *kendil* is closed by using *cirri*. Aside from being a lid for the *cirri* *kendil*, it also functions as a container for softening cooking spices (such as chili, salt, sugar, onions and others) or making chili sauce. In the Begalan tradition, *kendil* gives a moral message to live a life of *gemi nastiti ngati-ati* (frugal). *Cirri* gives a message that people who are married must be able to organize various kinds of differences so as to produce a strong and beautiful unity. Inside the *kendil* there are a number of coins that are ready to be grabbed after the *begalan* is over. Coins describe the sustenance that everyone in a household should look for. *Kendil* berbentuk bangun setengah elipsoidal sedangkan *coin* berbentuk daerah lingkaran.



Figure 11. *Kendil, Cirri and coin*

- Kendil* with major axis a and minor axis b and coin with radius r then:
- (1) Volum of *kendil* $\frac{4}{3}\pi ab^2$
 - (2) Area of coin = πr^2
 - (3) Perimeter of coin = $2\pi r$

Conclusion

Ethnomathematics provides hope for the future to bring mathematics closer to students realistically, as well as to promote the culture of a society with dignity. Furthermore, ethnomathematics can be used as a sector of mathematics curriculum development in Indonesia. The people of Banyumas have used the concept of geometrical shapes and flat shapes to make household utensils (*Breanong Kepang*) as well as Begalan art equipment containing pedagogical values to give advice to the bride and groom in entering the household ark.

Acknowledgement

We would like to thank the Research and Community Service Institute for providing support in research funding and also to the begalan association who has been willing to provide research data and to all parties who have supported the implementation of this research.

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