ETHNOMATHEMATICAL EXPLORATION OF THE APEM WONOLELO TRADITION IN SLEMAN REGENCY

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ABSTRACT

This study aims to explore and describe the mathematical concepts embedded in the Apem Wonolelo culture of Sleman Regency through an ethnomathematical approach. The research employed a qualitative method with an ethnographic design. Data were collected through participatory observation, in-depth interviews with apem makers and community leaders, as well as photographic and video documentation of the "Apeman" tradition. The data were analyzed qualitatively and descriptively through the stages of data reduction, data presentation, and conclusion drawing, with data validity ensured through source and technique triangulation. The results reveal five main aspects of ethnomathematics in the Apem Wonolelo tradition: (1) geometry and symmetry in the shape of the apem; (2) ratio and proportion in ingredient composition; (3) patterns and sequences in the production process; (4) measurement of volume and dough capacity; and (5) statistical concepts in the distribution tradition. Each of these aspects reflects the intuitive application of mathematical concepts in daily life. This study highlights that ethnomathematics not only represents local wisdom but also holds great potential as a contextual learning medium that connects culture, social values, and formal mathematical understanding in educational settings.

Keywords: *Ethnomathematics, Apem Wonolelo, Geometry, Ratio*

ABSTRAK

Penelitian ini bertujuan untuk mengeksplorasi dan mendeskripsikan konsep-konsep matematis yang terkandung dalam budaya Apem Wonolelo khas Kabupaten Sleman melalui pendekatan etnomatematika. Metode penelitian yang digunakan adalah kualitatif dengan jenis penelitian etnografi. Data diperoleh melalui observasi partisipatif, wawancara mendalam dengan pembuat apem dan tokoh masyarakat, serta dokumentasi foto dan video tradisi "Apeman". Analisis data dilakukan secara deskriptif kualitatif melalui tahapan reduksi data, penyajian data, dan penarikan kesimpulan dengan validasi menggunakan triangulasi sumber dan teknik. Hasil penelitian menunjukkan bahwa dalam budaya Apem Wonolelo terdapat lima aspek etnomatematika utama: (1) geometri dan simetri pada bentuk apem; (2) rasio dan proporsi bahan; (3) pola dan urutan dalam proses produksi; (4) pengukuran volume dan kapasitas adonan; serta (5) konsep statistika dalam tradisi pembagian apem. Setiap aspek tersebut mencerminkan penerapan konsep matematis secara intuitif dalam kehidupan masyarakat. Penelitian ini menegaskan bahwa etnomatematika tidak hanya merefleksikan kearifan lokal, tetapi juga memiliki potensi besar untuk dijadikan media pembelajaran kontekstual yang mengaitkan antara budaya, nilai-nilai sosial, dan pemahaman matematika formal di sekolah.

Kata Kunci: Etnomatematika, Apem Wonolelo, Geometri, Rasio

1. INTRODUCTION

Mathematics is often perceived as an abstract discipline detached from everyday life, creating the impression that it is difficult and irrelevant for many students [1]. In fact, within the context of modern education, mathematics should be taught in a meaningful way that connects to students' social and cultural realities [2]. One approach that bridges this gap is *ethnomathematics*, which examines how mathematical concepts are

manifested in the cultural practices of a community [3]. Through this approach, mathematics is not merely understood as a collection of formulas and symbols, but as a cultural product embedded in the daily activities of society. *Ethnomathematics* enables educators and researchers to uncover deep connections between local knowledge and formal mathematical reasoning, making learning more contextual, applicable, and meaningful.

Indonesia, as a nation rich in cultural diversity, holds immense potential for exploration through the lens of *ethnomathematics*. Various traditions, games, architecture, and culinary practices contain intuitive and empirical applications of mathematical concepts [4]. One fascinating example is the tradition and prepa*ratio*n of Apem Wonolelo in Sleman Regency, Yogyakarta Special Region. Apem Wonolelo is not only a traditional delicacy served during the "Apeman" ritual before Ramadan but also embodies symbolic values of harmony, togetherness, and balance [5]. Beneath its simple prepa*ratio*n process lies the implicit application of mathematical principles such as *geometry*, *ratio*, *symmetry*, and *statistics* passed down through gene*ratio*n as part of everyday reasoning. This phenomenon illustrates that local culture has great potential as a meaningful source for mathematics learning.

The study of *ethnomathematics* in Apem Wonolelo is important because this tradition represents the empirical mathematical thinking of Javanese society, shaped by collective experience and cultural habits. In the process of making apem, for instance, makers use specific ingredient *ratios*, estimate dough volume, and maintain uniformity in shape through *symmetry* and balance. All these activities reflect the application of mathematical concepts within a real cultural context [6]. Therefore, this research aims to explore the representation of mathematical concepts embedded in the Apem Wonolelo tradition, showing that mathematical knowledge is not solely acquired through formal education but also evolves from community-based cultural practices [7], [8].

From an educational perspective, ethnomathematical studies hold significant relevance for the development of contextual learning. Mathematics learning that connects to local culture can enhance students' motivation, conceptual understanding, and critical thinking skills [9]. By using cultural contexts such as Apem Wonolelo, students can understand *geometry* through the circular shape of the apem, *ratio* and proportion through ingredient composition, and statistics through the distribution of apem during the Apeman ritual. Such learning aligns with the principles of Contextual Teaching and Learning (CTL), which emphasizes the link between real-life experiences and academic understanding. A culture-based approach also supports character development by instilling values of cooperation, balance, and precision.

Theoretically, this research reinforces a new paradigm in mathematics education known as humanistic mathematics, which views mathematics as a human activity connected to values, culture, and creativity [10]. Through ethnographic studies, researchers can understand how communities apply mathematical concepts practically within specific social contexts. Thus, Apem Wonolelo can be seen as a "cultural text" containing implicit mathematical meanings worthy of scholarly interpretation. Wibowo [11] and Saleh et al. [12] highlights that cultural activities such as crafting traditional artifacts are forms of natural mathematical exploration that develop outside formal education systems. Therefore, studying *ethnomathematics* also means studying how people think, create, and adapt through their own mathematical logic.

Practically, the findings of this study can contribute to teachers, researchers, and curriculum developers in designing learning materials rooted in local wisdom [13], [14]. Through the integ*ratio*n of *ethnomathematics*, mathematics education can be directed toward developing analytical, logical, and contextual thinking skills. Moreover, students learn to appreciate their own culture and understand that mathematics exists in all aspects of life including daily activities such as cooking, trading, and making traditional cakes [15]. Hence, *ethnomathematics* serves a dual purpose: as a means of cultural preservation and as a pedagogical innovation in mathematics education. This effort also aligns with the Merdeka Belajar vision, which emphasizes the importance of contextual and humanistic learning.

Based on the above discussion, the study entitled "ethnomathematical exploration of the apem wonolelo tradition in Sleman Regency" aims to reveal and describe the forms of mathematical concept representation found in the making and distribution of Apem Wonolelo. Through an ethnographic approach, this research seeks to provide a deep understanding of how the Sleman community constructs mathematical knowledge through cultural practices. The findings are expected not only to enrich ethnomathematical studies in Indonesia but also to contribute practically to the development of contextual mathematics learning that is more relevant, meaningful, and grounded in local [16], [17].

2. LITERATURE REVIEW

2.1. *Ethnomathematics*

Ethnomathematics is a field of study that connects mathematical concepts with the cultural contexts in which people live and interact. According to Özcan [18], *ethnomathematics* is defined as the way in which particular communities understand, express, and apply mathematical ideas in daily activities rooted in their traditions, customs, and cultural values. From this perspective, mathematics is not only viewed as an abstract and universal science but also as a social construct that exists within every civilization. Several studies have shown that *ethnomathematics* can bridge the gap between formal education and students' cultural realities [19]. This approach provides opportunities for students to comprehend mathematical concepts through contextual activities relevant to their social environment, thereby enhancing motivation, understanding, and meaningful learning.

Furthermore, *ethnomathematics* serves as an essential tool for preserving local culture while revitalizing education based on indigenous wisdom. As Fauzi et al. [20] emphasizes, every culture possesses its own system of mathematical thinking, manifested in activities such as measuring, counting, designing patterns, and organizing space. Thus, *ethnomathematics* can be interpreted as a representation of practical community knowledge that reflects aesthetic, social, and spiritual values. In the context of Indonesian education, the ethnomathematical approach aligns with the Merdeka Belajar curriculum, which emphasizes contextual learning, critical thinking, and character development [21]. Through the implementation of *ethnomathematics* in teaching, students not only learn mathematical concepts formally but also understand their significance within their own cultural and social lives.

2.2. Apem Wonolelo

Apem Wonolelo is one of the traditional culinary heritages originating from Wonolelo Village, Sleman Regency, Yogyakarta Special Region. The apem cake holds deep philosophical meaning for the Javanese community, especially in the "Apeman" tradition conducted before the month of Ramadan as a symbol of apology and self-purification [22]. The round shape and soft texture of apem are often interpreted as representations of perfection, wholeness, and harmony in life. This tradition not only reflects spiritual and social values but also contains practical knowledge related to production processes, ingredient measurement, and consistency in crafting patterns. From an ethnomathematical perspective, these activities incorporate mathematical elements that are internalized within community habits, often unconsciously applied in daily life.

The study of Apem Wonolelo provides an opportunity to understand how cultural values can be integrated with scientific concepts such as *geometry*, *ratio*, and statistics. The symmetrical shape of the apem, the precise proportion of ingredients, and the distribution process during the "Apeman" ritual all reflect the contextual application of mathematical concepts [23]. Thus, Apem Wonolelo functions not only as a religious and social symbol but also as a cultural artifact that embodies the local mathematical intelligence of the Sleman community. Through an ethnographic approach, researchers can identify the interconnection between cultural activities and the mathematical thinking structures that naturally emerge in the everyday lives of apem makers.

2.3. Representation of Mathematical Concepts

The representation of mathematical concepts refers to how individuals or groups describe, interpret, and apply mathematical ideas in various forms visual, symbolic, or contextual. According to Susetyawati [24], representation is a crucial element in mathematical thinking as it enables individuals to connect abstract concepts with concrete situations. In the context of learning, representation functions to clarify students' understanding of mathematical ideas through symbols, diagrams, physical models, or real-life activities. Therefore, culturally contextual learning approaches such as *ethnomathematics* can enrich the forms of representation that are more meaningful for students [25], [26]. When students relate mathematical concepts to their everyday cultural practices, they not only comprehend the symbols but also the social and functional meanings behind those concepts [27].

In the cultural context of Apem Wonolelo, representations of mathematical concepts can be found in the geometric form of the cake, the *ratio* of ingredients in the recipe, and the distribution patterns within the social tradition. This demonstrates that mathematical representation is not always limited to numbers and formulas but may also appear in cultural artifacts and collective community practices [28], [29]. The study

of representation in *ethnomathematics* helps reveal that mathematical thinking is universal yet expressed locally according to surrounding cultural values. Therefore, understanding the representation of mathematical concepts within cultural contexts such as Apem Wonolelo is a crucial step toward developing mathematics education that is more contextual, humanistic, and relevant to students' everyday lives in Indonesia.

3. METHOD

The research method employed in this ethnomathematical study of the Apem Wonolelo culture in Sleman Regency is a qualitative approach using an ethnographic research design. This study aims to explore and describe various mathematical concepts embedded in the process of making and distributing Apem Wonolelo through the lens of the local cultural practices of the Sleman community. Research data were collected through participatory observation, in-depth interviews with apem makers and community leaders, as well as photographic and video documentation capturing the production activities and the implementation of the "Apeman" tradition. The data analysis process was conducted qualitatively and descriptively through three main stages: data reduction, data presentation, and conclusion drawing [30]. Data validity was ensured through source and technique triangulation, where the results of observations were compared with interview and documentation findings to ensure the accuracy of the results.

The main focus of the study includes five aspects of *ethnomathematics*: (1) *geometry* and *symmetry* in the shape of the apem, (2) *ratio* and proportion in ingredient composition, (3) patterns and sequences in the production process, (4) measurement of dough volume and capacity, and (5) statistical concepts in the apem distribution tradition. Through this method, the researcher seeks to reveal the natural emergence of mathematical concepts within the cultural practices of the Wonolelo community and to examine how these local mathematical elements can be integrated into culturally contextualized mathematics learning [31], [32].

4. RESULTS AND DISCUSSION

4.1. *Geometry* and *Symmetry* in the Shape of Apem

The distinctive circular shape of Apem Wonolelo, with its slightly convex center, represents the harmony between function and aesthetics in the culinary tradition of the Sleman community. From an ethnomathematical perspective, this form reflects an intuitive understanding of planar *geometry* and rotational *symmetry*, even though it is not formally articulated. When observed from above, the apem exhibits a rotational *symmetry* of 360°, meaning that its shape remains identical when rotated at various angles. Yanti [33] and Fitriana et al. [34] asserts that cultural artifacts, such as traditional foods, often manifest as outcomes of naturally developed mathematical thinking that emerges from everyday community practices rather than from formal education.

Furthermore, the symmetrical pattern of Apem Wonolelo does not occur by chance but rather results from gene*ratio*nal craftsmanship and experience in maintaining visual balance and proportional form. The apem makers apply principles of radius, diameter, and circumference when pouring the batter into circular molds although not consciously in mathematical terms. This process demonstrates an application of empirical *geometry*, where the community intuitively employs spatial and measurement concepts to produce uniform and aesthetically pleasing results. Khasanah et al. [35] found that traditional activities such as crafting artifacts or preparing food often involve complex geometric principles, reflecting practical mathematical reasoning that has evolved within local cultures.

In the educational context, the shape of apem can serve as a contextual learning medium to introduce the concepts of circumference and area of a circle in a tangible way. For instance, students may be asked to measure the diameter of Apem Wonolelo and then calculate its circumference using the formula $C = \pi \times d$ and its area with $A = \pi \times r^2$. Through such activities, students not only comprehend mathematical calculations but also recognize their connection to local cultural practices. Villarin et al [36] emphasize that culturally based mathematics learning enhances students' motivation and conceptual understanding, as it allows them to perceive the direct relevance between mathematics and everyday life.

Example Problem: An Apem Wonolelo has a diameter of 12 cm. Calculate its circumference and area.
Solution: The circumference can be calculated using the formula
$C = \pi \times d$
$\quad = 3.14 \times 12$
$\quad = 37.68$ cm.

The area can be found using
$$A = \pi \times r^2$$
$$= 3.14 \times 6^2$$
$$= 113.04 \text{ cm}^2.$$

Therefore, the circumference of the apem is 37.68 cm, and its area is 113.04 cm².

In addition, a study by Jacob [37] revealed that the integ*ratio*n of local cultural artifacts in mathematics learning can enhance students' spatial thinking and logical reasoning abilities. This finding reinforces that the use of Apem Wonolelo as a learning medium is not only an effort to preserve culture but also an effective pedagogical strategy. Thus, the circular shape of the apem not only symbolizes perfection and togetherness in Javanese culture but also serves as an educational tool for teaching geometric concepts that are meaningful, contextual, and rooted in the local wisdom of the Sleman community.

4.2. *Ratio* and Proportion in Ingredient Composition

In the process of making Apem Wonolelo, the balance of taste and texture highly depends on the proportion of the main ingredients rice flour, coconut milk, sugar, and fermented cassava (tape). The traditional proportion used is 3:2:1, meaning three parts of rice flour are mixed with two parts of coconut milk and one part of sugar. Although the makers do not use modern measuring tools, they rely on experience and traditional measuring instruments such as spoons, coconut shells, or ladles. This practice demonstrates that the community has applied the concepts of *ratio* and proportion for gene*ratio*ns, often without recognizing the mathematical elements involved. Törnquist-Plewa et al. [38] stated that cultural practices such as traditional culinary activities reflect the application of mathematical principles that naturally emerge from the practical needs of society.

The application of ingredient *ratios* in Apem Wonolelo production can be integrated into contextual mathematics learning, especially to introduce concepts of *ratio*, direct proportion, and inverse proportion. For instance, students may be asked to calculate the amount of rice flour needed if the apem maker wishes to double the production while maintaining the same flavor proportion. Through this approach, students learn that numerical comparisons in mathematics have a direct relationship with real-life processes. Such an approach not only teaches computational skills but also strengthens cultural understanding and logical reasoning abilities, as emphasized by Njonge [39] and Apriwulan et al. [40] in their study on culturally contextual mathematics education.

Moreover, understanding *ratio* in apem production can be linked to the concepts of scale and proportionality, which play significant roles in various life domains such as trade, engineering, and culinary arts. Mandinach [41] and Heryuriani et al. [42] highlighted that traditional communities possess a refined sense of proportional intuition derived from experience, allowing them to maintain balance between flavor and texture without the aid of precise measuring tools. This illustrates that mathematical knowledge in traditional culture is empirical and applied, evolving from real-world experiences and transmitted through social practices. Thus, mathematical thinking exists not only in classrooms but also in traditional kitchens, where cultural values and practical skills are continuously embodied and passed down.

Example Problem: A recipe for Apem Wonolelo uses a 3:2:1 *ratio* for rice flour, coconut milk, and sugar. If 600 grams of rice flour are used, how much coconut milk and sugar are needed?
Solution:
Total parts = 3 + 2 + 1 = 6 parts
$$1 \text{ part} = \frac{600}{3} = 200 \text{ gram}$$
Coconut milk = 2 × 200 = 400 grams
Sugar = 1 × 200 = 200 grams.
Thus, 400 grams of coconut milk and 200 grams of sugar are required.

Research by Fauzy [43] supports this view, showing that mathematics learning based on local culture can enhance students' numerical skills and conceptual understanding. Through the context of Apem Wonolelo production, teachers can help students grasp the relationships between numbers, proportions, and balance through meaningful, concrete experiences. Therefore, traditional culinary processes can function as natural

mathematics laboratories, where students not only learn numbers but also internalize values of precision, balance, and cultural heritage that are integral to the traditions of Sleman.

4.3. Patterns and Sequences in the Production Process

The production process of Apem Wonolelo follows a systematic and sequential order mixing ingredients, fermenting the dough, molding, and steaming. Each stage serves a specific function and must be performed in the correct order to ensure the apem rises properly. If any step is skipped or rearranged, the final result will differ in both flavor and texture. This repetitive and structured pattern reflects the concept of algorithms in mathematics, where each step is logically connected to the next. D'Ambrosio [44] explained that work patterns in traditional communities represent forms of algorithmic thinking that demonstrate structured and systematic reasoning foundations for developing modern mathematical concepts.

In a learning context, the stages of making apem can be used as a medium for teaching sequence and algorithm concepts contextually. Teachers may ask students to represent the process in a flowchart or as a sequence of mathematical steps, such as: (1) mixing ingredients; (2) fermentation; (3) molding; (4) steaming. Through this activity, students learn that mathematics is not only about numbers but also about systematic thinking processes applied in everyday life. Such a culturally based approach aligns with Wittmann [45] perspective, which emphasizes that cultural activities can serve as effective means to develop logical thinking and mathematical reasoning.

Furthermore, teachers can extend the learning by examining repetition patterns (ite*ratio*n) in apem production. For example, each new batch of dough may require an additional five minutes of fermentation to achieve a desired texture. This pattern can be modeled as an arithmetic sequence, allowing students to calculate total fermentation time after several ite*ratio*ns. Through this approach, mathematical concepts such as sequences and series are not taught abstractly but through concrete experiences rooted in local culture.

Example Problem: If the fermentation time for the first batch of dough is 30 minutes, and each subsequent batch increases the fermentation time by 5 minutes, what is the total fermentation time for five batches? Solution:
This represents an arithmetic sequence with $a = 30$, $d = 5$, and $n = 5$. The total time is given by the formula:

$$S_n = \frac{1}{2}n(2a + (n-1)d)$$
$$S_5 = \frac{1}{2} \cdot 5(2(30) + (5-1)5)$$
$$= \frac{5}{2}(60 + 20)$$
$$= \frac{5}{2}(80) = 200$$

Therefore, the total fermentation time is 200 minutes.

The study by Zuliana [46] and Waluya et al. [47] supports this finding, showing that culture-based mathematics learning enhances students' logical, systematic, and contextual thinking skills in elementary education. By using the Apem Wonolelo production process as a learning resource, students not only understand the sequence of steps as a procedure but also internalize mathematical concepts such as algorithms, patterns, and sequences in a meaningful context. Thus, local traditions serve not only as cultural heritage but also as effective pedagogical media that enrich mathematics learning through the realities of Sleman's community life.

4.4. Measurement and Comparison of Dough Volume

The uniform size and thickness of Apem Wonolelo demonstrate the empirical application of volume and capacity measurement concepts by the local community. In traditional practice, apem makers do not use modern measuring tools such as measuring cups or digital scales; instead, they rely on simple instruments like coconut shells, ladles, or spoons as their main measuring tools. Through gene*ratio*nal experience, they can accurately estimate the amount of dough needed to produce apem of consistent size and thickness. This phenomenon illustrates how traditional societies develop contextual mathematical knowledge rooted in daily practical needs. Khair [48] explained that traditional measurement practices represent a form of applied *ethnomathematics*, emerging from community efforts to maintain consistency and efficiency in production without depending on formal measurement systems.

In an educational context, the activity of measuring Apem Wonolelo dough can be adapted into experiential learning to introduce students to the concepts of volume and capacity. Teachers can encourage students to use various traditional containers to measure dough and then compare their measurements using standard units such as milliliters or liters. Through this activity, students learn to understand the relationship between volume, capacity, and container shape while realizing that mathematics exists in everyday activities such as cooking and baking. This contextual approach aligns with the findings of Hasibuan [49], who emphasized that culture-based learning helps students connect abstract concepts with real-life experiences, thereby enhancing conceptual understanding and learning engagement.

Furthermore, the practice of dough measurement can be linked to the concepts of similarity and volume *ratio*. For instance, if the apem mold size is enlarged with a scale factor of 2:1, the resulting apem volume will increase eightfold, consistent with the principle that the volume of a three-dimensional object changes according to the cube of the scale factor. Through this simple experiment, students can concretely understand the relationship between linear scale and volume. Such activities also help students develop proportional and spatial reasoning skills, as Murtikusuma et al. [50] asserted that cultural artifacts function as conceptual bridges between empirical experiences and formal mathematical reasoning.

Example Problem: If the volume of a small apem cake is 50 cm³, and a new mold is made twice as large in every dimension, what will be the volume of the larger apem?
Explanation:
The scale *ratio* is 2, so the new volume = $2^3 \times 50 = 8 \times 50 = 400$ cm³.
Thus, the volume of the larger apem is 400 cm³.

The study conducted by Rosnelli [51] supports the relevance of this type of learning, showing that the inte*gratio*n of local culture into mathematics education can enhance students' visual representation and spatial reasoning skills. Through the context of Apem Wonolelo, students not only learn to measure or calculate volume but also understand the cultural meanings of balance, consistency, and precision within Sleman's local traditions. Therefore, traditional measurement activities become more than just culinary practices they serve as ethnomathematical laboratories that foster the awareness that mathematics is an inseparable part of life and cultural heritage.

4.5. Statistical Concepts in the Apem Distribution Tradition
In the "Apeman" tradition held in Wonolelo before the month of Ramadan, the community has a custom of distributing apem cakes evenly among residents. This tradition is not only an expression of gratitude and togetherness but also reflects the application of basic statistical concepts in daily life, such as mean, total amount, and data distribution. The distribution of apem takes into account the number of families, household members, and production capacity, ensuring that everyone receives a proportional share. According to Putri et al. [52], acts of sharing in cultural contexts illustrate the application of mathematical principles in social life, particularly those related to equality and fairness. This demonstrates that social values within a community inherently contain concrete and applicable mathematical understanding.

In the learning context, the Apeman tradition can be integrated into lessons to teach the concepts of mean, median, and mode in a contextual way. For instance, if the number of apem cakes distributed among families varies Family A receives 10, Family B receives 12, and Family C receives 8 students can be asked to calculate the average number of apem per family and determine the median and mode from the data. Through this activity, students learn that statistics are not limited to numbers on paper but are also tools for decision-making and ensuring fairness within the community. This approach aligns with the findings of Wantoro et al. [53], who discovered that linking mathematical concepts with cultural activities enhances students' motivation and understanding of meaningful numerical values.

Furthermore, the Apeman tradition represents the values of cooperation (gotong royong) and social distribution, which can be associated with the concepts of set theory and data distribution. For example, students can categorize the number of apem cakes received by residents into specific groups to analyze how the data is distributed across a population. This activity helps develop analytical and data classification skills while fostering awareness of social justice in the distribution of resources. Maraña et al. [54] emphasizes that cultural activities such as ceremonies and community rituals are living manifestations of mathematical thought, where logical grouping and distribution naturally emerge from recurring social practices.

Example Problem: During the Apeman event, 120 apem cakes are distributed among 8 families. What is the average number of apem each family receives?

Explanation:

$$\text{Mean} = \frac{\text{total number}}{\text{number of families}} = \frac{120}{8} = 15 \text{ apem per family}$$

Thus, each family receives an average of 15 apem evenly.

The research by Siswanto et al. [55] reinforces the relevance of this approach by showing that culture-based mathematics learning can enhance students' analytical and social reasoning skills, as they learn through contexts closely related to their daily lives. By using the Apeman tradition as a learning material, students not only grasp mathematical operations but also internalize the values of fairness, togetherness, and solidarity embedded within the cultural practice. Therefore, statistics learning based on the Wonolelo tradition can serve as a humanistic *ethnomathematics* model, integrating numerical reasoning with the social and cultural values of the Sleman community.

5. CONCLUSION

The findings of this study indicate that the production, presentation, and distribution processes of Apem Wonolelo encompass a wide range of rich mathematical concepts, including geometry, ratio and proportion, patterns and algorithms, volume measurement, and social statistics. These results affirm that the everyday cultural activities of the Sleman community naturally function as spaces for the development of empirical mathematical reasoning while simultaneously serving as contextual, meaningful, and relevant learning resources for students. Therefore, teachers are encouraged to integrate local cultural practices into ethnomathematics-based mathematics instruction, for example through measurement projects, proportional calculations, production pattern analysis, and simulations of Apeman distribution to strengthen conceptual understanding. Such implementation also has the potential to enhance students' learning motivation, logical reasoning, and cultural awareness.

Further research directions and learning innovation opportunities may focus on developing digital instructional tools based on the *ethnomathematics* of Apem Wonolelo, such as digital worksheets, interactive modules, or AR/VR media that visualize the shapes, patterns, production processes, and statistical distribution of Apeman. In addition, innovation in mathematics education can be expanded through a project-based *ethnomathematics* approach, in which students engage directly with apem production centers to collect data, conduct measurements, and model proportions and production patterns mathematically. Teachers are also encouraged to develop authentic assessments that evaluate numeracy skills, reasoning abilities, and students' capacity to connect mathematics with local culture. Thus, the results of this study open wide opportunities for more humanistic, contextual, and culturally grounded mathematics learning aligned with the local wisdom of the Sleman community.

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