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An ethnomathematical analysis of the Gandrung Lombok dance as an effort to utilize local wisdom in the mathematics learning process

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ABSTRACT

Ethnomathematics is currently also a bridge for the emergence of new strategies in the mathematics learning process. The aim is to make mathematics easier to understand by finding cultural facts in everyday life, such as in the Gandrung Lombok dance. Until now, there has been no study of ethnomathematical analysis of the various movements of the Gandrung Lombok dance that can be used in the learning process. The aim of this research is to explain the ethnomathematics aspects of various Gandrung Lombok dance movements. The research was conducted using a qualitative descriptive method with an ethnographic approach involving participant observation, interviews, and documentation. Interviews were conducted with maestros and performers to explain and describe various mathematical phenomena in various Gandrung Lombok dance movements. Then, the collected field data was analyzed using a qualitative descriptive approach, and the validity of the data used in this research was tested using triangulation techniques. The results of the research explain that counting and measuring activities are performed in various Gandrung Lombok movements. Counting activities are carried out repeatedly by counting the numbers one to eight accompanied by accompanying music. Measurement activities in the presentation of Gandrung Lombok dance movements are implemented in the presentation of movement patterns, including hand, foot, and floor patterns. Ethnomathematics related to measurement is carried out by applying the geometric concepts of semicircles, circles, and triangles. The triangle concept is the most dominant concept in various Gandrung Lombok movements, which can be seen in the shape of the hand and foot patterns. One of the findings in this research explains that the concept of triangular geometry is an important element in building the aesthetic image of Gandrung Lombok, which needs further proof.

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1. Introduction

The discipline of mathematics sciences tends to be understood as a neutral, independent field that is detached from social values. The understanding of general society to this discipline tends to the problems of algorithms, axiom, and theorem explaining the existence of fact learning; the assessed concept is accepted universally. Such a view will perpetuate the veil of separation between both of them because the existence of culture cannot be separated from the value of variety in society [1]. On the other hand, society is faced with the causality of both, where the progress and retreat of culture are never separated from education development. The educational development that is meant clearly leads to the development of various sciences, without exception mathematics, which is a part of it. The relationship between education and

culture, in general, seems to be the opening of the connection between them as the new perspective currently known as ethnomathematics [2]. Reflecting back on some of the views about mathematics, explaining it as community life [3]. Mathematics is one of the sciences that is commonly used to solve daily problems in community life. This view further strengthens the awareness that culture and mathematics are two elements that go hand in hand in community life. In fact, society has used the concept of mathematics a lot in their daily life, but they seem less aware of it, so the relationship between mathematics and culture is still considered unclear and unrelated. The birth of ethnomathematics has also become a bridge to emerging new strategies in the mathematics learning process. In observing the learning process in the several education units, until today mathematics is still maintained in the stigmatization of difficult and boring lesson. This fact has implication for the lack of motivation and interest of students in the mathematics learning process [4]. The contextualization of mathematics in daily life is born as a strategy and stimulant for students to be more attractive and easily understand mathematics through their own cultural idioms. Understanding the mathematics concepts through reality and empirical experiences that students own. Through such a process, mathematics learning will be easier to understand because students can easily find cultural facts about mathematics concepts in their daily lives [3]. The contextualization of various mathematics concepts in daily life can be implemented to the cultural diversity such as traditional house, traditional clothing, culinary, music, dance, and so on.

Gandrung dance in the midst of the Sasak society life, now tends to be understood as an entertainment art entity. Historically, this dance has been related to the distribution of Gandrung in Banyuwangi and Bali [5]. As a form of cultural diffusion, Gandrung Lombok has undergone changes in its form adapted to the idiom and aesthetics of the typical movements owned by the Sasak society. It explains that Gandrung Lombok is an authentic entity that represents the reality and character of the community. It is constructed through a variety of values that live and grow in the Sasak community life. The existence of Gandrung Lombok becomes a form of cultural acculturation, which then develops into a community identity. In its performance, Gandrung Lombok no longer contains the image of Banyuwangi or Bali in every aesthetic movement presented. Formally, the society will be able to identify that the appearance of the various movement forms presented is different from the variety of movements found in the Gandrung Banyuwangi and Bali performances. The distribution of Gandrung in Lombok, in fact, is influenced by the idiom movement owned by the Sasak society [5]. The Gandrung, which was previously presented by a dancer from Bali on its journey, was replaced by the Sasak society. In Sasak society, initially, Gandrung was intended to entertain the soldiers returning from the battlefield. This dance becomes a representation of the joy of Sasak society, which then becomes a tradition in society's life. So far, this classical dance has not been utilized in the mathematics learning process in formal education units.

The authenticity of Gandrung Lombok can be seen through the display and the presentation of various movements in its performance. Gandrung dancer uses corrective makeup by clarifying face contour and expression. In the performance, a dancer wears a *gegelung* decorated with a frangipani flower. *Gempolan,* which is a form of a frangipani flower arrangement, is put above the ears. The clothes used seem practical and generally consist of long sleeve shirt, *kamben* which is wrapped around the chest, *bapang* as the decoration on the neck, at the waist using *stagen*, *seret* tied to the *stagen* in the form of a small rope, *eleq-eleq* attached to the *bapang* to stomach, *gonjer* in the form of the colorful shawl, and the property such as a fan. The overall form of the Gandrung Lombok performance shows two parts of the rounds. The first round is known as Bapangan, and the second part is called Gandrungan. In its performance, the Gandrung Lombok dance involves the whole of the dancer's body part, such as the head, hand, body, and feet [6]. Each variety of movements is presented together to form a structured pattern as a construction of the presentation aesthetic. Accompanied by *gamelan* traditional music, the audience was immersed in the image of the typical nuance of the Sasak society. The mathematics contextualization is implemented in this study through the entity of Gandrung Lombok aesthetic movement variety. The studies regarding ethnomathematics in dance have been conducted before. Some of the studies are about the implementation of the geometry concept geometry in traditional dance [5][7]–[10]. The ethnomathematics study of the movement variety of

Gandrung Lombok is a new discourse that has never been done before. This is an offer to explore and utilize cultural wealth and local wisdom as materials in the learning process. Besides that, this study also intends to find the meaning of reading about the correlation between the two. So far, studies regarding Gandrung Lombok have been conducted to understand the aesthetic element, the historical aspect, the development, and its usage in the creation of fine art [8], [11], [12]. This study aims to explain the ethnomathematics aspect of the variety dance movement of the Gandrung Lombok. The ethnomathematics aspect of Gandrung Lombok was studied in relation to the presentation of variety movement in the Bapangan section. In this section, the form of the presentation is more structured and orderly. Every movement has been arranged in such a way, and there is no improvisation room for the dancer. This effort is a step in explaining and affirming the relationship between mathematics and the culture owned by the Sasak society.

2. Method

In an effort to explain the relationship between culture and mathematics in the variety dance movement of Gandrung Lombok, this study uses a descriptive qualitative method with an ethnographic approach. This process is carried out to explain and describe the various phenomena that appear in the field. In this case, research is the key to giving meaning to the various emerging phenomena [13], [14]. The ethnographic approach is used in the observation process to explain the overall value meaning of the variety dance movement of Gandrung Lombok [15], [16]. The research was conducted through 3 stages: data collection, analysis, and presentation. The data collection method was conducted through direct observation, interviews, documentation, and literature study. Observations were carried out using participant observation, where the researcher was directly involved as a Gandrung Lombok dancer. Data mining was carried out using unstructured interview techniques with three sources who were Gandrung Lombok figures. The three people in question include Jero Sri, the Gandrung Lombok maestro, Mariadi Basri, the Lombok traditional arts maestro, and Irma Septiana, the Lombok Gandrung dancer. Then the collected field data was analyzed using a qualitative descriptive approach through the stages of data reduction, data presentation, and finally drawing conclusions [7]. Meanwhile, the validity test of the data used in this study is by triangulation. The studies regarding ethnomathematics in dance have been conducted before. Some of the studies are about the implementation of the geometry concept geometry in traditional dance [5] [7]–[10]. The ethnomathematics study of the movement variety of Gandrung Lombok is a new discourse that has never been done before. This is an offer to explore and utilize cultural wealth and local wisdom as materials in the learning process. Besides that, this study also intends to find the meaning of reading about the correlation between the two. So far, studies regarding Gandrung Lombok have been conducted to understand the aesthetic element, the historical aspect, the development, and its usage in the creation of fine art [8], [11], [12].

3. Results and Discussion

3.1. The Form of Gandrung Lombok Performance

The form of Gandrung Lombok's performance is generally divided into two sections. The first section of the Gandrung performance is called *Bapangan*. The mention of this part is not separated from the existence of accompanying gending, where throughout this round, the Gandrung dance is accompanied by Bapangan music. Besides the accompanying gending, this part can also be identified from the existence of the dance presenter, where the dance presentation in this round is only performed by a female dancer. The Gandrung performance usually performs more than one female dancer and can be classified as a form of group dance. The *Bapangan* part is presented by showing the same variety of movements, which are done together throughout the performance. The dance is shown dynamically in line with the rhythm of the accompanying music. The sound of the drum in the accompanying music gives emphasis following the dance movement shown. The nuance built into this performance is more flat. This section is a space for a female dancer to introduce herself to the audience or connoisseurs. In

the context of Gandrung Lombok, this effort to introduce herself is more aimed at the 'candidate' male dancer who will dance in pairs in the next round. The next section is known as Gandrungan, where a female dancer invites the audience (man) to dance together. This part begins with a female dancer giving the hand fan that is in her hand to the audience, often called a *nenepek* (who is affected by a hand fan). This is a sign that those affected by *tepekan* are the ones chosen to dance together. The female dancer and the audience, who were affected by the hand fan, entered the stage to dance together like a lover couple falling in love. The two dancers pay their respects to each other before dancing together. The presentation form of the *gandrungan* round is no longer structured, as in the Bapangan round. Neither female nor male dancer who is on the stage only seems to present harmonious movement in line with the presentation of accompanying music *gending*. Each performs the idiom of movement that is expressed expressively to present the appearance of 'gandrung' over both. The presentation rhythm in the accompanying music tends to be more cheerful, performing excitement as a representation of happy feelings.

3.2. The ethnomathematics in the Movement Variety of Gandrung Lombok

The dance movement is an important and main element in the presentation of the Lombok Gandrung dance. In the movement presentation, the uniqueness of Gandrung Lombok is manifested, which becomes a differentiator from the Gandrung presentation in another region. The presentation of the Gandrung Lombok dance, besides being presented in the movement form, is to be enjoyed for its artistic value; the Gandrung Lombok dance movement also essentially has the meaning of respect or dedication to the soldiers returning from the battlefield, which is shown by the fan property used to keep the soldiers no overheat [17]. The Gandrung Lombok dance movement's presence is based on an important factor, namely the regularity of the count in each movement so that a beautiful dance is created to be seen in real life. The Gandrung Lombok dance movement is a series of movement varieties that have been arranged sequentially. In the Gandrung Lombok performance outline, nine varieties of movements are shown.

The ten varieties of movements include *Nyengkang, Bapang, Ngeluhluh, Ngebah, Ngeter, Jujung Kepet, Nyelepit, Turun Tangis, and Narung*. The nine varieties of movements are presented structurally and orderly in the Bapangan section. The Nyengkang movement in the Gandrung Lombok performance presents the elegance of the dancer. The variety of forms of this movement involves the use of the hands and feet collaboratively. The dancer's hands simultaneously move towards the back of the ear and end by rotating both wrists. The position of both hands is bent in front of the shoulder, with the palms facing inward. At the time of rotation, the two palms touch the flowers attached to the two sides of the dancer's ears, and then, they look up and open their faces. The two flowers attached on both sides in ancient times generally contained *senggeger* (allure). It is intended to attract the audiences who watch the performance or, more specifically, used to attract the opposite gender by Gandrung dancers. The *Nyengkang* movement can be described in Fig. 1.

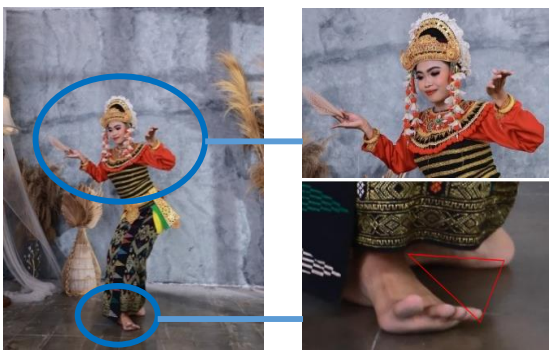

Fig. 1. *Nyengkang* Movement

In the *nyengkang* movement, the position of both dancers' feet forms an angle of 45 degrees. The right foot is in the back horizontally, and the left foot is in the head with a vertical position. These two positions of the dancer's feet explain that two relationships must be maintained as a foothold in living life. The horizontal foot position explains the relationship between humans to humans and humans to the universe. The vertical foot position gives an overview of the relationship between humans and God. These two things must always be maintained and become a foothold in living life. Based on the picture above, the shape of the foot movement of the Gandrung dancer forms a 45-degree angle. Ethnomathematics in the movement variety of *nyengkang* is found in counting and measuring activities. In the counting activity, the dancer adjusts to the counting on the accompaniment music. Repetitively, the dancer performs the counting activities from numbers 1 to 8, adjusting to the tempo speed presented in the accompaniment music. On the 4th count, the right leg is raised and alternates with the left leg. The movement is repeated for two repetitions (2 times the gong sound). The measuring activity is carried out by measuring the foot position that closes and opens to form a 45-degree angle. The movement of both dancer's feet forming a 45-degree angle explains the construction of the geometry concept of an isosceles triangle. It is even clearer if it is done through a photo shoot and draws a straight line from each angle formed. Three angles describe the position of humans and the universe, which are close to each other in life. Both angles are similar in size and tend to be larger than a 45-degree angle. In essence, both have the same purpose and direction at the higher top, as the manifestation of God in the relationship between the three. In the concept of triangles, there are three angles that are interconnected. This is a representation of the Sasak society's life, which must always maintain a balance between the three, namely God, humans, and the universe [17]. The second variety of movement that can be watched at the Gandrung Lombok performance is the *Bapang* movement. That variety of movements is carried out with the left foot position in ahead and the right foot in the back of the left foot with the left foot direction to the left diagonal direction and the right foot direction to the right diagonal direction by bending the knee slightly. Move your head quickly from right to bottom left, followed by the right-hand movement, in which the position is "above the head" while holding the hand fan. The left-hand position is forward, with a palm sticking out parallel to the left waist position.

Ethnomathematical activities in the *Bapang* movement are found in counting the beats during the implementation of the movement. Counting activities are carried out by adjusting the tempo speed of the accompaniment music. The dancer counts each part of the movement as many as eight counts. This is done twice in one pattern of presenting the Bapang movement. The dancer presents an alternating pattern between the right and left hands in the two counts. In addition to counting, Gandrung Lombok dancer also does the measuring activity. The measuring activity is carried out in the shape of a hand forming a 90-degree angle with the palm facing forward. The *Bapang's* movement presentation is an implementation of the geometry concept of an isosceles triangle. It is implemented not only in constructing shapes in the hand movement but also in the foot movement. The dancer must also implement this concept in positioning her legs when presenting the movement. The two isosceles triangle buildings presented in the position of hand and foot movements are the key to the aesthetic building of the *Bapang* movement in the Gandrung dance performance. The *Bapang* movement can be described in Fig.2.

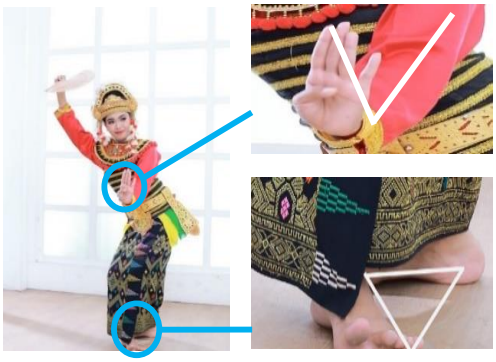

Fig. 2. *Bapang* Movement

The next variety of movement is *Ngeluhluh*. That variety of movement is carried out with the position of the right hand holding the fan "above the head" by moving the fan. The left-hand position is next to the left waist, as seen in the *bapang* movement. In this section, the sole tip of the dancer's foot is moved in a circle to form a semicircle by using the heel as the axis. The dancer then performs a circular movement in a clockwise direction. The *Ngeluluh* movement can be described in Fig.3.

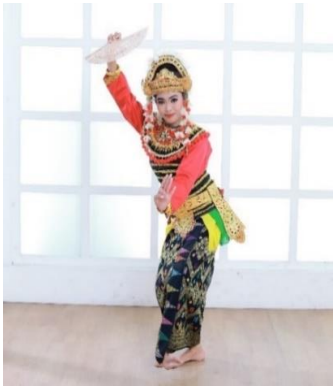

Fig. 3.*Ngeluhluh* Movement

Ethnomathematics activity in the *Ngeluhluh* movement is seen in the counting activity, which adjusts the rhythm to the accompaniment of Sasak's typical gamelan music. Count by repeating the numbers 1-8. This movement is carried out as many as two repetitions or twice the sound of the gong (2 x 8 counts). In this variety of movements, besides implementing the concept of isosceles triangle geometry that appears in the hand movement, a dancer also implements the concept of a circle shape. The circular concept in this dance movement represents the cosmos consciousness owned by the Sasak society. The unity of the cosmos consisting of micro cosmos and macro cosmos is reflected in the movement of turning the toes and step turning in a clockwise direction. In this case, the Sasak community is required to protect the environment always. This is found in the value of community life in the discourse related to the *kemaliq* [18], [19]. The *Ngebah* movement is done by stretching both hands parallel to the shoulders; the right-hand holds the hand fan facing down and the left fingers facing upwards. Both legs are slightly folded, with the position of the right and left heel touching each other as if forming a stance position. In this movement, the ethnomathematics activity is the dancer counting the sound gong one time or one repetition. Counting from 1-8 adjusts the tempo of the accompanying music presentation. The other ethnomathematics activity is to measure the angle formed from the position of stretching both hands. Where the two arms are stretched from a 90-degree angle by the dancer's body, the angle that characterizes the existence of the geometry concept of the isosceles triangle also appears to be shown by the two feet' position. In the series of Ngebah movements, the dancer also performs circular movements by forming a circle pattern. The *Ngebah* movement can be described in Fig.4.

Fig. 4.*Ngebah* Movement

The *Ngeter* movement is done with the position of the legs forming a V, and the body stands facing forward and slightly bent. The right hand is straight to the side at the shoulder height, holding the hand fan, and the left hand is bent in front of the chest at the shoulder height. In this movement presentation, the dancer practices the geometry concept of the isosceles triangle in the shape of the two legs position, as in Fig.5.

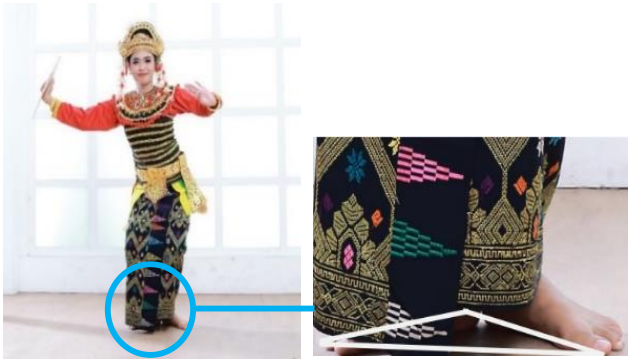

Fig. 5. *Ngeter* Movement

The *Jujung Kepet* movement means lifting the hand fan, as shown in Fig.6. As in the case of its mention, that movement can be identified from the pattern where the dancer lifts the hand fan she carries upwards. The *Jujung Kepet* movement is done with the right hand holding the hand fan straight up. The left hand is at the waist to form a triangle. This movement is accompanied by up and down body movement following the music rhythm. In this movement presentation, the dancer implemented the triangular geometry concept.

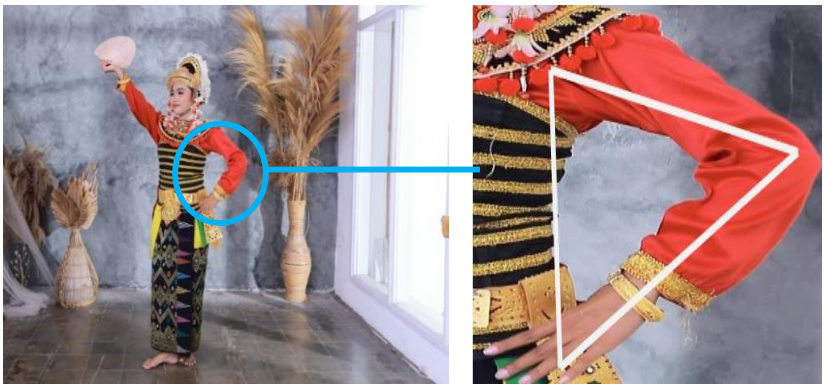

Fig. 6. *Jujung Kepet* Movement

The *Nyelepit* movement is carried out with the left hand blowing the *gempolan* (the flower in the ear) on the left side and blowing the *gonjer* (shawl) that exists on the left waist. This blowing movement is carried out by the dancers in turn. On the other hand, the right-hand shakes the hand fan with the hand fan position directed towards the dancer's body. The *Nylempit* moment can be described in Fig.7. The ethnomathematics activity in the *Nyelepit* movement in the Gandrung Lombok dance consists of counting activities. The counting activity is carried out by adjusting the accompaniment of Sasak's typical gamelan music. Count by repeating the numbers 1-8. This movement is carried out by counting one time of the gong sound. The measuring activity in the *Nyelepit* movement is done by the dancer in the position of both legs, forming a 90-degree angle. The shape of the *Nyelepit* movement is carried out with the left foot position straight forward and the right foot with a vertical position in front of the left foot so that if a line from the heel position of the left foot to the right toes, an isosceles triangle will be formed.

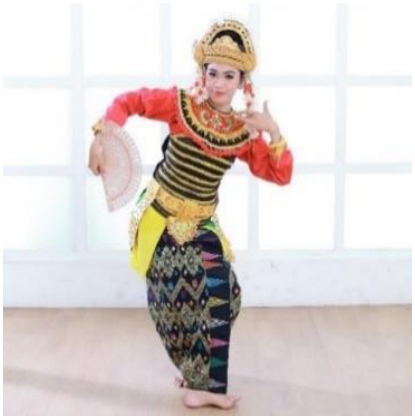

Fig. 7.*Nyelepit* Movement

The *Turun Tangis* is carried out alternately facing two directions: the first is in the direction of the front right oblique, and the second is the left front oblique, as in Fig.8. The first movement is done with the body slightly slanted to the right and facing the front right oblique, the right-hand bents in front of the chest by holding a hand fan that covers the face in part. The position of the left hand is bent and placed on the thigh of the left leg. Ethnomathematics activities in the Turun Tangis movement consist of counting and measuring activities. The counting activity was carried out by adjusting the accompaniment of Sasak's typical *gamelan* music. Count by repeating the numbers 1-8. This movement was carried out in 5 repetitions, twice in the kneeling position and three times when in the standing position. The dancer carries out the measuring activity in the Turun Tangis movement, with the body position forming a number 8 pattern and the leg position slightly bent. In this position, the two legs form a 90-degree angle. In the Turun Tangis movement presentation, the dancer implemented the geometry concept of an isosceles triangle. The concept can be seen in the position of the left hand, which is bent and placed on the thigh. The dancer also implements this concept on the legs, where the two legs also appear to form a triangle line.

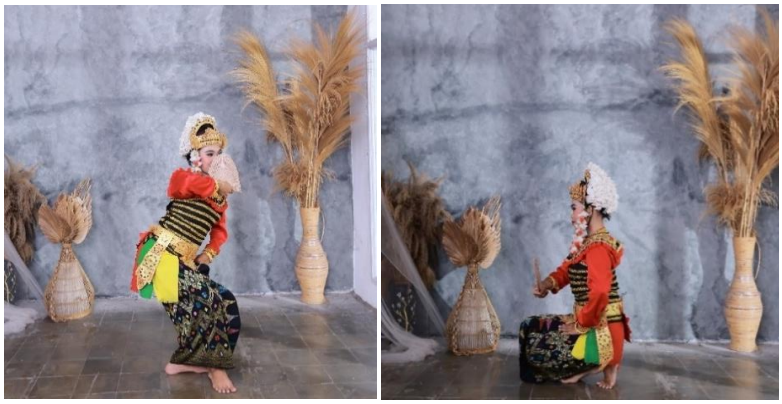

Fig. 8. Turun Tangis Movement & Narung Movement

The *Narung* movement is done in a sitting position with one of the heels with the side of the other leg ahead with the knee bent as shown in the Fig. 8. The dancer then stands up from a kneeling position before stepping on her right foot first. Stepping towards the back of the stage. In the narung position, the dancer counts four times to adjust the beat to the accompaniment music before standing and stepping. The measuring activity is shown in the body position, forming a pattern of the number 8 with the legs position slightly bent. The position of the legs also forms a 90-degree angle. The geometry concept formed in the *narung* movement is an isosceles triangle. This can be seen in the shape of the hand position in the *narung* movement. An isosceles triangle will appear if drawn in a straight line. This shows that in the *narung* movement, the Gandrung Lombok dance uses the geometry concept of an isosceles triangle.

Understanding the overall variety of movements in the Gandrung Lombok dance through the understanding of ethnomathematics in this study can explain the existence of counting and measuring activities. The counting activity in the gandrung dance presentation always follows the rhythm of the accompaniment music presentation. The dancer repeatedly counts from the numbers 1 to 8 as the count in each gong sound in the music presentation. The fast and slow counting is always dynamic, following the tempo of the music presentation. Measuring activity is done to show the aesthetic movements in the presentation. The angular shape and the implementation of geometric concepts in the presented movement pattern. Some of the geometric concepts implemented in the movement variety of the Gandrung Lombok dance include the shape of a semicircle, circle, and triangle. The concept of semicircle and circle is presented in the variety of the *Ngeluhluh* movement. The implementation of the triangle concept can be found in all the movement varieties presented. The idea of a triangle shape in the presentation of Gandrung Lombok seems dominant and becomes a common phenomenon full of meaning. Gandrung Lombok, as the identity of the Sasak community, represents its society. The concept of an isosceles triangle shape is a geometric concept that forms the aesthetic image of the movement in that dance, describing the characteristics of the Sasak society life. The Sasak community in their life is never far from the element "three." Some of them are the awareness of the three points of relationship, which include God, humans, and the universe. In their life, the Sasak society adheres to the three layers of the cultural value system as a representation of traditional institutions. The three layers of the system are *tindih* (humble), *maliq-merang* (abstain from violating dynamic-rule), and *krame* & *awig-awig* (etiquette and norm) [17], [20].

The isosceles triangle gives an idea of the existence of the three points' connection and gives an idea of the attachment of the Sasak society with a value of three. The existence of the *Wetu Telu* Islamic community (time three) is one of them, explaining that there will be three elements building the society's local beliefs, including tradition, culture, and religion [17], [21]–[23]. The symbols in the myth-building also seem to strengthen the suspicion of the importance of element 'three' in Sasak society. Where in the myth of the princess of Mandalika, there are 'three' princes who compete for a beautiful princess named Mandalika. The Sasak society also seems to respect the three leaders, including the leaders of the government, religion, and customs. In this study, the findings in the ethnomathematics reading of the movement variety of Gandrung Lombok, which in the form of the 'importance' of the three elements in the Sasak society life, are suspicion that must be proven its truth.

4. Conclusion

This research concludes that ethnomathematics are involved in various kinds of Gandrung Lombok dance movements. Counting and measuring activities are used to present the movement variety of Gandrung Lombok. The counting activity is carried out repetitively by counting from number one to eight. That count is a form of counting pattern that is according to the count in the accompaniment music presentation. In the accompaniment presentation, at one time, the gong sound consists of 8 counts or beats. The counting activity carried out by the dancer in the Gandrung Lombok presentation is not carried out constantly but dynamically follows the tempo of the accompaniment music presentation. The measuring activity in the presentation of the Gandrung Lombok dance movement is implemented, forming the shape of the movement pattern, including both hand, foot, and floor patterns. Ethnomathematics in this measuring activity is done by implementing the geometric concepts of semicircle, circle, and triangle. The implementation of the geometry concept of semicircular is found in the movement variety of *Ngeluhluh*, while the concept of a triangle is found in all the movement varieties of Gandrung Lombok in presenting the shape of hand and foot patterns. This phenomenon explains that the geometry concept of the triangle is an important element in constructing the aesthetic image of Gandrung Lombok. This finding is important for further research related to the movement of aesthetic construction in Gandrung Lombok. Gandrung Lombok, as an identity construction of the Sasak society, will always represent the life of the Sasak society. The implementation of the triangle concept in the arrangement of the dominant dance movement pattern in constructing its dance aesthetic is in line with the concept of 'three' in Sasak society. The concept of 'three' meant the relationship between God, humans, and the environment or

the universe. On the other hand, the Sasak society's daily life is closely related to the element three as represented in the *Wetu Telu* Islamic community entity, their respect for the three leaders in daily life, the existence of three princes in the myth of the Mandalika princess, and so on. The importance of element three in the Sasak society is a finding that needs to be done further.

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