

An Ethnomathematical Exploration of Lotek-Making Practices for Elementary Mathematics Learning

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Abstract

Traditional culinary practices can provide culturally meaningful contexts for mathematics learning, yet their embedded mathematical knowledge is not always explicitly connected to elementary education. This study aims to identify mathematical practices embedded in the preparation, production, and sales of Lotek, a traditional West Javanese dish, and examine their potential integration into elementary mathematics learning. Using a qualitative ethnomathematical approach, data were collected through reflective autoethnography, literature review, and in-depth interviews with five experienced Lotek vendors in Bandung City and three elementary school teachers in the Regol area. Data were analyzed through data reduction, display, and interpretive conclusion drawing, supported by source triangulation and reflexive journal writing. The findings reveal mathematical practices involving counting, measurement, estimation, sequencing, fractions, proportional reasoning, and social arithmetic across different stages of Lotek-making. The analysis also distinguishes practitioners' culturally situated knowledge from its interpretation within school mathematics. These findings demonstrate that Lotek-making is not merely a contextual example of mathematics but a culturally grounded source of mathematical knowledge that can support meaningful and culturally responsive elementary mathematics learning.

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INTRODUCTION

Elementary mathematics learning requires students not only to perform procedures but also to connect mathematical ideas with meaningful situations. When concepts are presented mainly in abstract and decontextualized forms, learners may have difficulty recognizing how counting, measuring, comparing, estimating, and reasoning operate in everyday life. Culturally responsive mathematics learning can address this challenge by beginning with practices familiar to learners and then supporting the translation of those practices into formal mathematical representations

(Acharya et al., 2021). In this sense, local cultural knowledge is not simply an illustration added after a concept is taught; it can become a source from which mathematical meaning is constructed.

Ethnomathematics examines mathematical ideas and practices as they are produced, communicated, and used within particular cultural communities (Prahmana & D'Ambrosio, 2020; Prahmana et al., 2021). It attends to culturally situated ways of counting, measuring, comparing, locating, designing, estimating, explaining, and reasoning, including practices that may not initially be expressed in formal school-mathematics language. For elementary learners, this perspective can support conceptual understanding and numeracy while also recognizing students' cultural identities and participation in community life. Accordingly, the present study treats the mathematical meanings in Lotek-making first as situated cultural practices and subsequently considers how those meanings may be translated into elementary curriculum concepts.

Various regions in Indonesia have distinctive traditional foods that have existed for a long time and persist to this day. These foods are highly valued and considered cultural heritage (Purwaning Tyas, 2017). Integrating cultural values, such as traditional foods, into mathematics learning can have a positive impact and make learning more meaningful because students' learning resources come from familiar environments (Pratama & Yelken, 2024). According to Harahap and Ananda (2025), integrating the cultural values of traditional foods into mathematics learning can help students explore the surrounding culture and relate it to the material and concepts in mathematics learning.

Traditional food provides a particularly rich site for ethnomathematical inquiry because culinary practice combines material quantities, sequences, embodied estimation, proportional adjustment, exchange, and culturally shared standards of quality. Previous Indonesian studies have examined Bugis snacks (Pathuddin & Raehana, 2019; Pathuddin et al., 2021), Sasak culinary traditions (Apriliani et al., 2025), semprong (Fadillah et al., 2022), kue balok (Salsabila et al., 2022), getuk and kue lapis (Harahap & Ananda, 2025), Majalengka cuisine (Herayanti et al., 2023), rengginang (Lestari & Rakhmawati, 2025), and lemang (Tampa et al., 2023). Across these studies, numbers and geometry are frequently foregrounded (Fitriani & Putra, 2022), whereas the relationship among production routines, proportional reasoning, economic practices, practitioners' own meanings, and pedagogical translation is less explicit. Lotek is relevant in this regard because its preparation involves vegetable selection and processing, peanut-sauce composition, portion adjustment, and sales practices that are embedded in Sundanese culinary knowledge. The present study therefore focuses not only on identifying formal mathematical categories but also on tracing how culturally situated practices can be interpreted and connected to elementary mathematics learning.

Although traditional foods have increasingly been used in ethnomathematics studies, research specifically documenting Lotek-making as a sequence of cultural and mathematical practices remains limited. The novelty of this study does not lie only in selecting a different culinary object. It lies in mapping mathematical activity across preparation, production, and post-production; distinguishing practitioners' situated meanings from researchers' formal mathematical interpretations; and translating the resulting activity map into possible elementary learning tasks. Accordingly, this study aims to (1) identify culturally situated mathematical practices in Lotek-making and sales, (2) interpret the relationship between those practices and elementary mathematical concepts, and (3) formulate pedagogical possibilities for culturally

responsive elementary mathematics learning. These objectives guide the analysis while avoiding claims about learning effectiveness, which was not tested in this exploratory study.

METHOD

This study employed a qualitative ethnomathematical design with a reflective autoethnographic component to examine Lotek-making as culturally situated mathematical knowledge (Creswell, 2014). The design combined researcher reflection with participants' accounts and observed cultural practices so that mathematical interpretations were grounded in the meanings and routines of practitioners. Data were generated through reflective autoethnography, in-depth interviews, observation of Lotek-related practices and artifacts, and a focused literature review. The literature was used to support ethnomathematical interpretation and to identify possible connections with elementary mathematics, rather than as a substitute for field data.

Participants consisted of five Lotek vendors in Bandung City and three elementary school teachers in the Regol area. Vendors were purposively selected based on at least 15 years of experience in the culinary business, enabling them to provide experienced accounts of ingredient selection, preparation, portioning, and sales practices. The teachers were selected because of their familiarity with locally based learning and contributed pedagogical perspectives regarding the potential use of Lotek in elementary mathematics. Interviews lasted approximately 45–60 minutes, were conducted at vendors' stalls or homes and in the school office for teachers, were audio-recorded with consent, and were transcribed verbatim.

Table 1. Research Participants and Data Sources

Data source	Participants/source	Data generated	Analytical purpose
Lotek vendors	5 vendors; ≥ 15 years of experience	In-depth interview and observed practice information	Identify culturally situated mathematical practices in preparation, production, and sales
Elementary school teachers	3 teachers in the Regol area	In-depth interview	Examine pedagogical relevance and possible curriculum connections
Researcher reflection	Reflective autoethnographic record	Reflexive notes and cultural observations	Make the researcher's interpretive position explicit and support contextual interpretation
Literature	Relevant ethnomathematics and mathematics education sources	Conceptual and curricular information	Support interpretation and mapping to elementary mathematics

Ethical procedures emphasized voluntary participation, informed consent, confidentiality, and respectful representation of local culinary knowledge. Identifying information was excluded from the reporting of findings. The analysis also sought to avoid treating practitioners' knowledge merely as informal versions of school mathematics; participants' explanations and observable practices were retained as the primary cultural basis for interpretation.

Data analysis followed the Miles and Huberman framework of data reduction, data display, and conclusion drawing. First, interview transcripts, observation records, and reflective notes were reviewed to identify recurring activities, including selecting quantities, estimating ingredients, sequencing preparation, adjusting portions, calculating prices, and recording sales. Second, the analysis followed an emic–etic pathway. Practitioners’ explanations and observable routines were first interpreted in terms of their practical cultural meanings (emic perspective), after which the researchers examined their possible mathematical structures (etic perspective). Third, the resulting interpretations were compared with elementary mathematics content to identify potential learning connections. Source triangulation across vendors, teachers, observations, and reflective records was used to examine consistency, while reflexive journal writing was used to document interpretive decisions.

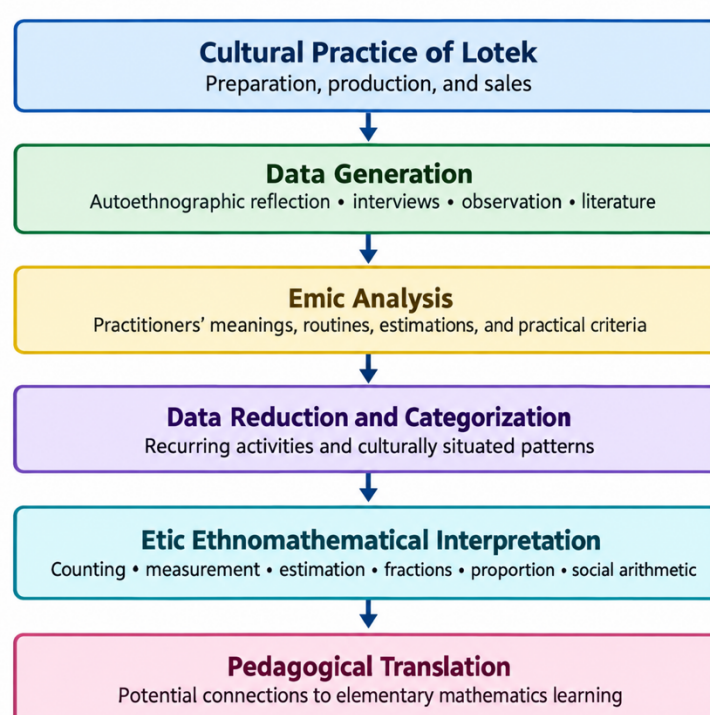


Figure 1. Ethnomathematical Data Analysis and Interpretation Process

The analytical sequence shown in Figure 1 makes explicit how the study moved from cultural practice and participant meaning to ethnomathematical interpretation and, finally, to potential pedagogical translation. This sequence was used to reduce the risk of imposing school-mathematics categories on cultural practices before practitioners’ meanings had been considered.

RESULTS AND DISCUSSION

Results

Mathematical Concepts in the Cultural Practice of Serving Lotek

Before 2000, the majority of the population in West Java was engaged in the agricultural sector, with a significant proportion working as farmers or farm laborers. This activity not only served as a primary source of livelihood but also had deep roots in the regional social and

economic structure. Land in the highlands was used to cultivate various types of horticultural crops with economic and nutritional value. Community involvement in these agricultural activities contributed to meeting food needs and became an important pillar of the local economy. Expertise in land management, understanding of crop cycles, and plant care practices were knowledge passed down from generation to generation.



Figure 1. A Plate of Lotek

Vegetable consumption patterns in West Java were significantly correlated with their agricultural activities (Iskandar et al., 2023). The habit of growing various types of horticultural vegetables not only aimed to meet household food needs but also had economic implications. Vegetables grown from their own land served as a source of food and were also traded in local markets. Income from vegetable sales contributed to improving the economic well being of farming families, enabling them to meet various needs.

There is a close relationship between horticultural vegetable consumption habits and horticultural agricultural activities in West Java, forming a mutually supportive system in providing food resources. Communities not only rely on market mechanisms to obtain vegetables such as peanuts, chilies, bean sprouts, cabbage, kale, and chayote, but also utilize the produce from their own horticultural farmland. The tradition of planting and processing agricultural products together strengthens the bonds of brotherhood and mutual cooperation within the horticultural farming community. Knowledge about local horticultural vegetable varieties, how to grow them, and how to utilize these ingredients in various culinary preparations is transmitted between generations, keeping local wisdom alive in the context of meeting food needs (Iskandar et al., 2023). The habit of consuming vegetables for the people of West Java is not just a taste preference, but also a reflection of cultural identity and a deep connection to natural resources and horticultural farming practices, a valuable heritage that deserves to be preserved in the local food system.

Mathematical Concepts Embedded in Cultural Practices

The cultural practice of making Lotek involves experience-based knowledge developed through repeated culinary work. Vendors estimate, measure, compare, sequence, and adjust ingredients according to practical criteria such as taste, texture, portion sufficiency, ingredient condition, and customer expectations. These practices should not be understood as incomplete versions of formal mathematics. Instead, they represent situated forms of quantitative and relational reasoning that can later be interpreted through school-mathematics concepts when

sufficient evidence supports that translation



Figure 2. Preparation Phase

One possible formal interpretation concerns proportional reasoning. When vendors increase or decrease a batch, ingredient quantities may be adjusted in relation to the amount of vegetables and the desired taste. From an elementary mathematics perspective, such adjustments can provide a context for discussing multiplicative comparison and proportion. However, the present data do not establish that vendors use a fixed constant ratio or a formal linear rule across all batches. The interpretation should therefore remain grounded in the observed practice of relational adjustment rather than assuming a uniform algebraic structure.



Figure 2. Production Process

Economic practices surrounding Lotek sales can be interpreted through social arithmetic. Vendors consider ingredient costs, selling prices, portions produced, and daily revenue when managing their businesses. These practices provide concrete contexts for addition, multiplication, unit price, revenue, and profit-related reasoning. Because the study did not apply a standardized numeracy framework, the findings do not classify vendors' competence as a particular 'level'; instead, they document the types of calculations and decisions evident in the cultural-economic practice.

Observation and interviews indicate that measuring and portioning are intertwined with practical judgments about ingredient sufficiency, taste, and waste reduction. These findings are interpreted cautiously: participant practices constitute the primary evidence, while terms such as fraction, proportion, and arithmetic are researchers' etic translations intended to support curriculum connection. Future reporting should include additional verbatim excerpts and concrete

quantity examples wherever available so readers can more clearly trace the movement from cultural data to mathematical interpretation.

Information gathered from the lotek vendors reinforces the findings regarding the use of numbers in the routine tasks of making lotek. They calculate the number of bunches of vegetables needed daily and precisely weigh complementary ingredients such as tempeh and spices to maintain consistent product quality. These practical numeracy skills extend to the domain of Social Arithmetic in their sales practices. Pricing strategies rely heavily on arithmetic skills to balance profit margins with customer purchasing power or affordability. Daily revenue is recorded and analyzed periodically to monitor business performance and the effectiveness of capital expenditures.

The mathematical concepts embedded in Lotek's cultural production activities can be grouped into three main operational stages: the preparation phase, the manufacturing phase, and the post-production phase. The preparation phase involves the use of integer concepts in managing raw material inventory. Sellers calculate the number of bunches of vegetables such as kale, cabbage, and long beans, as well as the number of peanuts to be processed. Standard units of measurement, such as grams for peanuts and liters for boiled water, are used to ensure accurate spice proportions. Data recording and resource management are often performed through mental calculations, demonstrating practical numeracy skills for maintaining the efficiency of horticultural ingredients.

The manufacturing phase involves boiling, cutting, grinding, mixing, and portioning. Sequencing these activities can be connected with ordinal numbers and time measurement, while cutting vegetables into relatively uniform sizes can provide a context for length comparison. Portioning and adjusting peanut sauce relative to vegetables can support discussion of fractions and proportional reasoning. Geometric claims about the mortar are not advanced here because the available data do not include dimensional measurements or participant explanations that would justify interpreting its shape as a specific formal curve.

The sales phase occurs after the manufacturing process is complete. Mathematical concepts transition into the realm of social arithmetic through economic transaction activities. Sellers apply arithmetic operations to quickly and accurately calculate the total price of a portion of Lotek and change. Data representation techniques are also evident in daily evaluations, where sellers informally tabulate the number of portions sold and calculate average daily revenue. This simple trend analysis of customer demand supports strategic business decisions, such as adjusting raw material stock for the next portion to optimize profit margins.

Implementation in Mathematics Learning

Based on the identified ethnomathematical practices, the mathematical knowledge embedded in Lotek-making was translated into potential learning activities for elementary mathematics. The translation was designed to connect practitioners' culturally situated knowledge with mathematical concepts appropriate for classroom learning, particularly measurement, fractions, proportional reasoning, and social arithmetic. Rather than presenting Lotek merely as an illustrative example, the proposed activities use its preparation, production, and sales practices as meaningful contexts for mathematical problem solving. These ideas were subsequently organized into a student worksheet (LKPD) as an example of how the findings could be

transformed into culturally responsive learning tasks. The worksheet presented in Figure 4 represents a proposed pedagogical design derived from the study findings and was not evaluated as an instructional intervention in this study.



Figure 4. Worksheet for Student

1. Identifying Problems

Students observe a simulation or contextual story about the challenges of a local culinary entrepreneur. They begin to think critically about how to maintain consistent flavors and how to calculate production costs so that the business can run sustainably without incurring losses.

2. Organizing in Teams

Students form work groups that act as young entrepreneurial teams. Within these groups, they share roles and responsibilities for analyzing data, discussing calculation strategies, and preparing problem-solving steps related to ingredient ratios and prices.

3. Conducting Investigations

Students conduct mathematical investigations by calculating the cost of each ingredient by weight or unit. They use proportional reasoning to determine the cost of a recipe, calculate the cost per portion, and even use "Large-Scale Proportioning" to predict ingredient requirements if the number of orders increases drastically.

4. Creating Solutions and Sharing

Students develop an ideal selling price strategy based on an analysis of the desired profit. They document the results of their discussions and calculations in the form of a creative presentation or business strategy presentation that demonstrates the logical relationship between capital, selling price, and profit.

5. Reflecting on Learning Outcomes (Analysis & Evaluation)

Students present their solutions and exchange ideas with other groups. They evaluate

whether their calculations are accurate and realistic and reflect on how mathematical decisions are connected with cultural practices. The activity should also acknowledge Lotek as community knowledge rather than reducing it to a commercial exercise. Teachers can discuss local terminology, food diversity, heritage values, and the importance of attributing knowledge to cultural practitioners. Where feasible, worksheets and examples should be reviewed with teachers and community members to support culturally respectful representation.

Discussion

The findings demonstrate that Lotek-making involves mathematical practices that emerge naturally from everyday cultural and economic activities. Counting ingredients, estimating quantities, measuring materials, sequencing preparation steps, adjusting ingredient proportions, and calculating production costs are not performed as formal school mathematics but as practical knowledge developed through experience. This finding reinforces the central perspective of ethnomathematics that mathematical ideas can be embedded in culturally situated practices and expressed through forms of reasoning that differ from formal mathematical representations. Similar patterns have been identified in studies of traditional foods and other cultural practices, where mathematical ideas emerge through measurement, proportion, geometry, calculation, and problem-solving activities (Pathuddin & Raehana, 2019; Apriliani et al., 2025; Pathuddin et al., 2021; Payadnya et al., 2024).

An important finding of this study concerns the relationship between practitioners' knowledge and formal mathematical concepts. For example, Lotek vendors adjust the quantity of spices according to the amount of vegetables and the number of portions while attempting to maintain consistency in taste. From the practitioners' perspective, this adjustment represents practical knowledge developed through repeated culinary experience. From a school-mathematics perspective, the same practice can be interpreted in relation to ratios, fractions, and proportional reasoning. Likewise, calculating ingredient costs, selling prices, and daily revenue can be connected with arithmetic operations and social arithmetic. This distinction is important because ethnomathematical analysis should not simply attach predetermined mathematical labels to cultural activities. Instead, mathematical interpretation should begin with an understanding of how practitioners themselves organize, explain, and evaluate their practices.

The findings also extend previous ethnomathematical studies of Indonesian traditional foods. Earlier research has identified mathematical concepts in traditional Bugis foods (Pathuddin & Raehana, 2019), Sasak culinary practices (Apriliani et al., 2025), Semprong cakes (Fadillah et al., 2022), and other local foods. The present study adds to this literature by examining Lotek as a sequence of interconnected activities from preparation and production to sales. This broader perspective shows that the mathematical potential of Lotek is not limited to the physical characteristics of the food or utensils but also includes decision-making processes involving quantity, proportion, efficiency, and economic calculation. Thus, the contribution of this study lies in mapping mathematical practices across the complete cultural and economic process of Lotek-making.

From a pedagogical perspective, these findings provide a basis for translating Lotek-related practices into contextual elementary mathematics activities. Measurement can be explored through ingredient quantities, fractions and proportional reasoning through changes in recipes and portions, and social arithmetic through production costs, selling prices, and revenue. Such

activities can be organized into ethnomathematics-based teaching materials or student worksheets, as previous studies have demonstrated the potential of cultural artifacts for developing contextual mathematics resources (Luthfi & Rakhmawati, 2022; Wahyuni & Suherman, 2023; Busrah & Pathuddin, 2021; Ubaidillah & Khotimah, 2023). Ethnomathematical contexts may also be incorporated into instructional approaches such as Problem-Based Learning and Realistic Mathematics Education when cultural practices are meaningfully connected with mathematical problems (Sumaji et al., 2025; Uskono et al., 2020).

However, the pedagogical value of Lotek should not be understood merely as using traditional food to make mathematics lessons more attractive. A culturally responsive approach requires teachers to preserve the relationship between mathematical tasks and the cultural knowledge from which they originate. Therefore, when Lotek-making is translated into classroom activities, students should encounter not only numerical problems involving ingredients or prices but also the reasoning used by practitioners to determine quantities, maintain taste, organize production, and make economic decisions. In this way, Lotek functions as a source of mathematical knowledge rather than simply as a decorative cultural context.

These pedagogical implications should nevertheless be interpreted cautiously. The present study identified mathematical practices and explored their potential translation into elementary mathematics learning, but it did not implement or experimentally evaluate the proposed learning activities with students. Therefore, the findings do not provide evidence that Lotek-based activities improve student engagement, reduce mathematics anxiety, or increase mathematical achievement. Instead, they provide an empirically grounded basis for designing culturally responsive mathematics activities that can be examined in subsequent classroom-based research.

Finally, the study is limited by its focus on a small group of Lotek practitioners and elementary teachers within a specific geographical context. Lotek ingredients, preparation techniques, measurements, and selling practices may differ across communities in West Java. Consequently, the mathematical interpretations identified in this study should not be generalized to all Lotek-making traditions. Future studies could compare Lotek practices across regions and examine how variations in local knowledge generate different mathematical ideas. Further research is also needed to develop, implement, and evaluate Lotek-based learning materials to determine their effects on students' mathematical reasoning, engagement, and learning outcomes.

CONCLUSION

This study identifies culturally situated quantitative and relational practices in Lotek preparation, production, and sales that can be interpreted in relation to elementary mathematics. The practices include counting, measurement, estimation, sequencing, portioning, proportional adjustment, and economic calculation. The central contribution is not simply a list of textbook concepts found in a traditional food, but an interpretive map that begins with practitioners' purposes and meanings before translating them into possible school-mathematics categories.

The findings suggest that Lotek can serve as a culturally responsive learning resource when its community meanings are preserved during pedagogical translation. The study does not establish that Lotek-based instruction improves numeracy or learning outcomes; rather, it provides an empirical and conceptual basis for designing and subsequently testing such instruction. Future studies should strengthen the evidence with richer participant excerpts, concrete quantity records

across different production conditions, community review of the cultural interpretation, and classroom trials aligned with specific grade-level outcomes.

The implications of this study provide guidance for educators in designing learning experiences based on contextual experiences and local wisdom values. Therefore, mathematics education should not be separated from students' socio-cultural realities, but rather serve as a bridge connecting academic knowledge, practical skills, and cultural identity. Future research

could explore the development of learning modules or teaching materials based on various local traditions in Indonesia, as well as test the effectiveness of culturally contextualized mathematics instruction on students' attitudes and learning achievement.

CREDIT AUTHORSHIP CONTRIBUTION STATEMENT

Anisa Agustina: Conceptualization, Data Curation, Formal Analysis, Funding Acquisition, Investigation, Methodology, Project Administration, Resources, Validation, Visualization, Writing - Original Draft, Writing - Review & Editing

Neni Mariana: Conceptualization, Supervision, Validation, Writing – Review & Editing.

Farida Istianah: Formal Analysis, Resources, Writing - Review & Editing.

DECLARATION OF COMPETING INTEREST

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available on request from the corresponding author.

ETHICS STATEMENT

This study did not require formal ethical approval. All participants provided voluntary informed consent, and no sensitive personal data were collected.

DECLARATION OF GENERATIVE AI AND AI-ASSISTED TECHNOLOGIES IN THE WRITING PROCESS

The author did not use any generative AI or AI-assisted technologies in the preparation of

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