Exploring Ethnomathematics of DIY's Traditional Foods as A Mathematics Learning Media in Geometric Shapes for Seventh-Grade Junior High School Students

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Abstract. The traditional foods of DIY (Yogyakarta Special Region) have diverse shapes and unique characteristics, making them interesting subjects for research. The aim of this study is to identify the mathematical aspects in various shapes of traditional DIY foods, specifically related to the seventh-grade curriculum on plane geometry, including squares and rectangles. This research employs a literature review method. The findings reveal that the geometric concepts found in DIY traditional foods include squares, rectangles, circles, and triangles. These geometric shapes can serve as media for mathematics learning, especially for junior high school students. The results also highlight the potential benefits of these findings for contextual learning and as examples of applying mathematical concepts in everyday life.

Keywords: Ethnomathematics, DIY traditional foods, plane geometry, learning media.

1   Introduction

Mathematics is often regarded as the foundation of various disciplines. The development of science and technology today cannot be separated from the role of mathematics. Mathematics has become part of culture and is used to analyze an individual's creative abilities [3]. It is seen as a tool for logical thinking and cultural advancement. The teaching of mathematics is closely tied to the education process, as one can only gain mathematical understanding and skills through formal education [5].

Describe the "Merdeka Curriculum" (Freedom Curriculum), which was introduced to enhance learning by focusing on essential content. This approach allows students to explore concepts in greater depth and strengthens their literacy and numeracy skills through differentiated, project-based learning [9]. The ultimate goal is to develop students into Pancasila learners [6]. This curriculum allows teachers, schools, and students to experiment, learn independently, and creatively adapt teaching to the developmental and individual needs of each student [8].

Ethnomathematics integrates culture and mathematics. Under the current "Merdeka Curriculum," teaching mathematics requires creativity and adaptability [13]. Studies

Ethnomathematics, which can help students understand how mathematics is used in daily life while also introducing them to cultural values. By learning cultural wisdom, students are more motivated to learn mathematics [2].

Indonesia, as a country with diverse tourist destinations, holds significant potential for developing tourism in every region. The cultural diversity in Indonesia gives rise to a wide variety of unique and distinctive foods or dishes, which can serve as an attraction for tourists [2]. Therefore, special attention is needed to ensure their preservation. This preservation is essential to prevent the loss of identity or authentic values within local cultures. Food, while being a basic necessity for all living beings to survive, also holds greater potential as a medium of communication in the context of culture and community [12].

The Special Region of Yogyakarta is part of Java, rich in diverse cultures and ancestral traditions. These inherited traditions manifest in various aspects, such as arts, education, economy, architecture, and traditional cuisine [7]. Physically, the traditional foods of Yogyakarta are characterized by distinct patterns and shapes that have remained consistent over time. For instance, onde-onde (round), yangko (square), gethuk (square), lemper (rectangular), and various other types of foods. Upon closer observation, these traditional foods exhibit geometric concepts, specifically plane shapes. Due to these unique shapes, the researcher finds it essential to explore and delve deeper into the geometric concepts embedded in Yogyakarta's traditional foods. This exploration aims to use these foods as a medium for teaching mathematics. Through this research, it is hoped that students can learn mathematics from the culture surrounding them, rather than being solely reliant on formal education

2   Methods

This study employs the literature review method. A literature review is a method of analyzing data by utilizing existing and readily available data, meaning the researcher does not engage in direct fieldwork. This study adopts a meta-analysis approach, which involves summarizing and analyzing findings from previous research [4]. The literature review process is conducted systematically through the stages of data collection, data reduction, analysis, and conclusion drawing.

The research is based on a review of various prior studies published in nationally accredited scientific journals. Articles were selected based on criteria established through searches on databases such as Google Scholar and ERIC, using keywords like "ethnomathematics exploration" and "mathematics learning media for middle school students." A total of 15 national and international articles published between 2018 and 2023 were included. The findings from these studies were synthesized into a discussion presented in this article.

3   Result and Discussion

The literature review process in this study involved 20 articles. These articles were reviewed using the content analysis method. The review results are presented in a table that includes article codes, titles, and the findings of the review. This literature-based research focused on exploring the ethnomathematics of Yogyakarta's traditional foods as a medium for teaching plane geometry to 7th-grade middle school students.

The study examined 15 research articles from journals written in both English and Indonesian. The findings indicate that the exploration of ethnomathematics through traditional foods from Yogyakarta, such as those with square and rectangular shapes, can be used as teaching materials for 7th-grade students in plane geometry topics. Suggested learning media include worksheets (LKPD) and PowerPoint presentations.

After screening the titles, abstracts, and full content of the articles, 15 studies met the criteria and were included in the literature review

Table 1. Results of Article Review.

Code	Article Title	Finding
A6	Ethnomathematics in the Shapes of Traditional Market Snacks in the Special Region of Yogyakarta	The purpose of this study is to identify geometric shapes in various traditional market snacks and their associated mathematical elements. Using an ethnomathematics approach, the researcher explored and categorized various traditional market snacks based on planar and spatial elements relevant to school curriculum materials. The mathematical elements discovered in this study were significant in terms of geometry. Additionally, in economic terms, the processes of production and sales revealed mathematical models involving linear equations with two and three variables.
A7	Ethnomathematics Exploration in Traditional Pekalongan Cakes as a Mathematics Learning Medium	The findings of this research reveal several mathematical concepts embedded in traditional Pekalongan cakes, such as circles, cylinders, rectangular prisms, and pyramids. These planar and spatial geometric shapes found in Pekalongan traditional cakes can be linked to mathematical problems, particularly those taught at the elementary school (SD) level.
A8	Ethnomathematics Exploration of Traditional Rengginang as a Mathematics Learning Medium in the Merdeka Curriculum	The ethnomathematics of the traditional snack rengginang contains mathematical concepts that can be implemented using a contextual learning and teaching model in mathematics classes at SMP PGRI 1 Bogor, specifically for 8th-grade students studying the topic of circles. This approach makes mathematics learning more meaningful, as the learning resources are derived from their own cultural environment.

A9	Ethnomathematics: Introducing Plane Geometry Through the Context of the Balaputera Dewa State Museum of South Sumatra	The researcher conducted interviews and distributed brochures to museum staff. The interviews revealed that the museum houses various historical artifacts, such as statues, stones, crafts, and architectural structures, which contain geometric concepts like trapezoids and rectangles. Utilizing the local cultural context aligns closely with the characteristics of Indonesian Realistic Mathematics Education (PMRI), specifically the local culture of Palembang. The Balaputera Dewa State Museum of South Sumatra serves as a learning medium for students and residents of Palembang to better understand the connections between local culture and mathematics.
A10	Ethnomathematics Exploration in Madura Batik Art for Geometry Learning	Madura Batik motifs can be used to introduce mathematical concepts such as geometry, making it easier to understand abstract concepts like points, angles, rectangles, triangles, circles, parallelograms, and straight, curved, parallel, and symmetrical lines. The concept of symmetry, particularly line symmetry, can serve as a medium for mathematics learning. Students can map the concept of line symmetry from various patterns found in Madura Batik motifs. These motifs not only facilitate the understanding of geometry but also serve as a way to introduce Madura's unique cultural heritage to students.
A11	Ethnomathematics-Based Learning Media: A Systematic Literature Review	The researcher conducted a study using the SLR (Systematic Literature Review) method based on 25 articles, where students' responses to ethnomathematics-based learning media showed an average score of 86.17, categorized as excellent. Thus, this can serve as a foundation for developing ethnomathematics-based learning media to achieve educational objectives, enhance students' abilities, and promote awareness of the surrounding culture.
A12	Innovative Ethnomathematics-Based Learning Materials for Plane Geometry at the Gusjigang Museum in Kudus	he research results indicate that the ethnomathematics-based learning materials for plane geometry achieved a feasibility score with an average percentage of 90.65%, categorized as highly feasible. The readability score reached an average percentage of 94.16%, categorized as easy to understand, and the student response to the ethnomathematics-based learning materials scored an average of 95.83%, categorized as excellent. These findings suggest that ethnomathematics-based learning materials can be effectively used as instructional materials for teaching mathematics to 7th-grade students during the even semester in middle schools (SMP/MTs) on the topic of plane geometry.

| A13	Web-Based Learning Media for Mathematics: Plane and Solid Geometry Materials	The researcher can design a web-based mathematics learning application featuring visual materials, explanations, and quizzes to capture users' attention and interest in learning mathematics, particularly on the topics of plane and solid geometry. The study focuses on designing the system using UML (Unified Modeling Language), which includes Use Case Diagrams, Activity Diagrams, and Application Interface Designs. The aim of this research is to develop a web-based mathematics learning media for teaching plane and solid geometry to elementary school students.
A14	Ethnomathematics Exploration of Jami Cikini Al-Ma'mur Mosque as a Medium for Teaching Geometric Concepts	The research findings reveal that the architectural structure of the Jami Cikini Al-Ma'mur Mosque incorporates various ethnomathematical elements related to geometric concepts such as squares, trapezoids, right triangles, cylinders, prisms, translations, rotations, semicircles, rectangles, reflections, pyramids, cuboids, dilations, parallelograms, spheres, rhombuses, and circles. These mathematical concepts are evident in features such as the main entrance of the mosque, its windows, supporting pillars, the ablution area, and the mosque's fence, showcasing concepts of solid geometry, plane geometry, and transformations.
A15	Exploration of Mathematical Designing Activities in the Tamansari Yogyakarta Structure and Its Implementation in Mathematics Learning	The researcher conducted several mathematical designing activities on the Tamansari structure, focusing on topics relevant to mathematics learning, particularly on Gedhong Sekawan, Pasiraman Umbul Binangun, Sumur Gumuling, and the reliefs present in Tamansari. Several relief patterns in Tamansari incorporate concepts of geometric transformations (reflection) and number theory, particularly in the reliefs that represent sengkalan memet (a traditional numerical inscription).

Table 2. Mathematical Concepts in Traditional Foods of Yogyakarta.

Traditional Foods of Yogyakarta	Images	Mathematical Concepts
Jadah Bakar *Jadah* is a type of traditional market snack made from glutinous rice and grated coconut. It goes by various names in different regions. In West Java, it is known as *ullen*. The		Grilled *jadah* incorporates the concept of planar geometry. This traditional snack is shaped like a rectangle, meaning it has two pairs of parallel sides and four right angles

way it is served also varies. Some are cut into pieces and sprinkled with grated coconut, while others are fried or grilled. It can be enjoyed with a dipping sauce like chili paste or rendang spices, depending on the cultural practices of each region.

Yangko

The chewy texture of *yangko*, made from glutinous rice flour, is typically sold in a variety of attractive colors. Not only does its chewy texture and sweet taste captivate attention, but the history or origin of *yangko* also piques the curiosity of tourists, encouraging them to give it a try.
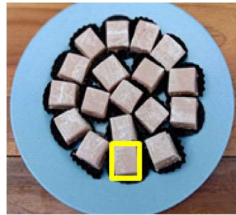
Yangko incorporates the concept of planar geometry. This traditional snack is shaped like a square, meaning it has two pairs of parallel sides and four right angles.

Mathematics learning using media can simplify and engage students in the learning process [11]. Articles coded A6, A7, A8, and A11, which have been reviewed, demonstrate that ethnomathematics-based learning media are effective during the teaching and learning process. The use of media in the learning process is intended to attract interest and foster learning motivation, thereby positively impacting the success of learning activities and the development of targeted skills [10]. Mathematics learning can benefit from the traditional culinary culture of Yogyakarta (DIY), particularly as a medium for mathematics education. In addition to enhancing students' motivation and self-confidence in learning, integrating this cultural aspect into the learning process helps students connect mathematical concepts to their real-life experiences. This makes the learning process more meaningful.

4   Conclusion

It can be concluded that the Special Region of Yogyakarta (DIY) is a region deeply rooted in various traditions. Traditional foods play a significant role in many traditional ceremonies, such as offerings, wedding processions, funerals, and Grebeg Maulud, often incorporating traditional foods as essential elements. The shapes of traditional foods

from DIY often reflect plane geometry concepts, such as squares and rectangles. Beyond their shapes, these foods are also characterized by their distinct flavors, which add to the unique cultural identity of Indonesia.

The exploration of ethnomathematics in traditional DIY foods, used as a medium for teaching mathematics to middle school students, has a positive impact on enhancing the effectiveness of learning, increasing students' motivation, boosting their confidence, and improving their conceptual understanding. This ethnomathematics study on traditional DIY foods is expected to serve as a foundation for further development of ethnomathematics in mathematics education using traditional foods from DIY.

References

1. Abdulah, A., Ummaroh, A., Salmia, U., Fadlilah, R., & Sari, N. H. M. (2023). Eksplorasi Etnomatematika Pada Kue Tradisional Pekalongan Sebagai Media Belajar Matematika. Prosiding Seminar Pendidikan Matematika Dan Matematika, 8(58), 351–358. https://doi.org/10.21831/pspmm.v8i2.308

2. Abdullah, A. A., Mubarok, M. N., Adawiya, R., Sholihah, D. A., Richardo, R., & Cahyo, D. N. (2024). Workshop pembelajaran matematika berbasis budaya melalui batik Giriloyo, Wukirsari, Imogiri, Bantul. ALKHIDMAH: Jurnal Pengabdian dan Kemitraan Masyarakat, 2(1), 222–229

3. Adawiya, R. (2022). Penerapan model pembelajaran kooperatif tipe numbered head together (NHT) untuk meningkatkan hasil belajar matematika kelas VII siswa MTS Amalul Ikhlas T.A. 2019/2020. Literasi Jurnal Ilmu Pendidikan, 13(1), 78–90

4. Ariyani, Y. D., & Wahyudi, A. (2023). The integration models of character education in social studies: A literature review. Journal of Elementary School Education, 156–158

5. Fitriani, D., & Putra, A. (2022). Systematic Literature Review (SLR): Eksplorasi Etnomatematika pada Makanan Tradisional. Journal of Mathematics Education and Learning, 2(1), 18. https://doi.org/10.19184/jomeal.v2i1.29093

6. Hartoyo, A., & Rahmadayanti, D. (2022). Potret Kurikulum Merdeka, Wujud Merdeka Belajar di Sekolah Dasar. Jurnal Basicedu, 5(4), 2247–2255. https://jbasic.org/index.php/basicedu

7. Huda, N. T. (2018). Etnomatematika Pada Bentuk Jajanan Pasar di Daerah Istimewa Yogyakarta. JNPM (Jurnal Nasional Pendidikan Matematika), 2(2), 217. https://doi.org/10.33603/jnpm.v2i2.870

8. Iswara, H. S., Ahmadi, F., & Ary, D. Da. (2022). Implementasi Etnomatematika pada Kurikulum Merdeka Melalui Hibriditas Budaya di Kota Semarang. Prosiding Seminar Nasional Pascasarjana (PROSNAMPAS), 2022, 447–453. http://pps.unnes.ac.id/prodi/prosiding-pascasarjana-unnes/447

9. Kumala, F. Z., Agarica, F., & Gunawan, G. (2024). Development of educational game learning media with an ethnomathematics approach based on Banyumas culture to improve students' mathematical understanding skills. Alphamath, 10(2), 221-243. http://dx.doi.org/10.30595/alphamath.v10i2.23347

10. Mulyani, L., Alberida, H., & Ristiono. (2023). Literatur Review Pengaruh Model Pembelajaran Inkuiri Terbimbing Terhadap Keterampilan Berpikir Kritis Peserta Didik Pada Materi Sistem Respirasi Kelas X SMA. BIOCHEPHY: Journal of Science Education, 03(1), 61–68. http://journal.moripublishing.com/index.php/biochephy

11. Richardo, R. (2017). Peran ethnomatematika dalam penerapan pembelajaran matematika pada kurikulum 2013. Literasi: Jurnal Ilmu Pendidikan, 7(2), 118–125

12. Utami, S. (2018). Kuliner Sebagai Identitas Budaya: Perspektif Komunikasi Lintas Budaya. CoverAge: Journal of Strategic Communication, 8(2), 36–44. https://doi.org/10.35814/coverage.v8i2.588

13. Wulandari, A. F., Hakim, A. R., & Kasyadi, S. (2024). Exploration of Ethnomathematics in Banyumas Traditional Food in Sokaraja Area, Central Java. Edumatica : Jurnal Pendidikan Matematika, 14(2), 173-185. https://doi.org/10.22437/edumatica.v14i2.36947