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RECONSTRUCTION OF MATHEMATICAL CONCEPTS IN THE BELIS TRADITION OF THE ADONARA COMMUNITY

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ABSTRACT

Previous ethnomathematics studies have primarily focused on identifying mathematical activities embedded in cultural practices, while limited attention has been given to reconstructing these activities into explicit mathematical concepts for mathematics education. Few studies have examined how mathematical concepts embedded in the belis tradition of the Adonara community can be systematically reconstructed while preserving their cultural meanings. Therefore, this study aims to describe the manifestations and meanings of mathematical concepts embedded in the belis tradition of the Adonara community, East Flores Regency, Indonesia, from an ethnomathematical perspective. This study employed a qualitative approach with an ethnomathematical perspective. Data were collected through observation, in-depth interviews, and documentation involving four traditional leaders with extensive knowledge of the belis tradition. Data were analyzed through data condensation, data display, and conclusion drawing and verification. The trustworthiness of the findings was established through source and technique triangulation. The findings reveal several mathematical concepts embedded in the belis tradition, including arithmetic operations, comparison and proportion, systematic sequencing, sets and classification, and social arithmetic. These concepts are reflected in determining quantities and values of customary objects, establishing balance between the obligations of the groom's and bride's families, sequencing the stages of the belis process, classifying customary objects, and estimating economic value and family responsibilities. Beyond their functional roles, these concepts embody cultural values of responsibility, justice, solidarity, mutual respect, and adherence to customary norms. The findings demonstrate that the belis tradition constitutes a valuable source of culturally grounded mathematical concepts and provides meaningful contexts for mathematics learning and the development of mathematics teaching materials.

Keywords: Ethnomathematics, *Belis* Tradition, Mathematical Concepts, Adonara Community, Local Culture.

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PRELIMINARY

Indonesia is a country with cultural diversity reflected in various traditions, customs, languages, arts, and local wisdom passed down from generation to generation. Local wisdom not only serves as a cultural identity for the community, but also contains various forms of knowledge that develop and are used in everyday life. This knowledge is

born from the community's experiences in interacting with their social and cultural environment, thus becoming an inseparable part of community life. Local wisdom not only serves as a cultural identity passed down from generation to generation, but also serves as a source of knowledge that can be used to identify and develop mathematical concepts implicit in various cultural practices of the communit (Zulaika et al., 2022; Tihnike, 2025).

The relationship between culture and mathematics is examined through an ethnomathematics perspective. D'Ambrosio (1985) explains that ethnomathematics is the study of how a cultural group understands, develops, and uses mathematical ideas in the context of their lives. This perspective shows that mathematics not only develops in formal educational settings but is also present in various social and cultural activities in society. In line with this, Bishop (1988) states that mathematical activities such as counting, measuring, classifying, locating, designing, and explaining are universal activities found across cultures. Recent studies have further confirmed that mathematical ideas are embedded in diverse cultural practices and can be systematically explored to reveal formal mathematical concepts that support meaningful mathematics learning (Anggraini et al., 2024; Nursanti et al., 2024; Rohman & Widiyastuti, 2024). Thus, various cultural practices have the potential to contain mathematical concepts that can be identified and analyzed through an ethnomathematical perspective.

One of the cultural traditions still maintained by the Adonara community in East Flores Regency is the belis tradition. The belis tradition is an important part of the traditional marriage system, manifested through the transfer of a number of traditional items from the man's family to the woman's family. In the Adonara community, belis is not understood as a mere economic transaction, but rather as a symbol of respect for the woman and her family, a bond of kinship, and a manifestation of social responsibility between the two families. The items used in the belis tradition generally include elephant ivory (*bala*), livestock, woven cloth (*kewatek*), or other traditional items with specific social and cultural values. The existence of this tradition demonstrates that the Adonara community still maintains a system of cultural values passed down through generations in their social life.

The implementation of the belis tradition involves various activities that demonstrate the existence of mathematical practices in community life. These activities include calculating the number of belis items required, determining the equivalence of value between traditional items, comparing the number and type of items given, grouping items into specific categories, and dividing the responsibility for fulfilling the belis among

family members. Furthermore, the deliberation process in determining the number and value of the belis also involves quantitative considerations related to the family's economic capacity and prevailing customary agreements. These activities demonstrate the existence of mathematical processes that align with the universal mathematical activities proposed by Bishop (1988) so that the belis tradition has the potential to become an object of ethnomathematics study that is rich in cultural and mathematical meaning.

Previous ethnomathematics studies have predominantly focused on identifying mathematical concepts embedded in various cultural practices, such as traditional games, crafts, and local traditions. However, these studies have generally been limited to identifying mathematical activities without systematically reconstructing them into formal mathematical concepts that can support mathematics education. In addition, studies specifically examining the *belis* tradition of the Adonara community from the perspective of reconstructing mathematical concepts remain limited. Therefore, the novelty of this study lies in its systematic reconstruction of the mathematical concepts embedded in the *belis* tradition into explicit mathematical structures that can be utilized in educational contexts. Accordingly, this study aims to reconstruct and describe the manifestations and meanings of mathematical concepts embedded in the *belis* tradition of the Adonara community through an ethnomathematical perspective. The findings are expected to enrich ethnomathematics research and provide a foundation for developing contextual and meaningful mathematics teaching materials based on local wisdom.

METHODS

This study employed a qualitative approach with an ethnographic approach. This approach was chosen because it allows researchers to deeply understand the cultural meanings inherent in the community. The research location is on Adonara Island, specifically in Nubalema Dua Village, Central Adonara District, East Flores Regency. Research informants were selected using a purposive sampling technique, consisting of traditional leaders, community elders, and members of the public familiar with and involved in the belis tradition.

Data collection techniques included observation, in-depth interviews, and documentation. Observations were conducted to directly examine the implementation of the *belis* tradition, particularly the customary deliberation process, the determination of the quantity and value of *belis* components, the grouping of customary objects, and the distribution of responsibilities among extended family members. In-depth interviews were

conducted with four purposively selected traditional leaders who possessed extensive knowledge and experience regarding the implementation of the *belis* tradition in the Adonara community. The interviews aimed to obtain in-depth information about the representation and cultural meaning of the mathematical concepts embedded in the *belis* tradition. Documentation was collected to support the research findings and included photographs of the *belis* process, records of customary deliberations, field notes, and relevant cultural documents related to the implementation of the *belis* tradition.

Data were analyzed using the interactive analysis model developed by Matthew B. Miles., & A. Michael Huberman (2023), which consists of three stages: data condensation, data display, and conclusion drawing and verification. Data condensation involved selecting, simplifying, and organizing the information obtained from observations, interviews, and documentation. The organized data were then presented systematically to facilitate interpretation before conclusions were drawn and verified throughout the research process. To ensure the trustworthiness of the findings, data validity was established through source triangulation and technique triangulation by comparing information obtained from the four traditional leaders with evidence collected through observations, interviews, and documentation.

RESULT AND DISCUSSION

The belis tradition is a crucial stage in the traditional weddings of the Adonara people. This tradition begins with a deliberation between the groom's and the bride's families to determine the components of the belis to be exchanged. This deliberation involves traditional leaders, extended family members, and other parties with authority in customary decision-making. During the deliberation, both parties discuss the number of *bala* (elephant tusks) and *witi* (goat) that the groom must provide, as well as the number of *kewatek* (traditional woven fabrics), *lipa* (non-traditional fabrics), and *epe eti* (household furnishings) that the bride will provide as customary recompense.

Research findings show that each component of the belis has a distinct form, function, and value. *Bala* is the primary component, possessing the highest traditional value and serving as a symbol of respect for the woman's family. Meanwhile, *witi* complements the belis, demonstrating the man's commitment to fulfilling customary obligations. In return, the woman provides *kewatek* , *lipa*, and *epe eti*, symbolizing respect and reciprocity between the two families. Documentation obtained during the research also

shows that all components of the belis are always stated in specific quantities and prepared based on agreements reached during customary deliberations.

(a) *Bala* (elephant tusk)

(b) *Kewatek* (traditional woven cloth)

(c) *Witi* (goat)

(d) *Epe Eti* (household goods).

1. The Concept of Numbers and Arithmetic Operations

In the Adonara community's traditional dowry (belis) ceremony, various activities demonstrate the application of number concepts and arithmetic operations in everyday life. The concept of addition is evident in the activity of counting the number of *bala* (elephant tusks), *witi* (goat), *kewatek* (traditional woven cloth), *lipa* (non-traditional cloth), and *epe eti* (household furnishings) used as part of the dowry. All these components are added together to determine the total dowry that the groom must fulfill, as agreed upon in the customary deliberation.

In addition to addition, the belis tradition also demonstrates the use of the concept of multiplication in determining the value of a belis. This concept is used when communities calculate the value of a component based on its quantity and unit price. For example, the agreed-upon number of *witi* is multiplied by the price per head to obtain the total value of the component. Similarly, *kewatek* or *lipa* can be calculated based on the

number of sheets and their respective values. This activity demonstrates the use of the concept of multiplication to estimate the overall economic value of the belis.

Table 1. Concept of Numbers and Arithmetic Operations

Cultural Activity	Mathematical Representation	Mathematical Concept
Counting the number of *bala*, *witi*, *kewatek*, *lipa*, and *epe eti*	$T = b + w + k + l + e$	Addition
Determining the remaining *belis* obligations	$R = T - P$	Subtraction
Estimating the total value of *belis* components	$V = n \times p$	Multiplication
Distributing *belis* obligations among extended family members	$S = \frac{T}{m}$	Division

Notation:

T = Total number of belis components;

b = Number of bala;

k = = Number of *kewatek*;

l = Number of lipa;

e = Number of epe eti;

R = Remaining belis obligations;

P = Number of fulfilled belis components;

V = Total value of a belis component;

n = Quantity of a belis component;

p = Unit value of a belis component;

S = Share of responsibility for each family member;

m = Number of contributing extended family members.

2. The Concept of Comparison and Proportion

The concept of comparison is evident when communities compare the value of one component of a belis with another to achieve equality in customary exchanges. For example, the value of one *bala* can be compared to a number of *kewatek* , *lipa*, and *epe eti*, which are considered to have equivalent customary value. This comparison forms the basis for the negotiation process, enabling both families to reach a mutually acceptable agreement. This activity demonstrates that communities use the concept of comparison to determine a *bala*nced relationship between the various components of the belis.

Furthermore, the concept of a comparison of value is also evident in the relationship between the level of respect given to the woman and the amount of dowry prepared by the man. The higher the respect desired to be shown to the woman's family,

the greater the amount of *bala*, *witi*, or other components of the dowry prepared. This relationship demonstrates a directional relationship between the two quantities, thus categorizing them as a comparison of value.

The concept of proportion is found in the process of fulfilling the belis (price dowry) involving the extended family. In practice, the obligation to fulfill the belis falls not only on the nuclear family but also on close relatives. Each family member contributes according to their financial means. Families with greater financial means typically provide more assistance than other family members. This division of responsibilities reflects the application of the concept of proportion in indigenous communities.

Table 2. Concept of Comparison and Proportion

Cultural Activity	Mathematical Representation	Mathematical Concept
Comparing the quantity of *bala* and *kewatek*	$\frac{b}{k}$	Ratio
Comparing the customary value of *bala* and *kewatek*	$\frac{V_b}{V_k}$	Proportion
Family contribution according to economic capability	$C_i = \frac{c_i}{T}$	Proportion

Notation:

b = Number of bala;

k = Number of kewatek;

V_b = Value of bala;

V_k = Value of kewatek;

C_i = Proportion of the contribution made by the iii − th family member;

c_i = Contribution of the iii − th family member;

T = Total belis obligation.

3. Concept of Sets and Classification

In the practice of the Adonara community's traditional dowry (belis), the concept of assemblage and classification is evident in the way the community groups the various components of the dowry based on type, function, and the party providing it. Each component of the dowry is not viewed as a standalone item, but rather as part of a specific group with its own meaning and function in the implementation of the custom. The components given by the man generally consist of *bala* (elephant ivory) and *witi* (goat), while the woman gives *kewatek* (traditional woven cloth), *lipa* (non-traditional cloth), and *epe eti* (household furnishings) as customary gifts.

Classification activities are also evident when the community differentiates the components of the belis based on their function and cultural value. *Bala* and *witi* are seen as symbols of respect from the man's family to the woman's family, while *kewatek* , *lipa*, and *epe eti* represent reciprocity and the reciprocal relationship between the two families. This functional grouping makes it easier for the community to understand the role of each component in the overall belis tradition.

Table 3. Concept of Sets

Cultural Activity	Mathematical Representation	Mathematical Concept
Components provided by the groom's family	$A = \{witi, bala\}$	Set
Components provided by the bride's family	$B = \{kwatek, lipa, epe\ eti\}$	Set
All *belis* components	$U = A \cup B$	Universal set
Relationship between the two groups	$A \cap B = \emptyset$	Disjoint set

Notation:

A =Set of *belis* components provided by the groom's family;

B = Set of customary gifts provided by the bride's family;

U = Universal set consisting of all *belis* components;

$\cup$= Union of sets;

$\cap$= Intersection of sets;

$\emptyset$ = Empty set.

The findings of this study demonstrate that the *belis* tradition of the Adonara community embodies various mathematical concepts that emerge through customary activities, including the concepts of numbers and arithmetic operations, comparison and proportion, sets and classification, and social arithmetic. These concepts are reflected in customary deliberations, determining the quantity and value of *belis* components, grouping customary objects according to their functions, distributing responsibilities among extended family members, and estimating the economic value of the exchanged customary goods. The identification of these concepts was based on evidence obtained through interviews with traditional leaders, field observations, and documentation of the *belis* process, which consistently showed that mathematical reasoning is embedded in the implementation of customary practices.

Research findings indicate that the concepts of numbers and arithmetic operations emerge through the activity of counting the number of *bala*, *witi*, *kewatek*, *lipa*, and *epe eti*, which constitute the principal components of the *belis* tradition. Addition is applied to determine the total number of *belis* components that must be fulfilled, whereas subtraction is used to identify the remaining customary obligations that have not yet been completed. Furthermore, multiplication is employed when estimating the total value of customary objects based on their quantity and unit value, while division is reflected in the distribution of responsibilities among members of the extended family in fulfilling the *belis* obligations.

However, the present study extends these previous findings in several important respects. While previous studies primarily focused on identifying arithmetic concepts embedded in cultural practices, this study reconstructs these mathematical activities into explicit mathematical concepts while simultaneously interpreting their cultural meanings within the ***belis*** tradition of the Adonara community. Furthermore, unlike previous studies that mainly examined cultural practices as contexts for mathematics learning, the present study demonstrates that arithmetic operations function as an integral part of customary deliberations, negotiations, and the fulfillment of customary obligations. Consequently, arithmetic operations in the ***belis*** tradition serve not only as computational procedures but also as mechanisms for maintaining collective responsibility, social harmony, and adherence to customary values. This finding broadens previous ethnomathematics research by demonstrating that mathematical concepts embedded in indigenous cultural practices can be systematically reconstructed into formal mathematical knowledge without neglecting their cultural significance.

1. The Concept of Comparison and Proportion

The concept of comparison and proportion is evident in the process of determining the balance between the components of the *belis* given by the groom and the customary compensation given by the bride. In customary deliberations, the community compares the number and value of the *bala* and *witi* with the *kewatek*, *lipa*, and *epe eti* to reach an agreement deemed fair by both families. Furthermore, the concept of proportion is also evident when extended family members contribute according to their respective economic capabilities to meet the needs of the *belis*.

The interpretation of these findings is supported by empirical evidence obtained through interviews, observations, and documentation. Interviews with traditional leaders revealed that the determination of the quantity and value of each *belis* component is

conducted through customary deliberation by considering the customary agreements, kinship relationships, and the economic capability of both families. The interview results also indicated that the balance between the *belis* provided by the groom's family and the customary compensation from the bride's family is an important principle for maintaining fairness and harmony in the marriage process. These findings were reinforced by field observations showing that the comparison of the quantity and value of each customary component became the main consideration during customary negotiations before the final agreement was reached. Documentation of the *belis* process further confirmed that the agreed composition of customary objects reflected proportional relationships between the obligations of the two families. These findings indicate that communities use the concept of comparison not only to determine quantitative relationships but also to maintain social and economic balance in the implementation of customary practices.

This finding is also supported by Qolbiyah et al. (2025), which shows that the concepts of ratio and proportion can be identified in cultural practices through the determination of the composition of ingredients and the relationship between quantities in the process of making traditional food. The study explains that cultural activities involving quantity comparisons can be used as a more meaningful context for learning mathematics because they connect formal concepts with real-life experiences of the community. However, the present study extends these previous findings by demonstrating that comparison and proportion in the *belis* tradition are not only reflected in determining quantitative relationships but also function as customary principles for achieving fairness, reciprocity, and mutual agreement between the two families. Thus, this study not only identifies the mathematical concepts embedded in cultural practices but also reconstructs them into explicit mathematical concepts while explaining their cultural meaning within the implementation of the *belis* tradition.

3. Concept of Sets and Classification

The research results show that the concepts of sets and classification are evident in how communities group *belis* components based on type and function. *Bala* and *witi* are categorized as components given by the man, while *kewatek*, *lipa*, and *epe eti* are categorized as customary gifts from the woman. Furthermore, each component can be classified based on its form, function, and cultural value.

The interpretation of these findings is supported by empirical evidence obtained through interviews, observations, and documentation. Interviews with traditional leaders revealed that the classification of *belis* components is carried out to distinguish the

customary obligations of the groom's family from the customary gifts of the bride's family, thereby ensuring that each component fulfills its respective customary function. The interview results also indicated that every customary object has a specific category determined according to its type, cultural value, and role in the marriage ceremony. These findings were reinforced by field observations showing that the *belis* components were grouped according to their categories before the customary handover process. Documentation of the *belis* ceremony further confirmed that each customary object was consistently classified based on its type, function, and traditional value. These findings demonstrate that the process of grouping *belis* components reflects systematic classification activities that correspond to the mathematical concept of sets.

This finding is also strengthened by Arwanto (2017), which explains that ethnomathematics studies show a close relationship between cultural activities of society and mathematical concepts. This view is in line with Anggraini et al. (2024), which reveals that ethnomathematics exploration in Malangan Mask art has succeeded in identifying mathematical concepts, such as sets and relations, through the process of grouping figures based on certain characteristics, thus showing that cultural practices contain mathematical concepts that can be identified and interpreted scientifically. However, the present study extends these previous findings by demonstrating that the grouping of *belis* components is not only intended to classify objects according to their characteristics but also functions to organize customary responsibilities, preserve cultural values, and ensure the orderly implementation of the *belis* ceremony. Therefore, this study not only identifies the concept of sets embedded in cultural practices but also reconstructs it into an explicit mathematical concept while explaining its cultural meaning within the Adonara *belis* tradition.

Therefore, the grouping of *belis* components in Adonara society can be understood as the application of the concept of sets that grows and develops in the context of the community's culture. Furthermore, these findings provide a meaningful context for mathematics learning because they enable students to understand the concept of sets through cultural practices that are familiar in their daily lives. Consequently, this study contributes not only to the development of contextual mathematics teaching materials but also to the enrichment of ethnomathematics research by demonstrating that indigenous classification systems can be systematically reconstructed into formal mathematical concepts while preserving their cultural significance.

CONCLUSION

The Adonara people's belis tradition contains various mathematical concepts integrated into everyday cultural practices, including arithmetic operations, comparisons, systematic sequences, sets, and social arithmetic. These concepts are evident in the process of determining the number of belis items, grouping the types of items, arranging the customary stages in an orderly manner, and considering economic values and the division of family responsibilities. In addition to functioning in carrying out the tradition, these mathematical concepts also reflect cultural values such as responsibility, respect, justice, solidarity, and adherence to customary norms. Thus, the belis tradition is not only a cultural heritage but also a space for preserving mathematical knowledge that lives within the community.

The results of this study can be further developed as a basis for developing contextual ethnomathematics-based mathematics teaching materials or learning media. Further research could focus on implementing and testing the effectiveness of integrating the belis tradition into mathematics learning in schools.

The reconstruction of these mathematical concepts also shows that the belis tradition can serve as a bridge between students' cultural experiences and formal mathematical knowledge. Through contextual examples derived from counting, comparing, grouping, and determining the value of belis components, students can be encouraged to recognize mathematics as knowledge that is present in their surrounding environment. This perspective can make mathematics learning more meaningful while simultaneously strengthening students' appreciation of local culture.

In this regard, the findings provide a conceptual foundation for the development of mathematics teaching materials that integrate local wisdom with curriculum content. Such materials can present belis-related situations as contextual problems while maintaining the cultural meanings attached to each practice. The integration should therefore be carried out carefully so that mathematical formalization does not eliminate the cultural values of responsibility, reciprocity, solidarity, and respect that characterize the Adonara belis tradition.

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