ETHNOMATHEMATIC EXPLORATION OF THE RANDAI DANCE IN MINANGKABAU CULTURE

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Abstract
Combining a mathematical approach with culture is called ethnomathematics. Indonesia is a country that has abundant culture. Culture can be used as a medium for learning and can enable students to become more familiar with the culture itself. The purpose of this research is to explore the basic mathematical concepts contained in Randai Dance, to find out mathematical concepts that can be put into practice in learning and to explore the educational values contained in the art of Randai Dance. This research is research using the literature study method. The results of the research reveal that in the context of Randai Dance, there are several elements of ethnomathematics that can be found, namely (1) patterns and symmetry, (2) rhythm and time calculations, (3) geometry in movement, (4) number calculations, and (5) patterns-patterns in costumes. The results of the research also reveal that there are educational values contained in the art of Randai Dance, namely barundiang (negotiating), bacarajosamo (working together), kaba, garak malingka and the practice of kato nan ampek. The mathematical concepts found can be applied to learning to explain abstract concepts in mathematics and to introduce cultural elements to students.
Keywords: Exploration, Ethnomathematics, Randai Dance, Minangkabau Culture, Educational Value

INTRODUCTION

Mathematics has long been considered the basis of various scientific disciplines. The development of science and technology today cannot be separated from the role of mathematics. Mathematics also plays a role in advancing human thinking power. Therefore, studying mathematics is something important. Mathematics becomes part of culture, applied and used for innovative analysis. In this case, the mathematics paradigm is a thinking skill and tool for developing a culture of excellence. Learning mathematics is always associated with the educational process, where mathematical concepts and skills are acquired only if individuals go to school.

Mathematical ideas applied in a unique sociocultural context refer to the use of mathematical concepts and procedures acquired outside of school as well as the mastery of mathematical skills outside of school. (Bishop, 1994) states that mathematics is a form of culture. Mathematics as a form of culture has actually been integrated into all aspects of people's lives. Furthermore (Pinxten, 1994) stated that in essence, mathematics is a symbolic

technology that grows from skills or activities in the cultural environment. Thus, a person's mathematics is influenced by their cultural background, because what they do is based on what they see and feel. Culture will influence individual behavior and has a large role in the development of individual understanding, including mathematics learning. Mathematics originates from the ways, styles and techniques developed by humans to respond to the environment, such as seeking explanations, understanding, experiences and solutions to phenomena around them (Prahmana, 2021). Based on this, developing student creativity can be carried out through meaningful integration of mathematics and cultural education to foster students' ability to develop cultural heritage according to the current context (Wulandari, 2016).

Mathematics learning in the classroom can be carried out more meaningfully by teachers by presenting real life, for example cultural activities in the classroom (Dominikus, 2018). Learning through this culture can accelerate students' knowledge because it is easy to remember and is directly related to everyday life. (Rosa, 2011) also emphasized that when culturally based mathematical problems in an appropriate social context are given as a tool in studying certain mathematical topics, it will have an impact on the meaningfulness of the material in students' minds.

Indonesia has a variety of cultures whose existence must be maintained and preserved. Indonesia has diverse cultures and languages, as evidenced by the 17,508 islands and 360 ethnic groups spread across Indonesia (Chandra, 2021), (Mendrofa, 2021). At this time, modernization causes culture to be increasingly forgotten. If modernization continues to erode the existence of culture, this can cause a country's identity to fade and the quality of its environment will decline (Hadi, 2018), (Prabowo, 2018).

This form of connection between mathematics and culture is called ethnomathematics. The term ethnomathematics was introduced by D'Ambrosio, a Brazilian mathematician, in 1977 to describe the practice of mathematics in identifiable cultural groups and is considered the study of mathematical ideas found in each culture. Linguistically, the prefix " *ethno* " is defined as something very broad which refers to the socio-cultural context, including language, jargon, codes of behavior, myths and symbols. The root word "*mathema*" tends to mean explaining, knowing, understanding, and carrying out activities such as coding, measuring, clarifying, concluding, and modeling. The suffix " *tics*" comes from the word techne and has the same meaning as technique (Ascher, 1994).

One of the goals of learning mathematics is to prepare students to use mathematics and mathematical thinking in everyday life (Ariyanti, 2019). According to (Barta, 2006) ethnomathematics is a complex and dynamic representation that describes the cultural influence of the use of mathematics in its application. In learning mathematics at school so far, students still think mathematics is difficult, too abstract, lots of formulas and so on, this is because learning mathematics at school is too formal and does not match what students experience in everyday life. Therefore, further research is needed to explore the cultures around us to find concrete mathematical concepts so that these concepts can be applied in mathematics learning at school.

Ethnomathematics was created by (D'Ambrosio, 2020) to describe mathematical practices in identifiable cultural groups and is considered the study of mathematical ideas found in each culture. Ethnomathematics is defined as the special ways used by a particular cultural group or society in mathematical activities. Where mathematical activities are activities in which there is a process of abstracting from real experiences in everyday life into mathematics (Sarwoedi, 2018). Ethnomathematics is knowledge obtained through culture

which aims to connect students' understanding of informal mathematics to formal mathematics obtained at school (Herawaty, 2018), (Richardo, 2017). Ethnomathematics provides students with an understanding that the existence of mathematics is not only found in the classroom, but also in the form of culture that grows and develops in the surrounding environment.

Indonesia, as an archipelagic country that has a diverse culture, naturally produces diverse ethnomathematics as well. One of the cultural objects that is very close to society is traditional dance. This cultural object is a means of communication between performers and spectators, as a spectacle, as a ritual, and so on which is passed down from generation to generation by ancestors. Dances from each particular tribe and region in Indonesia have characteristics that show unique regional characteristics (Dewi, 2012). Thus, studying ethnomathematics in traditional Indonesian dances can certainly make a positive contribution to mathematics learning in Indonesia.

In society, Indonesian culture which has its own charm is the art of dance, because dance is a work that is expressed through movement (Fathonah, 2019). Each region has different dances, depending on the customs and environment of the region (Sandhi, 2019). Randai dance is a culture from Indonesia which has many meanings originating from the Minangkabau area. An ethnomathematics exploration of Randai dance in Minangkabau culture offers an interesting insight into how mathematics can be integrated into traditional art. Randai is a dance originating from Minangkabau, West Sumatra, not just an artistic performance, but also reflects the philosophy, history and cultural values of the Minangkabau people. Based on the scientific explanation above, the researcher is interested in conducting research with the title "Ethnomathematics Exploration of Randai Dance in Minangkabau Culture".

METHOD

This research is research using the literature study method or literature study. A literature study is a comprehensive overview of research that has been conducted on a specific topic to show readers what is already known about the topic and what is not yet known, to find rationale for research that has been conducted or for ideas for further research (Denney, 2013). This research began by looking for sources that were relevant to the topic discussed, namely ethnomathematics in the Randai Dance in Minangkabau Culture. Then the sources are read and summarized so that it is easy to get a general idea of the results of ethnomathematics studies on Randai Dance in Minangkabau Culture. After that, the researcher examined how the results of this ethnomathematics study were integrated into learning. Finally, the researcher draws a conclusion from what has been studied.

RESULTS AND DISCUSSIONS

Explanation of the Randai Dance

Randai dance is an art that originates from Minang (West Sumatra). Randai dance is the only traditional art that is done collectively because it is built on elements of drama, *kaba* (stories), dance, song, and silat. Randai dance is a dramatic practice *of kato nan ampek* and is also known as one of *the pamenan adaik* (traditional games) or also known as the name *pamenan anak nagari* (country children's game). A game with circular movements, then moving slowly, while conveying *the kaba* (story) through singing alternately (Harun, 1993).

Barandai means *bakaba* (telling stories). Randai dance is a *kaba performance* and a form of drama or theater. *Kaba* is a message that contains local wisdom, advice using figurative

sentences or vague words (Zulkifli, 2013). Randai dance has its own characteristics; (1) Randai dance contains *kaba* (stories) which are popular in society, (2) the delivery of *kaba* is done in the form of dialogue and singing accompanied by traditional musical instruments such as *talempong, saluang, rabab*, and *gandang*, (3) dramatic value is developed through improvisation players and is generally spontaneous, (4) there is a close and harmonious relationship between the players and the audience, (5) Randai Dance can be played in an open environment called *medan nan bapaneh*, (6) Randai Dance performances are very flexible in terms of story and time (7) The language used in the Randai Dance performance is Minangkabau (Indrayuda, 2013).

Randai dance is a medium for conveying messages and local wisdom. Indigenous knowledge is the knowledge of certain indigenous peoples that has been used for centuries to survive and exist on a daily basis (Die, 2011). In local communities, this knowledge can be found in the form of stories, songs, rituals, myths and mythology, fairy tales, proverbs and folk tales. This can also be found in aspects of material culture, such as symbolic ornaments and body equipment, as well as the social meanings and interpretations contained in cultural artifacts. Pedagogically, instructionally and communicatively, this indigenous cultural knowledge informs and/or teaches about the idea of education as a community right, the rights and responsibilities of students to be independent and independent of others (peers, teachers and society in general).

Ethnomathematics Study of Randai Dance

Ethnomathematics is the study of how cultures use and understand their own mathematics. In the context of Randai Dance, ethnomathematics can cover various aspects, including movement patterns, rhythm, spatial organization, and the use of mathematics in creating and executing choreography.

Here are some concrete examples:

1. The pattern
   Movement patterns in Randai Dance can reflect mathematical principles. For example, the use of geometric patterns such as circles, rectangles or triangles in the movement structure.
2. Rhythm and counting
   Randai dance often has complex rhythms. Ethnomathematics can study how these rhythms are structured and organized mathematically. For example, how musical measures are arranged in certain rhythms and how mathematical patterns underlie these arrangements.
3. Space use
   Randai dance often uses space dynamically. Ethnomathematics can study how space is shared, used and filled in the context of choreography. This can include mathematical concepts such as geometry and perspective.
4. Proportion and symmetry
   Elements such as the proportions of the dancer's body and the symmetry of movements can also be analyzed from an ethnomathematical point of view. How the proportions of a dancer's body are considered in the creation of certain movements, and how symmetry is used to create visual harmony.
5. Using numbers
   Some Randai Dances may also use numbers or mathematical calculations in the execution of movements or in stories told through movements. Ethnomathematics can

examine how these numbers are related to cultural or philosophical meanings in Randai Dance.

By studying these aspects, ethnomathematics can help us understand the depth and complexity of Randai Dance as a cultural art form that not only functions as entertainment, but also as a mathematical expression of the understanding and worldview of the Minangkabau people. Although they do not always use geometric patterns explicitly, some movements in Randai Dance can depict geometric elements such as circles, quadrilaterals or triangles through regular movement arrangements and patterns. The following are several examples of the use of geometric patterns in the composition of Randai Dance movements:

1. Circle: Circular movements can symbolize unity or cycles in life or nature. For example, some movements in dance can form a circle formation to show community unity or the reciprocal relationship between elements in life. Dance movements can be arranged in a circular pattern to create the impression of continuous, harmonious movement. The use of circles not only creates an interesting visual, but can also reflect mathematical concepts such as symmetry and rotation.
2. Quadrilaterals: Movements that form sharp angles or are square can symbolize stability or structure. Quadrilaterals can be used to create patterns that are stable and regular. For example, when the dancers form a rectangular formation, it can represent power or harmony within a society or group.
3. Triangle: The movements that form a triangle pattern can be interpreted as dynamism or change. Triangles can be used to provide dynamics and variety to movement. For example, movements that form a triangle might be used to highlight conflict or change in a dance narrative, or to represent dynamic natural movements such as a waterfall or mountain.

These geometric patterns may not always be visible directly, but they can be interpreted by the audience as part of the Randai Dance choreography and aesthetics. They can provide additional depth to the message or theme that the choreographer and dancers wish to convey. Thus, the use of geometric patterns in Randai Dance not only adds visual beauty, but also creates order and structure that contains mathematical principles, which in turn enriches the aesthetic and cultural experience of the audience.

Figure 1. The wave movement of the randai dance always forms a single circular floor pattern from the first scene to the last scene

Music and dance are often intertwined in cultures around the world. In Indonesia, for example, Randai Dance is a traditional Minangkabau performing art form from West Sumatra that combines elements of music, dance and drama. Behind the arrangement of music in certain rhythms and the mathematical patterns that underlie Randai Dance movements, there are several important principles:

1. Musical Structure
   Randai Dance music is usually dominated by traditional instruments such as *talempong* (Minangkabau gamelan), *gendang*, *saluang* (bamboo flute), and *rebab* (small violin). This music has a distinctive rhythmic and melodic structure, often in a pentatonic or pelog scale.
2. Rhythm and Tempo
   Rhythm and tempo in Randai Dance music are usually closely related to dance movements. Fast rhythms may encourage dynamic, energetic movements, while slow rhythms may lend themselves to smooth, flowing movements.
3. Mathematical Patterns
   The dance movements in Randai Dance are often based on mathematical patterns that underlie the rhythm of the music. Some movements may be repeated in certain patterns, such as mathematical patterns in timing or rhythm. This creates balance and harmony between the music and dance movements.
4. Movement Settings
   The arrangement of dance movements in Randai Dance is also influenced by the narrative or story being told. These movements can reflect the emotions, characters, or situations being depicted in the story.
5. Interaction between Musicians and Dancers
   In Randai Dance performances, the interaction between musicians and dancers is very important. Dancers often respond directly to the music played by musicians, creating the impression of dynamic improvisation.

Overall, the arrangement of music in certain rhythms and the mathematical patterns that underlie the arrangement of Randai Dance movements create a harmonious harmony between different artistic elements, creating a powerful and memorable performance experience.

Educational Value in Randai Dance

There are several educational values in the process of the Randai Dance performance, namely: educational value in *the pasambahan* (opener), educational value in *the kaba* (story) that is performed, educational value in *the garak malingka* (circular movement) and educational value in the practice of the *kato nan ampek drama*.

Educational Value in *the Pasambahan* (Opening) of the Randai Dance

Pasambahan is the opening procession before *the kaba* is performed by all the Randai Dance performers (Figure 2). *Pasambahan* is always filled with prayer requests to God the Creator because he has made it easy to hold Randai Dance performances. Apart from that, there is also an apology to the audience if there are unintentional mistakes or something inappropriate in the performance. *Pasambahan* expressions are conveyed in rhymes accompanied by songs.

Figure 2. Pasambahan procession before kaba is performed

Activity *pasambahan* which contains spiritual values means that opening and starting work must begin by asking for help from the Creator, namely Allah, and starting work with a heart that is always sincere and clean. This shows that the character of the Minangkabau people really maintains vertical relationships, namely the relationship between humans and Allah (*Hablumminallah*), and horizontal relationships are human relationships (*Hablumminannas*). Spiritual values are an important dimension in human education (Niculescu, 2013). Spiritual values guide human behavior in understanding science (Chowdhury, 2016). In this case, spiritual values become a filter in responding to developments in science and technology. Therefore, religious values need to be applied in the educational process and teaching of science.

The spiritual values in *the pasambahan* (opening) of the Randai Dance performance can be applied in the learning process, in this case the principle of *Hablumminallah* can be practiced through praying before starting the lesson, combining the values of gratitude to God. Greatness and power by integrating divine values and Islamic values into the content of scientific material. Meanwhile, the *Hablumminannas* principle can be applied through interaction during the learning process with greetings, mutual love, respect and cooperation. Thus, the spiritual values in the *Pasambahan* (opening) performance of the Randai Dance can be called an alternative step to overcome students' moral decline and as an effort to instill students' character values so that they become fully human.

Educational Value in Performed *Kaba (Stories)*

Kaba is a story or story which is a medium for providing education to the Minangkabau people by referring to one character. *Kaba* explains that the story told is in the form of an event or social phenomenon or a phenomenon in the life of a character in his life in society. *The kaba* told in the Randai Dance performance is a matter of custom and culture. *The kaba* that is played is *the kaba* that circulates in Minangkabau which has elements of education, namely: religious education and traditional education. So if Randai Dance is a children's game, then Randai Dance still refers to Minangkabau customs.

The choice of *kaba* performed in the Randai Dance performance is adjusted to the message you want to convey to the audience. The *kaba* theme chosen is sometimes a description of a phenomenon or event that is currently rampant in people's lives. For example, *kaba* is used to educate and advise the younger generation if their behavior is contrary to custom so that the audience can learn from the *kaba*. This method is more effective because people feel that they are not being justified and are not being patronized in their behavior.

Kaba in Randai Dance has its own characteristics. First, the characteristic of Randai Dance is that it contains *kaba* (stories) which are popular in society. Second, the delivery of *kaba* is carried out in the form of dialogue and singing accompanied by traditional musical instruments such as *talempong, saluang, rabab*, and *gandang*. Third, dramatic value is developed through player improvisation and is generally spontaneous. Fourth, there is a close and harmonious relationship between the performers and the audience. Fifth, Randai Dance can be played in an open environment called *Medan Nan Bapaneh*. Sixth, the Randai Dance performance is very flexible in terms of story and time. Seventh, the language used in the Randai Dance performance is Minangkabau. *Kaba* in the art of Randai Dance can be pedagogically aligned with story or drama methods. Storytelling is a pedagogical strategy that trains students to speak and interact with other people. Telling stories to enable the transfer of knowledge between people. Storytelling among peers during the reflective process is reported to create an interactive environment and effective communication that

supports professional growth (Miller, 2008). Stories can help students build empathy, develop creativity, and critical thinking skills (Giorgetti, 2017).

Stories are appropriate tools for documenting experiences and generating reflection, because telling and writing stories is associated with facilitating, sharing, reflecting and building a social atmosphere in which a sense of collective experience is formed. Cognitively, students build connections with previous knowledge and create new knowledge, so storytelling can be used as a memory strengthening tool to help students transfer stored knowledge to new situations (Altintas, 2018). Stories enable people to understand and associate ordinary events with each other and help transform them into meaningful emotional models. Therefore, teaching through stories is a very powerful tool that can provide students with rich, energetic, meaningful and long-lasting imagination. Listening to stories stimulates imagination, previous experience, and knowledge.

The Value of Education in *Garak Malingka* (Circular Movement)

The Randai Dance performance is performed in a circle or called *garak malingka*. *Malingka* means circular, meaning all activities are carried out in a circle (figure 3). This circle is a symbol that contains philosophical meaning about unity, openness, and integration between humans and the circle or flow of the cosmos. The audience watches the Randai Dance in a circular position around the Randai Dance performer. Randai Dance players also do the same thing, in all performances *the kaba* is played in a circular position. A circular attitude also means deliberation in making decisions and is in accordance with the third and fourth principles in Pancasila, the basis of the life of the Indonesian nation. The circling movements made by the players mean that the Dai went around spreading Islam from one place to another following the history of the Minangkabau Randai Dance art. The position of the circle shows the boundaries of each *nagari's traditional authority* (a region). The essence of the circle is a guideline for living in society, living in deliberation by upholding the principle of prinsip *tagak sama tinggi duduak sama randah*, meaning that all humans are equal, speaking face to face, respecting each other.

Figure 3. Garak malingka (circular movement) in the randai dance performance

The position of *garak malingka* can be applied in the learning process. *Malingka* can be done in group discussions or class discussions. This position allows for social interaction between students, especially interaction in communication. In general, learning in each class in Indonesia is still heterogeneous, so the position of *garak malingka* provides opportunities for students to carry out *peer tutoring* in understanding concepts and allows all students to be actively involved in the learning process.

The Value of Education in *Kato Nan Ampek's Drama Practice*

Minangkabau have the art of speaking. This term is attached to the term *kato nan ampek (four words), as a way of speaking that* Minangkabau people must pay attention to when interacting in everyday life. First, *kato mandaki*, a way of speaking to younger people to

older people. Second, *kato manurun*, which is the way older people speak to younger people. Third, *kato malereng*, which is a way of speaking between respected people. Fourth, *kato mandata* is a way of speaking used by people of the same age or age. Randai dance is an art that applies language arts in the dramatic practice *of kato nan ampek*, with the dialogue format *of kato mandaki* and *kato manurun* which occurs between the mandeh (mother) and the children. *Kato mandaki* is used when *bakato* (talking) with *urang tuo* (parents or older people). It represents the education of the Minangkabau people who have strict rules in speaking and communicating. *Kato nan ampek* has four elements, namely: *kato mandaki* is a way of speaking to older people humbly and gently, for example with father, mother and uncle. *Kato mandata* is a way of speaking to peers (figure 4). *Kato malereng* is a way of speaking to people we respect and *kato manurun* is a way of speaking to young people with an educational mind.

Figure 4. Kato mandata's dramatic behavior in the randai dance

The concept of *kato nan ampek* is currently difficult to find in everyday life, especially in Minangkabau community dialogue. However, the *kato nan ampek nature* is still visible from his behavior, children respect their parents by shaking their hands and kissing their parents' hands. In dialogue, it is very difficult to find *kato mandaki* appearing in speaking, especially in dialogue between the younger generation and older people. They tend to use the *kato mandata*. This is possibly caused by the influence of the high level of knowledge of young people who have a high level of education, thus fading out *caro ba kato mandaki ka yang tuo* (how to speak using *kato mandaki* to older people) whose education is lower than that of the younger generation. However, no matter how great a child or nephew is in the art of Randai Dance, he still maintains the polite format, *kato mandaki*. Therefore, if you present Randai Dance as character building in the world of education, you are bringing ethics and culture into the Minangkabau realm. This means that discussing Randai Dance as an element of education is the same as talking about the character of the Minangkabau people.

CONCLUSION

Randai dance as one of the local wisdom of the Minangkabau people can be used as a medium for developing national cultural values for students. The art of Randai Dance can also be integrated into the learning process and content. From a pedagogical perspective, Randai Dance can be synonymous with learning methods, namely the story method and drama method because the artistic construction of Randai Dance is filled with dialogues delivered using the drama method. The drama method can provide opportunities for students to display their thoughts both physically, verbally and in writing and allows students to interpret the expressions of their peers. Ethnomathematics is an approach that integrates mathematics with culture, offering innovative solutions to improve the effectiveness and quality of mathematics learning in schools. This approach not only involves teaching mathematics into a cultural context but also explores mathematical knowledge embedded in local culture.

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