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Learning Mathematics Through Ethnomatematics Studies Containing Character Values and Cognitive Aspects in Congklak Games for Children of the Dayak Losarang Tribe

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Abstract. Technological progress is becoming more advanced and sophisticated, which has both beneficial and bad effects on child development. Children are more interested in modern technology than conventional things, which causes them to develop apathetic and individualistic dispositions. Traditional games are games that are passed down from generation to generation, highlight noble values, cultural values, and character values, and are good for children's development. The purpose of this study was to identify the cognitive elements, character values, and ethnomathematics components of the game of congklak played by children of the Losarang Dayak tribe in relation to learning mathematics. Thus, the congklak game is increasingly popular and is often used in elementary schools to teach mathematics in Indramayu district. This study used an ethnographic design, field notes, conducted in-depth interviews, and made observations to collect data for research. While ethnomodeling is used to represent ideas and mathematical practices of the Losarang Dayak community through ethical, emic, and dialectical approaches in school mathematics, ethno-mathematics as a type of research seeks to uncover the universally significant features of mathematical activity. The congklak game played by Losarang Dayak children has ethnomathematics elements, character values, and cognitive aspects, according to research findings. Playing congklak helps children of the Losarang Dayak Tribe develop social skills, perseverance, thoroughness, and honesty. Besides that, it also increases sportsmanship, develops analytical skills, fosters creativity in children, trains self-development, and sharpens emotional skills. The cognitive skills needed in congklak games include the ability to count, add numbers, develop strategies, improve memory, foster creativity, solve problems, and understand comparisons of many and few.

Keywords: Cognitive aspects; ethnomathematics; character values; learning mathematics in the congklak game

INTRODUCTION

In every aspect of civilization, including the Losarang Dayak people, mathematics is part of the culture. It emphasizes that all people develop a unique way of practicing mathematics known as ethno-mathematics activities and allows mathematical principles to be incorporated into cultural practices. Every action taken is closely related to mathematics, making mathematical knowledge the basis for every human activity (Muhtadi et al., 2017). One of the foundations for the development of science and technology is mathematics, which is universal knowledge (Nurhasanah et al., 2017). Every activity in life cannot be separated from mathematics, making it a science (Prahmana, R.C.I, Zulkardi, & Hartono, 2012). Mathematics is very similar to culture in terms of practices or customs that have been practiced for generations and date back to ancient times. There are mathematical phenomena at all times, and many human activities are unconsciously part of mathematics (Young, 2017).

"Mathematics is a scientific discipline that can improve thinking and argumentation skills, make a meaningful contribution to the world of work, and provide support for the development of science and technology", (Wasiati, 2022). The learning strategies used by educators, the media they use to provide instruction, and the individual learning preferences of each student all have an impact on the challenges students face. Studying mathematics is not the same as studying other sciences (Wahyuni, 2017). It is not enough just to memorize principles when studying mathematics; we also have to understand it. Therefore, learning math in science involves much more than rote memorization. But it must be done in a comfortable learning environment. For example by using learning media. Utilization of game media in the educational process is also possible. The congklak game is one that can be used in the classroom as a learning media.

It would be interesting to learn more about the relationship between culture and mathematics as it relates to school-based mathematics teaching. Culture is all human activity, including ideas, actions, and the influence of learning and habits on people's lives (Nurmansyah et al., 2019). In everyday life and in the socio-cultural environment, mathematics is an abstraction of

human reason. According to (Handayani & Suparni, 2022), they discussed the relationship between culture and mathematics.. Mathematical thinking in everyday life is influenced by culture. The development of mathematics cannot be separated from the culture and values of society, because the influence of human culture is inherent in all aspects of human life and will last forever (Anintya et al., 2019).

Mathematical thinking in everyday life is influenced by culture. Mathematics education refers to the method by which human activity produces mathematics (Gravemeijer & Terwel, 2000). To broaden their knowledge, students must concentrate on applications based on real-world situations by forming relevant connections across all subjects (Nisa, 2019). Making meaningful connections between all disciplines helps students focus more on real-world applications, which is why cultural integration is so important. There have been many previous studies related to ethnomathematics (Hardiyanti et al., 2020; Koriah et al., 2021a, 2021b; Mellawaty et al., 2023; Riyanto et al., 2021; Sudirman et al., 2020, 2021; Yaniawati et al., 2023).

The study of the relationship between mathematics and culture is known as ethnomathematics, which attempts to understand these relationships so that society and students can understand them better, and mathematics will be easier to learn. A teacher must be aware of and use methods that help enhance learning because mathematics has historically been seen as an abstract branch of knowledge. The aim of the teaching challenge is to help students make connections between visual-intuitive and rational-logical thinking processes and mathematical concepts (Verner, I., Massarwe, K., & Bshouty, 2019). One approach to understanding this is to study and understand how ethno-mathematics applies mathematics to certain cultural groups (Haryanto et al., 2017).

Ethnomatematics is more than just the word ethno (ethnicity) or tribe. When viewed from a study perspective, ethnomathematics is described as an anthropology of mathematics culture and mathematics education. Aspects of important and fundamental values that have been passed down from one generation to the next can be found in culture, namely habits. The application of mathematical principles is a never-ending habit, resulting in various results. This can be seen from various cultural products, especially in Indonesia, such as works of art, building styles, traditional games, and livelihoods, showing how integral mathematics is with culture and history. Mathematics is discussed in cultural settings, referred to as ethno-mathematics. Teaching and learning about culture can be influenced by ethnomathematics, so it can be incorporated into the curriculum. Ethnomatematics is one way of humanizing mathematics given the diversity of cultural practices around the world (Anggreini & Priyojadmiko, 2022; François, 2010; Palhares, 2012).

METHODS

This study uses an ethnographic approach in a qualitative research method with an exploratory design to map objects in a relatively deep manner. A research approach known as ethnography, focuses on sociological goals through in-depth observations of sociocultural phenomena (Marinda Sari Sofiyana et al., 2022). The main topics of the ethnographic approach are patterns of behavior, language, beliefs, rituals and ways of life. To describe, clarify, and analyze the cultural aspects of a civilization or ethnic group, an ethnographic approach is used. The ethnographic approach places an emphasis on cultural studies that examines the culture-sharing behavior of certain people or groups (Susanti, 2020).

Data collection methods in research include field notes, interview transcripts, and documentation with the help of using a smartphone. This research method for evaluating primary data follows the Miles and Huberman process for data analysis, which includes data reduction, data presentation, and confirmation of reduction results (Sugiyono, 2018). The next stage after data reduction is presenting or displaying the data (Sugiyono, 2018). In practice, the researchers used the ATLAS.ti 9 software to analyze the data.

The purposive sampling method is the sampling technique used in this study (Arikunto, 2010), where the children of the Bumi Segandu Losarang Tribe are the selected sample. The data collection methods are interviews, observation, and literature review. Observations and direct interviews were carried out with selected samples. In accordance with the research objectives, open interviews with participants were carried out in turns and used the same questions (Iranto, H., & Bungin, B., 2011). By asking the sample to play the traditional congklak game to observe mathematical ideas, the observation data was collected systematically.

The findings from the traditional game of congklak are then documented and analyzed for anything related to mathematical concepts. Finally, literature studies are used to collect data to obtain additional and specific information from previous research findings (Snyder, 2019). The traditional congklak game, the mathematical concepts in the traditional congklak game, and related other mathematical concepts such as geometrical aspects, especially spatial and plane shapes, algebraic elements, translations, sets, and probability are discussed in the literature review conducted. Literature review is only used to support theories that have been researched in the traditional game of congklak, so there are no inclusion and exclusion criteria in the references used..

RESULTS AND DISCUSSION

The definition of culture as a connecting medium between mathematics and the culture of society is used to explain mathematical concepts and ideas. By utilizing ethnomathematics, one can make learning mathematics relevant and meaningful by describing everyday experiences, making it easier for students to remember and master mathematical concepts. Children learn mathematics and culture along with ethnomathematics.

It is interesting to know from the research process that students can use ethnomathematics in the context of traditional games as a learning resource. This does not rule out the possibility that games that are often played by students can teach them the meaning of mathematics. It is necessary to carry out additional research in the form of research to examine games that are often played by students to determine the extent to which ethnomathematics is meaningful for the learning process.

Many studies have examined ethnomathematics in traditional games. The ethnomathematics of the traditional congklak game as a method of learning mathematics (Rohmatin, 2020). Exploring the Concept of Counting Operations in the Kempreng Traditional Game through ethnomathematics studies (Susanti, 2020). Ethnomatematics Exploration Traditional Game of marbles (Pratiwi & Pujiastuti, 2020). The Traditional Game of Engklek and Its Instruments as a Teaching Resource Using Ethnomatematics (Aprilia et al., 2019). Through the Old Soy Sauce Fried Rice Game, students can learn about number patterns (Rosikhoh & Abdussakir, 2020).

Ethnomatematics Elements in the Congklak Traditional Game

Congklak is a very popular local game and has spread to almost all of Indonesia. Congklak is an Indonesian word, so is the name of the group. This traditional game is known as congklak or congklakan among the Losarang Dayak tribe. Called as Mancala in English (Voogt et al., 2010). Congklak seeds and boards are needed when playing the game. Congklak boards are available in various materials, including plastic, plain wood, wood with colorful patterns, and folding wood with colorful patterns. Congklak fruit can be made using small stones, clam shells, snail shells, tamarind seeds, dead sea slugs, and other materials.

Usually there are 16 holes which are divided into 7 small holes and 2 target holes (one hole for each participant). Using 98 congklak seeds (14x7), each player must have 49 congklak seeds. The number of seeds in the target hole determines the winning score. The findings from observations and interviews with research subjects, namely children of the Losarang Dayak tribe who participated in the study as congklak players, showed that elementary school-age children were able to play the traditional congklak game well. Congklak game rules are also understood by children. In addition, children know the tools needed to play congklak. Here is a photo of congklak game equipment.

Figure 1. Children playing the traditional congklak game

Children are able to carry out the process of implementing the congklak game well. They know the tools needed and the rules they must understand to play congklak. Traditional games such as congklak have rules which state that players must have 49 congklak seeds and cannot lie or cheat. Participants must first suit (sut), and the winning player will be the first in the game. Implementation of the game by rotating

clockwise.

There are several steps to play the congklak game. First, the player must do a suit (sut), after that the player who wins will play first in the game. The player who starts the game first selects one of the selected holes and takes all the checkers, placing them one by one into the hole to his left. Players can pick up the checkers in the hole and continue the game if the last checker is placed in their area. But the game will be continued by the enemy if the last seed lands on their empty territory.

If there are no more seeds that can be taken (all seeds are in the big hole of both players), then the game is considered over. The person with the most seeds is the winner. In this congklak game, children will devise a plan so they can win. In addition, when this game is played during class learning, it will stimulate and engage students to participate in the lesson.

Here are some ethnomathematics elements of the classic congklak game (Rohmatin, 2020).

1) Jackhole: the design conveys children's understanding of how to find volume and learn flat shapes such as circles or hemispheres.

2) Congklak seeds: teach children about how to count and accuracy.

3) Determination of playing turns: learn about professionalism and honesty in playing with the steps of doing a suit (suit).

4) Goal hole/player barn: children learn about probability and number material.

5) The process of playing until the winner is determined: congklak is able to train a trading spirit and sharp thinking in making decisions.

Ethnomatematics is related to the practice of mathematics, mathematical ideas, and mathematical knowledge of a socio-cultural group of people related to calculation, grouping, sorting, inference, and modeling (Dominikus, 2018). The steps for preparing the game and the rules for playing the congklak game are examples of ethnomathematics, namely in the form of mathematical concepts, including planes, geometric shapes, and counting. In addition, at the preparatory stage of the game, players do suits (sut) to understand the concept of chance (Lia Prayitno, 2016).

Two players can take part in the traditional congklak game where players have characters that teach about sportsmanship and honesty. In addition, playing congklak can also teach players about how to count. This is shown when players count the congklak seeds they have put in the holes, and the rules of the game require that each hole be filled with seven congklak seeds, which are the same number as the number of congklak that the player collects in their destination hole (the barn). The game of congklak has some of the more distinctive elements, namely helping to develop a trading mindset and sharp decision-making. The social and emotional benefits of playing congklak are increasing players' confidence because they will compete, they can control their emotions to concentrate more on their goals, and develop patience in playing so as to prevent players from making hasty decisions.

Character Education Values in the Congklak Game

The traditional game of congklak is played throughout Indonesia under various names. Referred to as congklak (congklakan) in Indramayu. The game of congklak is more often called congklak in some parts of the island of Sumatra. Congklak is more often referred to as dakon, dhakon, or dhakonan on the island of Java. While the congklak game is more commonly known as the slow thump in Lampung province and the designations mokaotan, maggaleceng, aggalacang, or nogarata on the island of Sulawesi. The name of the congklak game in English is mancala (Siregar et al., 2014).

The positive impact of the congklak game on improving character education. Various attitudes, knowledge, motivations, talents, and behaviors all play a role in that character.

1) Develop and improve social skills.

Socialization is a key component of success. When a child socializes well, it is easier for them to get along with all their peers and develop empathy and sympathy. By playing congklak, it will allow children to have better social interaction with their friends (Kamid et al., 2021). Play allows children to communicate more with their peers and teaches them problem-solving skills.

2) Develop and strengthen children's patience, perseverance and honesty.

Everyone needs to learn patience from an early age, and patience is something that everyone needs. As participants in this congklak game, taking turns placing seeds in the congklak hole can teach children to be careful and patient with each other (Asteria, 2017). This teaches children to be patient and wait for their turn.

3) Develop and train the virtues of sportsmanship.

The Congklak game develops accuracy and honesty when teaching arithmetic (Kamid et al., 2021). Honesty in this game is shown when

players fill the holes with their hands and are prohibited from inserting more than one seed into the big hole. Therefore, this game can teach children to be honest from an early age (Hudiria et al., 2019).

4) Develop and train analytical skills.

According to (Dominikus, 2018), congklak is practiced so players can evaluate the flow of the game. Players can win when they are able to take seeds that will benefit them. So this kind of expertise is needed in everyday life.

5) Cultivate and enhance children's creativity.

Every game will definitely cause boredom. Therefore, children are required to use their creativity by modifying the game with the original concept, but they are not allowed to add rules that have been decided together with their friends.

6) Train and develop children.

Children sometimes compare themselves with other players or playmates when playing congklak. This helps them develop a positive self-concept and boosts their self-confidence. In addition, friends who are playing are motivated not to lose to their friends.

The congkak game emphasizes nine character traits, including integrity, perseverance, self-control, curiosity, creativity, independence, responsibility and respect (Salsabilah et al., 2022). The congklak game fosters honesty, accuracy in calculations, and precision (Astuti et al., 2023). Each child must be able to estimate his victory by collecting the most seeds. Today, modern games ignore those character values. The congklak game can be used as a way to develop morals, ethics and honesty. Traditional games can help children develop their communication skills in social situations so that they are able to compete, work together and make new friends. Character values are developed through congklak game activities that encourage tolerance and empathy for players and can hone emotional skills to be with and interact with playmates. Waiting for your turn and getting used to queuing is a reflection of being patient, following the rules of the game, being observant or thorough, and having dexterity in your hands/feet, the spirit of hard work, training your body skills, being careful, and sportsmanship. The benefits of playing the traditional congklak game are as follows: children's happiness takes precedence over their ability to learn mathematics, their ability to patiently wait for their turn to play, their ability to develop winning strategies, their accuracy when inserting congklak fruit into the congklak hole, and their honest practice (Pingge et al., 2023; Rinto et al., 2022).

Character Values and Cognitive Aspects of the Congklak Game in Mathematics Learning

Congklak games can help children develop character values, morals and life lessons. Congklak games can help students acquire moral principles when they learn mathematics. Because a learner must be honest, thorough, patient, innovative, and responsible in order to understand mathematics. If a teacher uses the congkak game as a learning medium, then there are various character values that can be communicated to students such as cooperation, mutual respect, and honesty. These characters include integrity, steadfastness, respect, perseverance, hard work, and respect for others. Character values are a fundamental component that must exist in learning mathematics, also called the characteristics of learning mathematics, when associated with the context of learning mathematics. That is, the congklak game can be used as one of the media in learning quality mathematics because through the congklak game, one can learn to count, accuracy, patience, honesty, and develop a game plan that can help one to win.

The congklak board contains one large hole on each end and seven small holes on each side. The hole in the congklak board looks like a circle from above. However, the hole in the congklak board looks hemispherical when viewed in three dimensions. The congklak board serves as a way for both players to learn about circles and balls (Sari & Switania, 2021). Players usually compare which hole has the most seeds before taking another. Players will use a better concept of probability to fill the objective hole if the hole has more checkers. Players in this congklak game unconsciously use the concept of opportunity and comparison. Each player will count the number of seeds won at the end of the game. This implies that the counting task will be performed by all players. After both players have determined who has the most seeds, they compare the two numbers and choose the larger of the two. The congklak game can develop cognitive aspects including (Ruswana & Zamnah, 2023): (1) counting skills; (2) calculating and adding skills; (3) sharpen strategy; (4) memory skills; (5) increase creativity; (6) problem solving; (7) know the ratio of many-little; (8) know comparisons; (9) practicing numeracy skills.

The ethnomathematics study of character

values and cognitive aspects through the congklak game in mathematics learning, the relationship between ethnomathematics, character values and cognitive aspects in the congklak game can be presented in the following table:

Table 1. Ethnomatematics of character values and cognitive aspects that can be developed through congklak games in learning mathematics

Parts of Congklak	Ethnomatematics Elements	Character Values	Cognitive Aspect
Congklak Hole (Top board hole congklak)	The congklak board hole is circular when viewed from above, can be used as an example of teaching flat shapes, congruence of circles, and also about symmetrical shapes. In addition, a congklak board in the form of a hole the size of half a ball when viewed from the bottom can be used as material to find the volume of a geometric shape in a ball.	Train and improve honesty, perseverance, and patience; encourage and develop children's creativity; as well as having and practicing self-development.	Train numeracy skills, hone strategies, increase creativity, problem solving, and develop numeracy skills.
Congklak seeds	When inserting the congklak seeds into the hole, the player counts the congklak seeds that enter, and the condition for each game is that the hole is filled with seven congklak seeds. This demonstrates the concept of counting integers and sets.	Because the players in this game take turns putting the congklak seeds into the congklak board holes, this is a good way to train children's patience and perseverance. When playing this congklak game that teaches honesty, especially when children's hands are filling in the holes, players must be honest and not cheat by putting more than one seed into the big hole.	Counting and counting skills, train skills count and count.
Turn determination Play	Since the player who wins the suit (sut) will have the first chance to play, the concept of chance is implied.	To engage with friends during play, waiting their turn, and getting used to queuing, a person must practice and improve their patience, caring, interactional skills, and emotional intelligence.	Memory skills, addition and subtraction skills, and counting techniques are all taught in this game.
Player barns (destination holes)	The aim of this game is to teach children the value of big and small numbers by counting the congklak seeds in each player's barn (destination hole).	Analysis, rigor, and honesty and sportsmanship are skills that can be trained and improved.	Understand the concept of comparison
Game process	To improve players' reasoning ability, cultivate a trader's soul in players, and sharpen their minds to make successful decisions.	Develops social skills of players and enhances a sense of cooperation, sportsmanship, tolerance and empathy.	Skills that train counting include the ability to add and subtract, improve strategy, remember information, and be more creative.

CONCLUSION

Congklak is a traditional game that incorporates ethnomathematics elements, character values, and involves mathematical cognitive learning. Congklak is a very good game in helping students understand abstract mathematical symbols. In the congklak game there are several ethnomathematics components.

The congklak seed has the idea of calculating integers and sets, while the congklak seed has materials for calculating the volume of a spherical shape. Players' barns offer greater and lesser values during their turn to play, which is an opportunity to hone a child's reasoning. At this stage, children learn how to make decisions with good judgment and for their own benefit. Characteristics in this game can train and improve social skills, increase patience, honesty, and thoroughness, train creativity, practice self-development, sincerity, ability to interact, cooperate, discipline, tolerance, empathy for players, and be able to hone children's emotional skills while waiting for play. Congklak has cognitive components such as practicing numeracy skills, knowing many and few comparisons, sharpening strategies, memory skills, increasing creativity, problem solving skills, and practicing numeracy skills.

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