EDU-MAT: Jurnal Pendidikan Matematika *ISSN: 2338-2759 (print)*
https://ppjp.ulm.ac.id/journal/index.php/edumat *ISSN: 2597-9051 (online)*

ETHNOMATHEMATICS IN THE RADAP RAHAYU DANCE AND ITS IMPLEMENTATION IN MATHEMATICS LEARNING

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DOI: http://dx.doi.org/10.20527/edumat.v12i2.19254
Received : 19 May 2024 **Accepted :** 5 October 2024 **Published :** 31 Oktober 2024

Abstract: Radap Rahayu dance is an original dance from South Kalimantan, Indonesia. This dance is a cultural heritage of Banjar, South Kalimantan. It has ethnomathematics potential that needs to be studied. The study aimed to explore the ethnomathematics aspects of the Radap Rahayu dance. The subjects of this research were Banjarmasin cultural figures and artists, dance lecturers and dance teachers The four focuses of this ethnographic research are, finding the mathematical concepts in the movement, musical instrument accompaniment, clothing, and ethnomathematics implementation of the Radap Rahayu Dance in mathematics learning. Data collection techniques using Focus Group Discussion with observation, interviews, and elaboration of the three research subjects. The data analysis technique refers to Miles and Huberman, with data validity using source triangulation. The research results show four things. First, there is a concept of counting, measurement, reflection, circles, and triangles in the Radap Rahayu dance movements/varieties. Second, there is a concept of symmetry, a circle, and an integral symbol on the musical instrument accompanying the Radap Rahayu Dance. Third, there is a concept of a triangle, symmetry, parallel lines, a circle, and dilatation in the costume of Radap Rahayu Dance. And, the implementation of the ethnomathematics aspects of the Radap Rahayu Dance in Mathematics Learning is found in the student module and Worksheets, which contain project-based activities making mathematics more meaningful and fun.

Keywords: Ethnomathematics, Radap Rahayu Dance, Mathematics Learning

PENDAHULUAN

South Kalimantan, is one of the provinces in Indonesia, which is rich in culture. Besides being thick with religion, South Kalimantan with its Banjar tribe, is also rich in local wisdom. The Banjar tribe as one of the tribes in South Kalimantan has a variety of cultures, including traditional handicrafts, traditional games and arts such as music and dance. Some Banjar tribal cultures are known for their traditional arts, namely panting music, traditional dance, madihin, lamut and traditional theater arts. Romadoni (2017) explains that the Banjar people have various forms of traditions that have existed since ancient times and are still practiced today which include mathematical concepts, for example children's games, manual measurement methods, building structures and so on. One of the traditional arts of the Banjar tribe

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that has cultural values and can be used as an object of ethnomathematical study is the Radap Rahayu dance. This dance is a traditional dance that serves to welcome guests as a form of site. Research related to ethnomathematics in Banjar people, especially South Kalimantan is still very minimal, therefore researchers feel it is important and interested to raise the theme of this research, by trying to start an ethnomathematics study in one of the Banjar cultures, namely the traditional dance of Radap Rahayu. This study will explore more about the ethnomathematical aspects of the Radap Rahayu Dance.

Mathematics and culture are two things that are very closely related to our lives. Mathematics is a source of knowledge and the main needs of each individual, meanwhile culture is a unified whole and a comprehensive guide to behavior in society and plays an important role in growing the noble values of the nation. According to Ubayanti, Lumbantobing, and Manurung (2016), mathematics is part of culture, because mathematics and its learning make mathematics the property of all mankind, and therefore mathematics is universal. Thus, culture-based mathematics learning can be used as a medium for students to transform their findings into creative forms and principles related to nature, which are the design of learning experiences as well as strategies for creating learning environments that integrate culture as part of the learning process.

Meanwhile, Abdullah (2016) states that in learning mathematics, a bridge is needed that can connect mathematics with culture and everyday life, namely ethnomathematics. D'Ambrosio (1985) explains that the goal of ethnomathematics is to do mathematics in a different way by considering the development of academic knowledge in different sectors of culture and society. That's ethnomathematics, the culture of a sense of mathematics. In this study, researchers will explore the ethnomathematical aspects of the Radap Rahayu dance, both in terms of movement and dance accompaniment tools used, the clothes worn by dancers and linking them to their implementation in learning mathematics.

There has been no research related to ethnomathematics on the Radap Rahayu Dance, where research so far still views the Radap Rahayu Dance as limited to art, culture and local wisdom. Indeed, there has been research from Habibah, Zulkarnain, & Budiarti (2022) regarding the ethno-mathematics exploration of geometric concepts in the movement patterns of the traditional Banjar Baksa Kembang dance, as well as other geometric shapes. However, the difference in this research is the type of dance, whether it has the same or different patterns. Such as research by Rukmini & Juwita (2020), which focuses on analyzing the structure of the Radap Rahayu dance, or Juwita et al (2024) regarding the exploration of beauty and meaning in the traditional movements of the Radap Rahayu Dance. So, it is necessary to look at the Radap Rahayu Dance through an ethnomathematics lens. The study aimed to explore the ethnomathematics aspects of the Radap Rahayu dance.

METHOD

This research belongs to the type of qualitative research because the researcher intends to analyze and describe the mathematical concepts contained in the Radap Rahayu dance. This research method uses an ethnographic approach, which ethnography is a qualitative research procedure that describes and analyzes cultural groups (Creswell, 2012). In ethnographic research

the researcher describes, analyzes, and interprets elements of a cultural group such as thought patterns.

The method of data collection carried out by the researchers was to dig up information through library research, observation, and interviews with cultural figures and artists from the Banjar tribe who clearly knew about the object of research, namely the Radap Rahayu dance. Some of the figures who will be interviewed include the head of the UPTD Taman Budaya South Kalimantan, the chairman of the Banjarmasin Arts Council, and art teachers at SMAN 5 Banjarmasin, as well as dance lecturers at STKIP PGRI Banjarmasin.

The object of research is the ethnomathematical aspect of the Radap Rahayu dance of the Banjar Tribe, South Kalimantan. The instruments used in this study were the researchers themselves (human instruments), interview guidelines and observation sheets. The data analysis technique used in qualitative analysis has four stages, namely collecting data from sources obtained from interviews, data reduction, data presentation, and drawing conclusions.

RESULT AND DISCUSSION

Ethnomathematics in the Radap Rahayu dance

Radap rahayu dance is a Banjar tribe culture that grows and develops in South Kalimantan. This dance is the identity of the Banjar people who consider "guest is king" following the friendly, generous, and open attitude of the Banjar people in interacting with the community. The Banjar people consider the radap rahayu dance that serves to welcome important guests at certain events. However, along with its development, this dance is also displayed as public entertainment, such as at weddings. Also, this dance belongs to the type of group dance, where the dancers of radap rahayu must be an odd number as the number depicts the descent of an angel from heaven who provide safety and peace on earth. In general, there are seven dancers, but the number of dancers may be more or less as needed.

1. ***The movement of Radap Rahayu Dance***

   Dance movements are the most important element in the Radap Rahayu dance. Apart from being presented in the form of movements to enjoy its artistic value, every movement of the Radap Rahayu dance contains the meaning of respect is conveyed. The various movements of the Radap Rahayu dance include *gerak Terbang Layang* (gliding movement), *Gerak Limbai Kibas* (*Limbai Kibas* movement), *Gerak Dandang Mangapak* (*Dandang Mangapak* movement), *Gerak Duduk Mendoa* (prayer sitting movement), *Gerak Duduk Membunga* (flower sitting movement), *Gerak Alang Manari* (*Alang Manari* movement), *Gerak Lontang Setengah* (*Lontang Setengah* movement), *Gerak Lontang Penuh* (*Lontang Penuh* movement), *Gerak Gagoreh Sembadra* (*Gagoreh Sembadra* movement), *Gerak Gagoreh Srikandi* (*Gagoreh Srikandi* movement), *Gerak Mantang* (*Mantang* movement), *Gerak Tapung Tawar* (*Tapung Tawar* movement), *Gerak Puji Bantam* (*Puji Bantam* movement), and *Gerak Angin Tutus* (*Angin Tutus* movement).

   The movements of Radap Rahayu dance are based on an important factor, namely the fixed count in each dance movement. Then, beautiful

dance movements are created to be seen in real terms. Another important factor is the adjustment of the form in the Radap Rahayu dance which has rules for the form of the hands, and feet and measuring the distance to form a standardized formation. The dancers in Radap Rahayu dance have their respective position points in forming several floor patterns in the form of simple geometry.

Ethnomathematics in the movement forms of the Sigeh Pengten dance includes the activities of counting, measuring, and some geometric studies, such as one-dimensional geometry, two-dimensional geometry, and geometric transformations. The article tries to explain in detail the ethnomathematics in each movement of the Sigeh Pengten dance, as follows:

a. Terbang Layang Movement (Gliding movement)

The gliding movement is performed by walking quickly, with small steps, making 2 rounds with the feet on tiptoe and hands waving over the cupu, and moving to the right side of the body, which is done repeatedly. The movement is performed 3 times, heading to the stage, before praying, and leaving the stage. During the movements, the dancers line up with their steps adjusting to the fast musical instrument accompaniment. The discussion of mathematics in gliding movement is described as follows:

1) Counting activity

Counting activities are performed by adjusting the accompaniment of gupek music. The counts are with repetition of numbers 1, 2, 3, 4, 5, 6, 7, and 8. This movement uses a cassette version of the music with a count of 2 x 8 beats. Counts are made when the dancers walk by following the beat of the music until the next change of motion. For example, a count of 2 x 8 beats means the dancers must count 1, 2, 3, …, 8. Then, they repeat the count from 1 to 8.

2) Measuring Activity

The measuring activity in the *terbang layang* movement (Gliding movement) is measuring the steps of each dancer's feet to adjust the changes in the next floor pattern. Adjusting is aimed at the straight line floor pattern changes to the next floor pattern, namely the triangular floor pattern. The size of the footstep adjusted to the stage.

Figure 1. *Terbang Layang* movement (Gliding movement)

Figure 1 is the picture of a gliding movement with 5 dancers in a straight line. Before moving, each dancer must measure the step distance to the next move. In this case, for example, is the position rules of the dancers. Dancer number (1) moves forward 5 steps, parallel to dancer number (5). Dancer number (2) moves forward 4 steps slightly forward, parallel to dancer

number (4). Dancer number (3) moves forward in 3 steps. Dancer number (4) moves forward in 2 steps. And, dancer number (5) does not move.

Figure 2 Step Adjustment

The figure 2 shows the process of measuring footsteps in gliding. That, the dancers are moving places according to their respective distances.

Figure 3 Floor Pattern Changes

Figure 3 is the result of the process of measuring the steps, taken by the dancers during the *terbang layang* movement (gliding movement).

3) Straight Line

Figure 4 Gliding Floor Pattern

Figure 4 shows that the dancers form a line up straight to form the next floor pattern. This shows the movement of the Radap Rahayu dance uses the concept of geometry, in the form of straight lines which belong to one-dimensional geometry.

b. Limbai Kibas Movement

Figure 5 Movement of Limbai Kibas

The limbai kibas movement is performed by moving the hand to the right and left alternately. Then, the body movement adjusts to the hand movement. There are two kinds of this movement, movement down and standing. The eyes of the dancer focus on the hands, while they adjust the intended level. Mathematics in this movement will be discussed as follows:

1) Counting activity

The limbai kibas movement has a beat count rule to adjust the slow music tempo, namely 2 x 8 beats. The count is 1 x 8 beats to the right and 1 x 8 beats to the left with each of the two crossing directions, starting from the right and continuing to the left.

2) Isosceles Triangle

Figure 6 Floor Pattern of Limbai Kibas Movement

Figure 6 shows that the dancer performs the limbai kibas movement. If a line is drawn from each point of the dancer's position, it will form an isosceles triangle floor pattern, as shown in picture 6.

3) Reflection

Reflection (mirroring) is the operation of reflecting an object with a line as a mirror plane. After being closely observed, the movement has the characteristic of reflection. For example, the dancer is in the middle and plays as a mirror plane on the Y-axis. Reflection of the motion to the Y-Axis.

$$\mathrm{P(x,y)} \xrightarrow{\boldsymbol{Y-Axis}} P'(-x,y)$$

With a mirroring matrix

$$P_y = \begin{pmatrix} -1 & 0 \\ 0 & 1 \end{pmatrix}, so$$

$$P'_y = \begin{pmatrix} -1 & 0 \\ 0 & 1 \end{pmatrix}\begin{pmatrix} \mathrm{x} \\ \mathrm{y} \end{pmatrix}$$

Here, the movement-image has a point P(4,4). Then, a reflection is carried out on the Y-axis. And, it obtained:

$$P'_y = \begin{pmatrix} -1 & 0 \\ 0 & 1 \end{pmatrix}\begin{pmatrix} 4 \\ 4 \end{pmatrix}$$

Then, it obtained:

$$P'_y = \begin{pmatrix} 4 \\ 4 \end{pmatrix},$$

as shown in the figure 7:

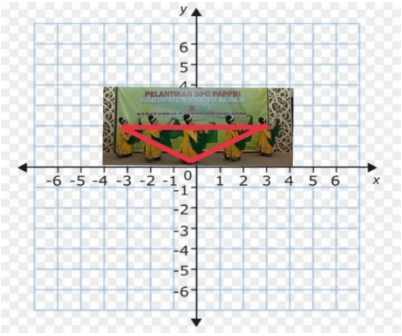

Figure 7 Reflection of the Y-Axis Limbai Kibas movement

The figure is a form of reflection of the limbai kibas movement with an example using a point (4,4) and produces a mirror image with a point (-4,4). Also, the figure proves, when the dancer performs a swinging movement - the middle dancer used as a mirror plane - the two dancers on the right are the same as the two dancers on the left, both in movement and in the position of the dancers.

c. Dandang Mangapak Movement

Figure 8 Movement of the Dandang Mangapak

This movement is performed four times, namely every two times closed with a shoulder goal as the movement of the arm swings forward and palms forward. The mathematics in the mangapak dandang is described as follows:

1) Counting activity

The dandang mangapak movement has a rule of counting in beats, following the slow music tempo, namely with a count of 1 x 8 beats.

2) Isosceles triangle

Figure 9 The Floor Pattern of Dandang mangapak Movement

Figure 9 shows that performing the dandang managapak movement, the dancers form a floor pattern by forming an isosceles triangle.

3) Reflection

When the dancers perform the dangdang mangapak movements, the dancers only change, from the previous movements without changing places. Therefore, the dandang mangapak movement is still the same as the previous movement, namely applying the concept of reflection (mirroring). That is a reflection of the Y axis.

$$\mathrm{P(x,y)} \xrightarrow{\boldsymbol{Y-Axis}} P'(-x,y)$$

With a mirroring matrix

$$P_y = \begin{pmatrix} -1 & 0 \\ 0 & 1 \end{pmatrix}, so$$

$$P'_y = \begin{pmatrix} -1 & 0 \\ 0 & 1 \end{pmatrix}\begin{pmatrix} \mathrm{x} \\ \mathrm{y} \end{pmatrix}$$

From the figure, the movement has a point P(4,5), then a reflection is performed on the Y axis. And, it obtained:

$$P'_y = \begin{pmatrix} -1 & 0 \\ 0 & 1 \end{pmatrix}\begin{pmatrix} 4 \\ 5 \end{pmatrix}$$

So, it obtained:

$$P'_y = \begin{pmatrix} -4 \\ 5 \end{pmatrix},$$

as shown in the following picture:

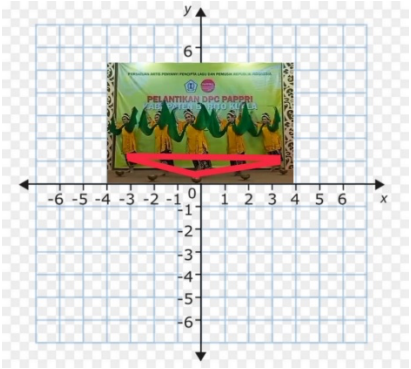

Figure 10 Reflection of the Y Axis (Dandang Mangapak Movement)

Figure 10 is a form of reflection of the dandang mangapak movement, with the example of using a point (4.5) and producing a mirror image with a point (-4.5). Also, the figure proves, when the dancer performs a swinging movement - the middle dancer used as a mirror plane - the two dancers on the right are the same as the two dancers on the left, they do a bow motion in their points.

d. *Duduk Mendoa* Movement (Prayer Sitting Movement)

Figure 11 Prayer Sitting Movement

The Prayer Sitting Movement is performed in an elegant sitting position, with the knee and front heel supporting the body. This movement appears twice in the Radap Rahayu dance. The mathematics in this movement is described as follows:

1) Counting activity

The Prayer Sitting Movement has a rule of counting in beats, following the tempo of slow music, namely a count of 1 x 8 beats.

2) Isosceles triangle

Figure 11 Floor Pattern of praying Sitting movement

Picture 11 shows, if a line is drawn from each point of the dancer, will form a floor pattern of isosceles triangle.

3) Reflection

The floor pattern of prayer sitting is still the same as the previous movement, namely an isosceles triangle. In principle, a flat shape of an isosceles triangle when the center line is taken with the Y axis, will produce two identical objects on the right and left sides. It is a reflection of the floor pattern on the Y-axis.

$$\mathrm{P(x,y)} \xrightarrow{\boldsymbol{Y-Axis}} P'(-x,y)$$

With a mirroring matrix

$$P_y = \begin{pmatrix} -1 & 0 \\ 0 & 1 \end{pmatrix}, so$$

$$P'_y = \begin{pmatrix} -1 & 0 \\ 0 & 1 \end{pmatrix}\begin{pmatrix} x \\ y \end{pmatrix}$$

From the figure, the movement has a point P(3,4), then a reflection is performed on the Y axis. Then, the P' is obtained:

$$P'_y = \begin{pmatrix} -1 & 0 \\ 0 & 1 \end{pmatrix}\begin{pmatrix} 3 \\ 4 \end{pmatrix}$$

So, it obtained:

$$P'_y = \begin{pmatrix} -3 \\ 4 \end{pmatrix}$$

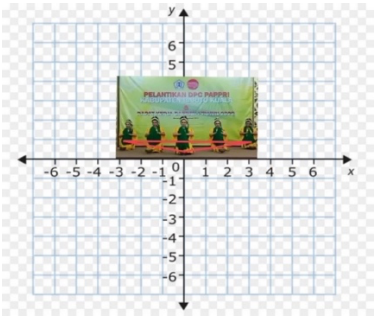

Figure 12 Reflection of the Y Axis of Praying Sitting

Figure 12 shows a form of reflection of the prayer sitting movement, with the example of using points (3,4) and producing a mirror image with point (-3,4). In the picture, the middle dancer plays as a mirror plane. Then, the dancers on the right and left are the same, in both the movement and position.

e. *Duduk Membunga* Movement (Flower Sitting Movement)

Figure 13 *Duduk Membunga Movement* (Flower Sitting Movement)

The movement is performed in a sitting position. Then, the right and left hands go up and down to the rhythm of the song. This movement is performed twice in the Radap Rahayu dance. The mathematics of this movement is described as follows:

1) Counting activity

The rule of counting in beats follows the tempo of slow music, with the count in flower sitting motion 1 x 8 beats.

2) Isosceles triangle

Figure 14 Floor pattern of Flower Sitting Movement

Figure 14 shows that this movement has not changed its formation from the previous movement. Then, the floor pattern is still in the form of an isosceles triangle.

3) Reflection

The floor pattern of the flower sitting movement is the same as the previous movement, namely an isosceles triangle. In principle, if a flat shape is an isosceles triangle, when the center line is taken with the Y-axis will produce two identical objects on the right and left sides. Reflection of the floor pattern of a flower sitting movement on the Y axis.

$$\mathrm{P}(\mathrm{x},\mathrm{y}) \xrightarrow{\boldsymbol{Y-Axis}} P'(-x,y)$$

With a mirroring matrix

$$P_y = \begin{pmatrix} -1 & 0 \\ 0 & 1 \end{pmatrix}, so$$

$$P'_y = \begin{pmatrix} -1 & 0 \\ 0 & 1 \end{pmatrix}\begin{pmatrix} \mathrm{x} \\ \mathrm{y} \end{pmatrix}$$

Diketahui gambar gerak limbai kibas memiliki titik P(3,3) kemudian dilakukan pencerminan terhadap sumbu Y maka P' diperoleh sebagai berikut:

From the figure, the movement has a point P(3,3), then a reflection is performed on the Y axis. Then, the P' is obtained:

$$P'_y = \begin{pmatrix} -1 & 0 \\ 0 & 1 \end{pmatrix}\begin{pmatrix} 3 \\ 3 \end{pmatrix}$$

So, it obtained:

$$P'_y = \begin{pmatrix} -3 \\ 3 \end{pmatrix}$$

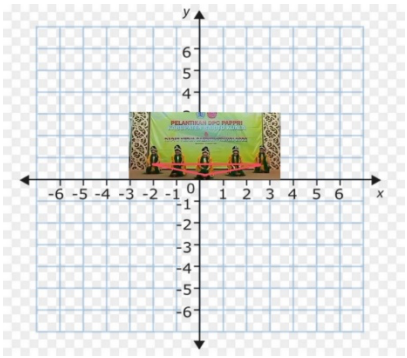

Figure 15 Reflection of the Y Axis of Flower Sitting Movement

Figure 12 shows a form of reflection of the prayer sitting movement, with the example of using points (3,3) and producing a mirror image with point (-3,3). In the picture, the middle dancer plays as a mirror plane. Then, the dancers on the right and left are symmetrical.

f. *Alang Menari* Movement

Alang menari movement is performed in a standing position. The initial motion is with the hands in front of the body, then tilted to the right and left, according to the direction of walking. The mathematics of the motion of the movement is described as follows:

1) Counting activity

The count in this movement is 1 x 8 beats, following the musical accompaniment with 4 times the count.

2) Measuring activity

The measuring activity in the *alang menari* movement is measuring the steps taken by each dancer, to adjust to changes in the next floor pattern. It performs with the aim of the isosceles triangle floor pattern changes to the next floor pattern, namely the straight line floor pattern.

Figure 16 Measurement Process of the footstep

Figure 16 shows the process of measuring the footsteps for the next pattern, which is a straight-line floor pattern.

Figure 17 Floor pattern of *Alang Menari* Movement

Figure 17 shows the floor pattern of the *alang menari*, formed after measuring the steps by the dancers.

3) Straight line

Figure 17 is the floor pattern in the *alang menari* movements. The floor pattern, in Figure 17, is a form of a straight line that included one-dimensional geometry.

g. Lontang Penuh Movement

The movement is performed by moving the hands to the right and left alternately, according to the walking footsteps. Then, the body movements adjust to the hand movements. The mathematics in lontang penuh movement is discussed as follows:

1) Counting activity

The movement has a beat rule to adjust the tempo of slow music, namely 4 x 8 beats. It consists of the count of 2 x 8 beats to the right and 2 x 8 beats to the left.

2) Straight Line

Figure 18 Floor Pattern of Lontang Penuh Movement

Figure 18 shows that the dancers make a line up straight to form a straight-line floor pattern. Then, the lontang penuh movement in the Radap Rahayu dance uses geometric concepts of straight lines which included one-dimensional geometry.

h. Lontang Setengah Movement

The lontang setengah move-ment is performed by moving the hands forward, to the right and left alternately. Then, the body movements follow the hand movements. The eyes while dancing focus on the hands and adjusting the intended level. The mathematics in lontang setengah is described as follows:

1) Counting activity

The lontang setengah movement has a beat rule, that follows the tempo of slow music, namely 2 x 8 beats. It consists of Counting 1 x 8 beats to the right and 1 x 8 beats to the left.

2) Straight Line

Figure 19 Floor pattern of Lontang Setengah movement

Figure 19 shows that the dancers make a line up straight to form a straight-line floor pattern. Then, the lontang setengah movement in the Radap Rahayu dance uses geometric concepts of straight lines which included one-dimensional geometry.

i. Gagoreh Sembadra

1) Counting activity

The count for gagoreh sembadra is 1 x 8 beats to the left and to the right.

2) Straight Line

Figure 20 Floor pattern of Gagoreh Sembadra movement

Figure 20 shows that the dancers make a line up straight to form a straight-line floor pattern. Then, the gagoreh sembadra movement in the Radap Rahayu dance uses geometric concepts of straight lines which included one-dimensional geometry.

j. Gagoreh Srikandi

1) Counting activity

The count for gagoreh srikandi movement is 1 x 8 beats, following to the musical accompaniment.

2) Straight Line

Figure 21 Floor pattern of Gagoreh Srikandi movement

Figure 20 shows that the dancers make a line up straight to form a straight-line floor pattern. Then, the gagoreh srikandi movement in the

Radap Rahayu dance uses geometric concepts of straight lines which included one-dimensional geometry.

k. Mantang Movement

1) Counting activity

The count for mantang movement is 4 x 8 beats, following to the musical accompaniment.

2) Straight Line

Figure 22 Floor pattern of Manteng movement

Figure 22 shows that the dancers make a line up straight to form a straight-line floor pattern. Then, the mantang movement in the Radap Rahayu dance uses geometric concepts of straight lines which included one-dimensional geometry.

l. Tapung Tawar Movement

Tapung tawar is the core movement of the Radap Rahayu dance. This movement is performed in a standing position. The hands wave towards the center, right, and left alternately. The mathematics in this movement is described as follows:

1) Counting activity

The count on the *tapung tawar* movement is 4 x 8 beats, following the musical accompaniment. This movement is performed in four directions, the front, right, left, and back.

2) Measuring activity

The measuring the steps of each dancer's feet to adjust the changes in the next floor pattern. Adjusting is aimed at the straight line floor pattern changes to the next floor pattern, namely the trapezoidal floor pattern. The size of the footstep adjusted to the stage

Figure 23 Step Adjustment

Figure 23 is the process of measuring footsteps for the next floor pattern, namely the trapezoidal floor pattern

Figure 24 The Floor Pattern of the *Tapung Tawar* Movement

The figure is a floor pattern of *tapung tawar* movement which is formed after measuring the footsteps of the dancers.

3) Trapezium

Figure 24 is the floor pattern of the *tapung tawar* movement. The floor pattern is in the form of a trapezoidal flat shape.

4) Reflection

Tapung tawar movement uses a mathematical concept, namely a geometric transformation in the form of

a reflection. it is a reflection of the floor pattern of the samber melayang jalan movement of the Y axis.

$$\mathrm{P}(\mathrm{x},\mathrm{y}) \xrightarrow{\boldsymbol{Y-Axis}} P'(-x,y)$$

With a mirroring matrix

$$P_y = \begin{pmatrix} -1 & 0 \\ 0 & 1 \end{pmatrix}, so$$

$$P'_y = \begin{pmatrix} -1 & 0 \\ 0 & 1 \end{pmatrix}\begin{pmatrix} \mathrm{x} \\ \mathrm{y} \end{pmatrix}$$

From the figure, the movement has a point P(3,5), then a reflection is performed on the Y axis. Then, the P' is obtained:

$$P'_y = \begin{pmatrix} -1 & 0 \\ 0 & 1 \end{pmatrix}\begin{pmatrix} 3 \\ 5 \end{pmatrix}$$

So, it obtained:

$$P'_y = \begin{pmatrix} -3 \\ 5 \end{pmatrix}$$

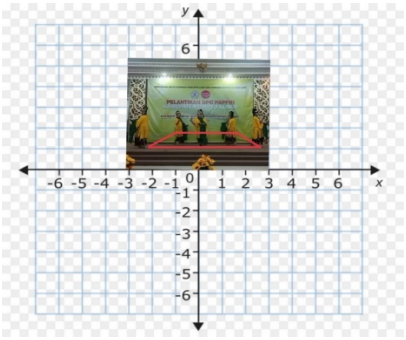

Figure 25 Reflection of Y-Axis (Tapung Tawar Movement)

From the figure, the concept of reflection is applied in tapung tawar movement.

m. Puji Bantam Movement

The *puji bantam* movement means the shawl target movement where this movement is performed in a sitting position and both hands hold the ends of the shawl. The mathe-matics in the movement is described as follows:

1) Counting activity

The puji bantam movement has a beat count rule to adjust the tempo of fast music, with a count of 2 x 8 beats.

2) Measuring activity

The activity of measuring the *tolak tebeng* movement is measuring the footsteps taken by each dancer to adjust to changes in the next floor pattern.

Figure 26 Step Measurement

Figure 26 is the process of measuring steps in *puji bantam* movement. The dancers move from the trapezoidal floor pattern to the triangular floor pattern.

Figure 27 The Floor Pattern of *Puji Bantam* Movement

The figure is the measuring process, performed by each dancer in performing the *puji bantam* movement.

3) Isosceles triangle

Figure 27 shows that the floor pattern in *the puji bantam* movement is a flat triangular shape.

4) Reflection

The *puji bantam* movement uses a mathematical concept in the form of reflection or mirroring. It is a reflection of the floor pattern to the Y-axis.

$$\mathrm{P}(\mathrm{x},\mathrm{y}) \xrightarrow{\boldsymbol{Y-Axis}} P'(-x,y)$$

With a mirroring matrix

$$P_y = \begin{pmatrix} -1 & 0 \\ 0 & 1 \end{pmatrix}, so$$

$$P'_y = \begin{pmatrix} -1 & 0 \\ 0 & 1 \end{pmatrix}\begin{pmatrix} \mathrm{x} \\ \mathrm{y} \end{pmatrix}$$

From the figure, the movement has a point P(5,5), then a reflection is performed on the Y axis. Then, the P' is obtained:

$$P'_y = \begin{pmatrix} -1 & 0 \\ 0 & 1 \end{pmatrix}\begin{pmatrix} 5 \\ 5 \end{pmatrix}$$

So, it obtained:

$$P'_y = \begin{pmatrix} -5 \\ 5 \end{pmatrix}$$

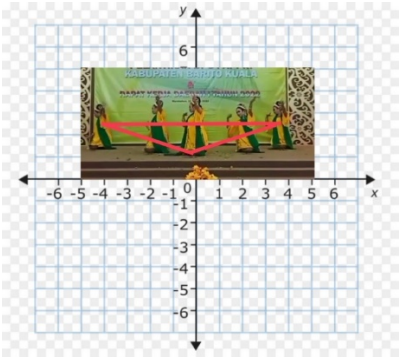

Figure 28. Y-Axis Reflection (*Puji Bantam* Movement)

The picture shows the reflection in performing the *puji bantam* movement. From the figure, the dancers move their hands and feet symmetrically.

n. Angin Tutus Movement

The *angin tutus* movement is performed with the body standing and both hands stretched straight up, and the left hand straight down to the side in a circular motion. The mathematics for angin tutus movement is described as follows:

1) Counting activity

The backward flash motion is performed with a count of 2 x 8 beats, adjusting the fast music tempo.

2) Circle

A circle is the locus of points in a plane that are the same distance from a certain point. This particular point is in the center of the circle which is called the center of the circle. The distance is the radius of the circle. The circle on the angin tutus is a floor pattern that is formed with the foot turning fully to where the foot originally started moving. The circle floor pattern is seen in the following figure:

Figure 29 Floor pattern Angin Tutus Movement

The figure 29 shows the circle formed by each dancer with their feet.

Figure 30 The Circle Process of the *Angin Tutus* Movement

Figure 30 is the process of each dancer performing the angin tutus movement, with their arms stretched straight up and their legs fully rotating around the cupu, by adjusting the beats of the musical accompaniment.

Implementation in Mathematics Learning

Based on the results of FGDs with various sources, the implementation of the results of this research is in the form of two learning modules, namely learning modules for students and teachers, and learning modules for students. Student modules and student modules, along with IPR certificates.

Ethnomathematics in the Radap Rahayu Dance movement

In the findings of the research that focused on the movement of Radap Rahayu Dance, several mathematical concepts were obtained including the concept of counting/ counting, the concept of measurement, the concept of reflection/mirror, the concept of a circle, and the concept of a triangle. From one point of view, all these basic concepts, both counting, measuring, and other concepts in mathematics can be interpreted as knowledge that is inherent in life activities and is very close to culture (Maryati & Prahmana, 2018).

Ethnomathematics on musical instruments accompanying the Radap Rahayu Dance

There are many musical instruments that accompany the Radap Rahayu Dance including the Violin, Baboon, Gong, Flute, Panting, and small and large drums. Every musical instrument also has an ethnomathematical aspect in it. There is the concept of symmetry, the concept of a circle, the integral symbol, etc. An example of an integral symbol found on the Violin shows that one of the goals of ethnomathematics is to connect or introduce mathematics through culture so that it can be more easily understood, through local culture (Suwarsono, 2015).

Ethnomathematics in Radap Rahayu Dance clothing

There are many ethnomathematical aspects of the Radap Rahayu dance clothing including the concept of triangles, the concept of symmetry, the concept of parallel lines, the concept of a circle, the concept of dilation, etc. Both the concept of geometry and the transformation of geometry show that ethnomathematics is also a form of beauty from the observed aspects (Wulandari & Puspadewi, 2016)

Implementation of ethnomathematical aspects of Radap Rahayu Dance in Mathematics Learning

The findings that have been analyzed and reduced are then summarized in the form of student modules and students' worksheets as the implementation of the ethnomematics

aspect of Radap Rahayu Dance. To make learning mathematics more meaningful and fun (Massarwe, Verner, & Bshouty, 2010).

CONCLUSIONS

Based on the findings, it concluded that there are mathematical contents that can be applied in learning mathematics in the Radap Rahayu dance, namely: (1) the concept of counting, the concept of measurement, the concept of reflection/mirroring, the concept of circles, and the concept of triangles in the Radap Rahayu Dance movements/varieties; (2) the concept of symmetry, the concept of a circle, and an integral symbol on the musical instrument accompanying the Radap Rahayu Dance; (3) the triangle concept, the concept of symmetry, the concept of parallel lines, the concept of a circle, and the concept of dilatation in the Radap Rahayu Dance clotihing. The implementation of the ethnomathematics aspects of the Radap Rahayu Dance in Mathematics Learning is contained in the student module and students' worksheet, which contains project-based activities that make mathematics more meaningful and fun.

The results of student modules and students' worksheets are hoped to be used by mathematics teachers and lecturers supporting school mathematics learning subjects and/or relevant ones. There are objects of ethnomathematics study that can be implemented in learning and other perspectives, such as the evaluation of learning mathematics that need to be studied.

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