**Journal of Mathematics Instruction, Social Research and Opinion**
Vol. 4, No. 3, September 2025, pp. 1003 - 1011, https://doi.org/10.58421/misro.v4i3.726
ISSN 2962-7842 

# Ethnomathematics Peanut Cake in Learning Social Arithmetic

**Nabila Adelia Dahlan[1], Siti Maysarah[2]**
[1,2]Pendidikan Matematika, Universitas Islam Negeri Sumatera Utara, Medan, Indonesia

**Article Info**

***Article history:***

Received 2025-08-23
Revised 2025-09-26
Accepted 2025-09-29

***Keywords:***

Ethnomathematics
Peanut-Cake
Social Arithmetic

**ABSTRACT**

This study examines ethnomathematical practices in a home-based peanut-cake (kue kacang) business and draws implications for teaching social arithmetic. Using a descriptive-qualitative, ethnographic approach, data were collected through observation, interviews, and documentation with the business owner, Mrs. Mardiana Rangkuti (Medan, Indonesia). Analysis reveals that key social-arithmetic concepts are embedded across procurement, processing, packaging, and sales, including gross, tare, and net calculations, unit conversions, pricing, profit, and profit percentage, with minimal risk of loss. Daily records indicate a profit rate of 233.52% relative to production costs, illustrating how routine commercial decisions operationalize mathematical reasoning. The study translates these authentic practices into context-rich classroom tasks (e.g., computing net weight from gross and tare, comparing pricing strategies, and evaluating profit percentages under varying input costs). The novelty lies in integrating local cultural and economic activities into mathematics instruction, enabling students to connect formal social arithmetic concepts with real-life contexts. This approach is expected to improve conceptual understanding, relevance, and engagement in learning social arithmetic.



***Corresponding Author:***

Nabila Adelia Dahlan
Pendidikan Matematika, Universitas Islam Negeri Sumatera Utara, Medan, Indonesia
Email: nabilaadelia439@gmail.com

## 1. INTRODUCTION

Education is a crucial aspect of human life that cannot be ignored [1]. Education plays a crucial role in building national civilization [2]. As well as being the basis for the survival of society [3]. Mathematics is one of the subjects taught to students in formal education, from elementary school to high school, and even in college [4]. Mathematics education is an important part of developing students' cognitive abilities.

Additionally, education is a prerequisite for the development of highly skilled human resources in the future [5]. This can be seen from the many hours of mathematics lessons that automatically dominate other subjects [6]. Accordingly, strengthening the

quality of mathematics learning is strategic for nurturing problem-solving, reasoning, and decision-making skills that underpin lifelong learning and national competitiveness.

Based on the Law of the Republic of Indonesia in Government Regulation (PP) No. 4 of 2022, which amends PP No. 57 of 2021 regarding National Education Standards, one of the subjects that must be taught in elementary and secondary school education is mathematics. In Permendikbud No. 22 of 2016 explained that the learning objectives in mathematics are to measure students to be able to: 1) Understand the concepts and forms of mathematics, apply concepts or logarithms precisely, accurately, efficiently, and flexiblely in solving a problem; 2) Describe the pattern of mathematical properties in the form of reasoning, can develop or manipulate years Mathematical forms when building an argument, prove, or interpret arguments and statements in mathematics; 3) solving a mathematical problem that includes the ability to understand the form of problems, determine the problem model and math resolution, and provide the right solution; and 4) Communicating arguments or ideas in the form of symbols, tables, diagrams, or other media [7]. These objectives emphasize not only procedural fluency but also conceptual understanding, reasoning, problem-solving, and communication—dimensions that require rich, contextual learning experiences.

However, these achievements are not optimal. According to the 2018 data from the Program for International Student Assessment (PISA), Indonesian students ranked 74th out of 79 countries in mathematical literacy, with a score of 379. In 2022, although the ranking increased by 5-6 positions, the average score actually decreased to 366 due to learning loss during the COVID-19 pandemic [8]. This persistent gap indicates that conventional approaches have not sufficiently fostered mathematical literacy, underscoring the urgency to adopt pedagogies that connect school mathematics with students' lived experiences.

One way to improve mathematics learning is to integrate cultural aspects into the learning process. The integration of Ethnomathematics into school mathematics learning is feasible because it can enrich and complement the school mathematical content [9]. Based on how mathematics is taught in school, and see how mathematics develops [10]. The inclusion of cultural elements in education, especially in mathematics learning, is expected to serve as an alternative learning method and a means of cultural preservation [11]. Mathematics learning with a cultural approach can be said to be a response for students who find it difficult to understand mathematics in terms of memorization and concrete construction [12]. Cultural integration into mathematics education is commonly referred to as ethnomathematics [13]. In this view, culture provides authentic contexts (artefacts, practices, measurements, trade) through which formal concepts—such as social arithmetic—become meaningful and transferable.

According to Astuti in [14], Ethnomathematics is a strategy that can provide assistance to students in realizing the relationship between learning mathematics and the socio-cultural concepts that exist in the surrounding community. Etnomatematics is one approach that can be used to improve student mathematics learning outcomes. According to Lidinillah in [15] ethnomatematics functions as a bridge between mathematical mindset and community culture. According to [16], mathematics and culture are two aspects that are interrelated and inseparable. Thus, Ethnomathematics can be used to enrich students'

mathematical understanding as well as help maintain cultural heritage and strengthen the local identity of the community [17]. This makes learning more relevant and meaningful by linking mathematical ideas to daily life and cultural context [18]. Consequently, ethnomathematics positions local knowledge as a pedagogical resource, fostering identity affirmation and deeper engagement with mathematical reasoning.

One of the ethnomathematics storage is a bean cake. Peanut cake is a traditional Indonesian cake that is popular and has a long history [19]. Peanut cakes have a significant economic value for SMEs, especially in terms of income and job creation. Peanut cakes can serve as an example in learning mathematics, particularly in social arithmetic materials. Concepts such as net, gross, tara, profits, and profit percentage can be applied in the production and sale of peanut cakes. Thus, learning mathematics can be more contextual and relevant to everyday life. For MSMEs, peanut cakes can be a significant source of income. By understanding mathematical concepts such as social arithmetic, MSME actors can optimize the production process and sales of peanut cakes, thereby increasing income and profits. In addition, peanut cakes can also be a product that helps improve the local economy and community. Thus, this study aims to explore the concept of Ethnomathematics in relation to peanut cakes and their applications in learning social arithmetic material, as well as understanding the economic value of peanut cakes for SMEs.

Previous research has shown that ethnomatematics can be used in learning mathematics to improve student learning outcomes [20], [21], [22]. However, research on Ethnomathematics related to peanut cakes is still limited. This research differs from previous studies in that it focuses on exploring the concept of Ethnomathematics in relation to peanut cakes and their applications in learning social arithmetic material. This research is expected to contribute to the development of mathematics education in Indonesia by demonstrating how culture can be effectively utilized in mathematics learning to enhance student learning outcomes.

## 2. METHOD

This study uses a qualitative descriptive method with an ethnographic approach [23]. This approach was chosen because it was suitable for exploring cultural practices related to the production of peanut cakes in the context of daily life. Through ethnography, researchers can gain insight into how these cultural activities incorporate mathematical concepts, particularly social arithmetic. The research subject is Mrs. Mardiana Rangkuti, S.E., owner of a peanut cake business in Medan. Subjects were chosen with the criteria: (1) having more than 20 years of experience in the bean cake business, (2) still maintaining traditional production methods, and (3) business products are widely known in the community. This criterion involves examining representative subjects in the context of traditional food ethnomathematics. Sampling was purposive to ensure information-rich cases, with the business site serving as the naturalistic setting. The researcher acted as a non-participant observer while maintaining reflexive field notes to mitigate bias and enhance credibility.

Data is collected through three main techniques: (1) in-depth interviews with business owners to obtain information related to the production, sales, and profit calculation; (2) direct observation of production activities and sales transactions; and (3) documentation in the form of notes, photos, and business financial data. Interviews were semi-structured, audio-recorded (with consent), and transcribed verbatim; observations followed a checklist capturing weights, packaging counts, prices, and transaction flows; documentation included purchase receipts, packaging logs, and price lists to support triangulation. Data Analysis Following the Miles and Huberman Models, which include:

a. Reduction of Data - Selecting and simplifying data that is relevant to the focus of the research.
b. Presentation of data - compile data in the form of narration, tables, and charts so that it is easy to understand.
c. Drawing conclusions/verification - find patterns, linkages, and verify findings repeatedly until valid conclusions are obtained.

Data saturation is achieved when information obtained from interviews and observations no longer gives new findings. To maintain research integrity, ethical procedures are applied by asking for informant consent (informed consent), ensuring the confidentiality of identity, and obtaining a research permit before the data collection process is carried out [24]. Credibility was strengthened through source-method triangulation and member checking of key summaries with the informant. Dependability and confirmability were supported by an audit trail of transcripts, field notes, and analytic memos. Identifiers were pseudonymized, and digital files were stored securely with restricted access.

## 3. RESULTS AND DISCUSSION

### 3.1. Results

**Data reduction**

The peanut cake business under study has been in operation for over 20 years. The production process is carried out daily in large quantities. From 10 kg of raw beans (gross), 9.8 kg of nuts after being roasted (net), while 0.2 kg of peanut skin is wasted as a tara. This calculation illustrates the application of social arithmetic concepts in everyday activities. Peanut cakes are produced in two forms of packaging, namely: (1) 640 packs with the contents of 12 cakes per pack, and (2) 100 jars with the contents of 70 cakes per jar. This product is sold at Rp 4,500 per pack and Rp. 28,000 per jar, both inside and outside the city of Medan. These figures correspond to 7,680 pieces (packs) and 7,000 pieces (jars), totaling 14,680 cakes/day, illustrating how routine production decisions rely on counting, unitization, and proportional reasoning.

**Data presentation**

Based on the results of interviews conducted by researchers, he produced peanut cakes in two forms: packages and jars. Data on material requirements and business capital per day are displayed in Table 1.

Table 1. Material data in 1 day

| Material | Amount | Cost |
|---|---|---|
| Peanuts | 10 kg | Rp. 250,000 |
| Bread crumbs | 20 kg | Rp. 300,000 |
| Sugar flour | 50 kg | Rp. 600,000 |
| Palm oil | 10kg | Rp. 150,000 |
| Egg | 80 items | Rp. 400,000 |
| Salt | 200 gr | Rp. 3,000 |
| Total capital | - | Rp 1,703,000 |

**Drawing conclusions/verification**

The data obtained show that the subject produces large amounts of peanut cakes every day and sells them in Medan and outside the field, earning Rp 1,703,000 per day. Ross checks that among interview, observation, and documentation, the results are consistent, yielding an estimated profit rate of ~233.52% (= Rp3,977,000 / Rp1,703,000 × 100). This verification supports the interpretation that social-arithmetic concepts (gross, tare, net, pricing, profit, and profit percentage) are embedded and consistently applied across procurement, processing, packaging, and sales.

### 3.2. Discussion

Figure 1 shows a packet of peanut cakes, while Image 2 shows a jar of peanut cakes. The two figure above depict how the products are wrapped and prepared for sale. A jar of peanut cakes is shown in Figure 2, while a plastic-wrapped packet is shown in Figure 1. These two packaging forms underscore the need for unit counting, converting the number of cakes per container, and differentiating pricing strategies, all of which are authentic contexts for teaching social arithmetic in the classroom.

Figure 1. Packet of peanut cake

Figure 2. As a jar of peanut cake

**Net, gross, and tara**

Net is net weight, gross is total (gross) weight, while tare is the deducted weight [25]. They relate as:

Gross = Net + Tare;

Net = Gross − Tare;
Tare = Gross − Net;
Tare Percentage = $\frac{Tare}{Net}$ × 100%.
Using these formulas, the subject's data can be computed for social arithmetic.

Given: Gross = 10 kg; Net = 9.8 kg.
Find: Tare =?
Solution:
Tare = Gross − Net = 10 kg − 9.8 kg = 0.2 kg.

From the results above, it can be seen that the skin in the released beans accounts for 0.2 kg of the total weight of 10 kg of beans.
This shows that peanut skins yield a tare of 0.2 kg from a total of 10 kg. This finding indicates consistent field measurement practices, enabling a direct mapping between production experience and the formal gross–tare–net concepts.

**Profit**

Net profit is the positive difference between revenue and costs (and tax) [22]. The following formula from profit
Profit = Selling Price − Cost Price.
Based on data obtained by researchers, selling peanut cakes can be used as an arithmetic learning ingredient. Researchers will calculate the daily profits from sales obtained by the peanut cake business owner.

- Income in Medan:
  Packs 300 × Rp4.500 = Rp1.350.000;
  Jars 40 × Rp28.000 = Rp1.120.000;
  Total income in Medan = Rp2.470.000.
- Income outside Medan:
  Packs 340 × Rp4.500 = Rp1.530.000;
  Jars 60 × Rp28.000 = Rp1.680.000;
  Total income outside Medan = Rp3.210.000.

Given:
Selling price = Rp5.680.000;
Purchase Price = Rp1.703.000.
Profit = Rp5.680.000 − Rp1.703.000 = Rp3.977.000.

Thus, the subject earns Rp3,977,000 per day. Pedagogically, this scenario can be transformed into tiered classroom tasks (e.g., varying input prices, simulating discounts/shipping) to cultivate modeling, proportional reasoning, and justification of pricing strategies. Thus, the profits obtained by the subject from selling peanut cakes every day are Rp 3,977,000. It can be seen that the subject achieves a substantial profit from the sale of peanut cakes, thanks to both efficient production and effective selling prices.

**Profit percentage**

In trade, the amount of profit or loss at the purchase price is usually stated in a percentage. According to Ponidi & Nugraha in [22], the profit of the seller when the selling price exceeds the purchase price is known as the percentage of profits. The following formula from the percentage of profit:

$$\%\text{Profit} = \frac{Profit}{Purchase\ Price} \times 100\%.$$

Based on the calculation of profit obtained from the subject, namely Rp 3.977.000. From the calculation of the profit, the percentage can be determined to find out what percentage of profits is earned by the subject every day.

Given:
Profit = Rp3.977.000;
Purchase Price = Rp1.703.000.

$$\%\text{Profit} = \frac{\text{Rp3,977,000}}{\text{Rp1,703,000}} \times 100\% = 233.52\%.$$

The subject earns a large profit, amounting to 233.52% per day from the sale of peanut cakes. However, keep in mind that this profit can fluctuate depending on several factors, such as sales that are not used up on the market. Based on the interview results, the subject stated that there were rare instances of unsold sales, and if any, only a few packs were not sold due to factors such as stall keepers' negligence or product damage.

In this case, the subject continues to produce peanut cakes daily due to stable demand and the ability to manage an effective stock. The subject also has a strategy to reduce losses, such as monitoring stock and regulating production in accordance with demand. Thus, the subject can minimize losses and maximize profits from the sale of peanut cakes.

## 4. CONCLUSION

This study demonstrates that the production of peanut cakes involves social arithmetic concepts, including gross, net, tara, profit, and profit percentage. This finding confirms that daily cultural activities, particularly traditional food businesses, can serve as contextual and meaningful learning resources for mathematics, especially in social arithmetic materials. This study implies that ethnomathematics integration into learning can help students understand mathematical concepts more real, interesting, and relevant to their lives. Thus, mathematics teachers can utilize local wisdom as teaching materials to enhance understanding while fostering appreciation of the regional culture. The contribution of this research extends beyond the development of mathematical education to the wider community, aiming to preserve local culture while enhancing student mathematical literacy.

## ACKNOWLEDGEMENTS

The researcher expressed his gratitude to Mrs. Mardiana Rangkuti, S.E.,., as the resource person whgavermission to conduct thethe research andassisted theted the researchers during the study.

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