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ETHNOMATHEMATICAL EXPLORATION OF MARTABAK TELUR PREPARATION: A REPRESENTATION OF GEOMETRIC TRANSFORMATION CONCEPTS

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ABSTRACT
The gap between formal mathematics and cultural reality often creates cognitive barriers in geometry learning. This study aims to uncover the concepts of geometric transformation embedded in the production process of Tegal-style Martabak Telur. This research employs a qualitative exploratory approach with a case study design. Data were collected from three Martabak Telur vendors, selected via purposive sampling, using systematic participatory observation and high-precision visual documentation. The data were analyzed using the Miles and Huberman interactive model (reduction, presentation, and verification). The results indicate that the Martabak Telur making process is a concrete representation of dynamic geometry, encompassing: dilation in the dough-flattening technique, rotation and translation in managing heat distribution on the pan, and reflection in the symmetry of the cutting process. These findings hold significant pedagogical value as a foundation for Realistic Mathematics Education (RME), effectively bridging abstract geometric concepts through meaningful cultural contexts.
Keywords: ethnomathematics; Martabak Telur; meaningful learning; transformational geometry; realistic mathematics education

ABSTRAK
Kesenjangan antara matematika formal dan realitas budaya sering kali menimbulkan hambatan kognitif dalam pembelajaran geometri. Penelitian ini bertujuan untuk mengungkap konsep transformasi geometris yang terdapat dalam proses pembuatan Martabak Telur khas Tegal. Penelitian menggunakan pendekatan kualitatif eksploratif dengan desain studi kasus. Data dikumpulkan dari 3 (tiga) orang penjual Martabak Telur sebagai informan kunci yang dipilih melalui purposive sampling, melalui observasi partisipatif sistematis dan dokumentasi visual berpresisi tinggi. Data dianalisis menggunakan model interaktif Miles dan Huberman. Hasil penelitian menunjukkan bahwa proses pembuatan Martabak Telur merupakan representasi konkret dari geometri dinamis, yang meliputi: dilatasi pada teknik meratakan adonan, rotasi dan translasi dalam mengelola kematangan di wajan, serta refleksi pada simetri pemotongan produk. Temuan ini memiliki signifikansi pedagogis sebagai landasan pengembangan Realistic Mathematics Education (RME), yang efektif menjembatani konsep geometris abstrak melalui konteks budaya yang bermakna bagi siswa.
Kata kunci: *etnomatematika; Martabak Telur; pembelajaran bermakna; geometri transformasional;* realistic mathematics education

Introduction

Ethnomathematics is defined as the recognition of the diverse ways in which communities engage in mathematical activities. This theory is supported by the view of Purba & Nurwijaya, (2024) that local wisdom is a valid and relevant source of knowledge for students outside the classroom. Implementation in Indonesia includes exploring mathematical content in batik making and musical instrument crafting (Supriyadi et al., 2024; Wyrasti et al., 2023). To create more lively learning, the concept of solid geometry can be taught through local culinary media. This strategy effectively connects formal theory with practical applications that are familiar to everyday life.

The integration of ethnomathematics through traditional cuisine is a vital step in instilling geometric concepts while preserving national identity (Sonkqayi, 2023). Culinary objects such as bagea or sago plates are essentially concrete teaching aids that can overcome mathematical abstraction, which is often a primary cause of students' difficulties in solving real-world mathematical problems (Govender & Stott, 2024; Milla Husna & Noriza Munahefi, 2024). This neglect not only reduces the quality of learning but also distances students from their cultural roots. In response to this, Indonesia's geographical wealth offers a variety of culinary delights with distinctive processing techniques as learning resources (El Bedewy et al., 2024). One of the most powerful representations is the Martabak Telur, a specialty of Tegal. This dish is not only delicious, but also contains complex mathematical logic in its preparation procedure, which is carried out intuitively by the craftsmen.

One of the mathematical concepts underlying the exploration of Martabak Telur representations is Transformational Geometry. Mathematics is widely known as the science of patterns, structures (El Bedewy et al., 2024), and reasoning as well as a driver of technological innovation, while Transformational Geometry is a branch of mathematics that focuses on specific methods for studying changes in the position, size, and properties of objects based on certain rules (Thompson, 2025). This branch examines in depth aspects of symmetry, similarity, and congruence (Abar et al., 2024). When these geometric principles identified in local cultural practices, the phenomenon is studied in the field of ethnomathematics (Meeran et al., 2024).

The application of the principles of Transformational Geometry in the context of Martabak culture is academically framed in Ethnomathematics. By definition, ethnomathematics is the study of the relationship between mathematics and culture (Näslund-Hadley et al., 2025). This approach is crucial because it creates a space for interaction between mathematics and culture on a personal and social level, making the learning process more meaningful and relevant to real life (Govender & Stott, 2024). In Indonesia, one area of cultural wealth that has great potential and is rich in ethnomathematical elements is traditional cuisine, ranging from traditional cakes to main dishes (Rezeki et al., 2025; Shadiq & Nur, 2025).

Although ethnomathematics studies by Gula & Jojo (2024) and Nguyen et al. (2025) have extensively described geometric aspects and visual patterns in traditional architecture and clothing, the exploration of active learning mechanics remains limited. This gap is evident in current literature: the analysis by Novikasari & Febriana (2024) on batik, as well as the studies by Owusu & Obuo Addo (2023) and Abah & Chinaka (2025) on traditional games, primarily focus on static artifacts or discrete arithmetic. To date, the culinary domain remains an untapped laboratory for dynamic geometry.

This study addresses this gap by exploring transformational geometry in the preparation of Martabak Telur, specifically the Tegal specialty. Unlike motifs in batik or abstract patterns in games, Martabak Telur demands stringent spatial and temporal precision during the skin-stretching and folding process. This fabrication involves tangible geometric transformations (rotation, reflection, and dilation) in a three-dimensional space that requires real-time volume optimization. The urgency of this research lies in its potential to bridge the gap between students' realistic thinking and abstract mathematical concepts. By framing culinary arts as a dynamic mathematical process, this study offers a new paradigm: shifting the focus from “mathematics as a static form” to “mathematics as an iterative process”, thereby making complex concepts more applicable and meaningful.

Research Methods

This study employs a qualitative case study design with an ethnographic approach to explore the concepts of transformational geometry in the making of Martabak Telur. The ethnographic approach aims to build students' cultural awareness through interaction and to place culture as the basis of learning (Supriyadi et al., 2024). This design was chosen to facilitate an in-depth investigation of Martabak Telur as a cultural artifact and a medium for visualizing Transformational Geometry, providing an empirical framework for contextual understanding. This approach is crucial for producing data with substantive interpretive depth, which is a key prerequisite in ethnomathematics studies (Matindike & Ramdhany, 2025).

The research was conducted through three systematic stages: (1) pre-fieldwork, which involved determining the location, selecting informants, and developing observation instruments; (2) fieldwork, consisting of intensive participant observation of the Martabak Telur making process where data were collected through detailed field notes and visual recordings; and (3) analysis, which applied Miles and Huberman’s (1994 as cited in Nurhikmayati et al., 2022) analytical framework, consisting of data reduction, data presentation, and conclusion drawing. The research location was a culinary center in the Tegal area, where purposive sampling was employed by selecting three egg martabak sellers as key informants, each with a minimum of 10 years of practical experience (Banjo & Luneta, 2025; Matindike & Ramdhany, 2025). This selection aims to ensure an in-depth exploration of established and consistent cultural practices, which is a key principle of qualitative case studies in ethnomathematics.

The researcher served as the primary instrument, conducting observations supported by structured guidelines and high-precision visual documentation tools to ensure empirical validity (Al Fahrezi & Nur, 2025). The observation process utilized an unstructured guide that was systemized into an activity classification table focused on four main geometric transformation indicators (see Appendix 1 for the detailed Observation Sheet): (1) dilation, represented by changes in dough scale during thinning; (2) rotation, observed through changes in dough orientation on the griddle; (3) translation, seen in the linear displacement of the dough; and (4) reflection, identified by the symmetry of martabak pieces upon cutting. Visual documentation in the form of photos and videos played a strategic role in capturing these spatial dynamics and freezing detailed phenomena for empirical analysis.

To ensure the accuracy of interpretation, this study employed data triangulation by integrating three main data streams: (1) kinesthetic data from participant observations, (2) spatial data from visual documentation, and (3) conceptual data from the literature on Transformational Geometry. Cross-comparison of these three elements ensures the objectivity and accuracy of the researcher's interpretation in translating the cultural practice of Martabak making into mathematical formalism.

Results and Discussion

Martabak Telur is a traditional Tegal dish that plays a significant role in Indonesian culinary and cultural heritage. Martabak Telur represents a culinary manifestation of Indonesians' food preferences and has become one of the culinary icons that define the standard of savory deliciousness in Indonesia. Technically, this food product utilizes gluten polymerization in wheat dough to produce an elastic outer layer, which, combined with animal proteins, egg-shaped and seasoned beef, as well as spring onions, is formed through a frying process. This dish is a perfect blend of attractive physical processing techniques and complex flavor balance, reinforcing its role as a symbol of local wisdom resilience amid culinary modernization (Weiland & Williams, 2024). The following is an illustration of Martabak Telur. The following is an illustration of the Martabak Telur, as shown in Figure 1.

Figure 1. Martabak Telur

The illustration of the Martabak Telur dish, as shown in Figure 1, is not merely a culinary product but the result of a systematic process rich in mathematical concepts. An in-depth exploration of Martabak Telur making practices through a kinesthetic lens reveals a hidden layer of formal mathematical knowledge. Supported by visual data triangulation, this study classifies artisan activities into a Transformational Geometry framework. This matter proves that locally inherited practical knowledge has a precise logical structure covering four domains of transformation: 1) Dilation is a way of observing the instruments applied to expand the dough surface radially and laterally, 2) Rotation is a form of technique of turning the dough 180 degrees against the horizontal axis of the pan, 3) Translation occurs in the linear shift of the martabak towards the edge of the pan as a mechanism for separating oil residue, and 4) Reflection is a visual form of the martabak division method that follows the axis of symmetry, producing identical pieces.

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Dilation (Change in Size)

The traditional practice of making Martabak Telur has a deep mathematical representation, especially in the phenomenon of dough dilation. The flattening process uses a cylindrical tool to transform the solid dough mass into a thin, wide sheet that is geometrically identical to the change in size of an object. Through the modeling in Figure 1, it is clear how martabak craftsmen intuitively apply the principle of enlarging a circular flat shape to achieve the desired skin dimensions. A visual representation of this dough dilation modeling can be observed sequentially in Figures 2a and 2b.

Figure 2a. Initial Dough

Figure 2b. Preparing the Dough

Implicitly, the technique of making martabak dough is a real application of the concept of dilation in transformation geometry, as we can see from Figure 2a. Initial Dough to Figure 2b. Cooking Preparation Dough. This phenomenon is characterized by a change in geometric dimensions, where the dough mass undergoes a significant expansion in surface area from a thick lump to a thin sheet. To mathematically analyze the change in the position of the points on the dough, we visualize it in the form of dilation with centers at (0,0) and (a,b), which are illustrated sequentially in Figures 3a, 3b, and 3c as a bridge between cultural practice and scientific concepts.

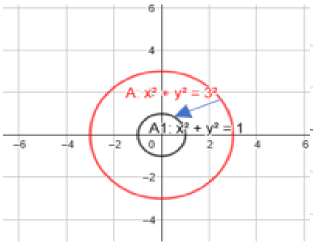

Figure 3a. Dilatation at (0,0)

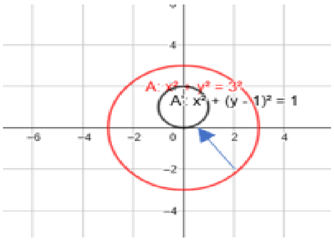

Figure 3b. Dilatation at (0,1)

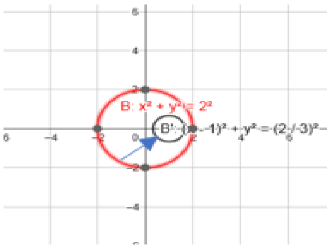

Figure 3c. Dilatation at (1,0)

Figure 3 presents an effort to abstract the kinesthetic activities involved in making Martabak into mathematical formalism through a dilation analysis that represents the dough expansion phenomenon. The quantitative analysis of the dough-spreading process is visualized by modeling the dough as an ideal circle with the base equation $x^2 + y^2 = r^2$. To demonstrate how the concept of dilation operates within the Martabak making practice, this study employs a geometric simulation with a scale factor of k = 3. The use of k = 3 in this model serves as a theoretical illustration to visualize how the dimensional changes from a dough ball to a thin sheet can be formalized into the concept of geometric transformation. This model does not aim to report precise physical measurements of the dough, but

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rather serves as a cognitive tool for students to understand the relationship between the kinesthetic activity of *Martabak*-making and mathematical formalism.

Furthermore, Figure 3a illustrates the dilation at the center point P (0,0) with the aforementioned scale factor. Additionally, Figure 3b explains the generalization at the center point P (0,1), while Figure 3c explains the center point P (1,0). Figures 3b and 3c represent the result of generalizing to any center point P(a,b), yielding the model equation $(x - a)^2 + (y - b)^2 = (kr)^2$. The application of this model in Figure 3b implements the center point coordinates P (0,1), resulting in parameter values of a = 0 and b = 1. Meanwhile, Figure 3c applies the center point P (1,0), which assigns a value of 1 to parameter a and 0 to parameter b. The application of this model is summarized in Table 1 below.

Table 1. Dilatation on a circle with center (a,b)

No	Starting Point	Circle Equation	Scale Factors	Equation of a New Circle
1	(0,0)	$x^2 + y^2 = 3^2$	3	$x^2 + y^2 = 1^2$
2	(0,1)	$x^2 + y^2 = 3^2$	3	$x^2 + (y - 1)^2 = 1^2$
3	(1,0)	$x^2 + y^2 = 2^2$	3	$(x - 1)^2 + y^2 = (2 \times 3)^2$

Table 1 presents three scenarios of changes in the circle equation based on the shift of the center point (a,b) with a scale factor of 3. In the first scenario, a dilation with the initial point at (0,0) maps the circle equation $x^2 + y^2 = 3^2$ to $x^2 + y^2 = 1^2$. In the second scenario, shifting the initial point to (0,1) maps the same circle equation to $x^2 + (y - 1)^2 = 1^2$. Finally, in the third scenario, a dilation from the initial point (1,0) on the circle $x^2 + y^2 = 2^2$ results in the new equation $(x - 1)^2 + y^2 = (2 \times 3)^2$. Overall, this table quantifies how the shift in the center of dilation affects the algebraic transformation of the martabak dough's shape.

Rotation (Turning)

The process of cooking Martabak Telur provides a concrete illustration of the concept of geometric transformation, particularly the operation of rotation. Operationally, the craftsman changed the position of the martabak on the pan by systematically changing the orientation of the entire dough. Martabak object is presented as a rectangular flat shape that undergoes a rotational transformation at a certain angle to the center point located on the symmetry axis of the pan as a traditional practice that represents the application of mathematical principles in the activity of making Martabak Telur. In line with the application of rotation, this can be modeled in Figure 4a and 4b.

Figure 4a. Beginning the Cooking Process

Figure 4b. Steps in Cooking

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Figures 4a and 4b illustrate the martabak cooking process, which demonstrates a geometric transformation in the form of rotation. The shift of the martabak from an upright (vertical) position to a flat (horizontal) position is physical evidence of a position transformation through a pivot point. Further analysis confirms that rotation can occur at the center point O(0,0) or at any center point P(a,b) as a process of shifting the object. The illustration in Figures 5a and 5b clarifies this process.

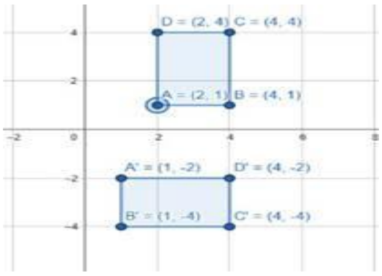

Figure 5a. Rotation at (0,0)

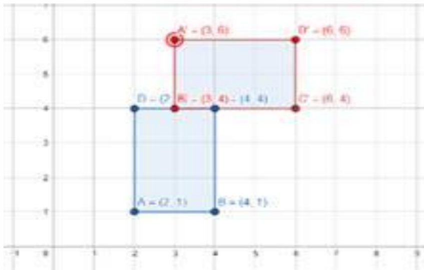

Figure 5b. Rotation at (3,5)

This often-unnoticed rotational phenomenon proves the existence of geometric precision in culinary activities. This phenomenon is illustrated in Figures 5a and 5b, which demonstrate the coordinate shift from the initial point to the final position. Mathematical analysis of this transformation uses the clockwise rotation formula with center O(0,0) to determine the shadow coordinates (x', y'). If the rotation is performed around the center O(0,0) clockwise, the formula is $x' = x\,cos\theta + y\,sin\,\theta$ and $y' = -x\,sin\,\theta + y\,cos\,\theta$. For the center of rotation at point P(a,b), the calculation of the new coordinates refers to the transformation equation involving the center parameter (a,b) and angle θ using the equation: $x' = (x-a)cos\,\theta - (y-b)sin\,\theta + a$ and $y' = (x-a)sin\,\theta + (y-b)cos\,\theta + b$. The details of the rotated coordinate data are fully contained in Table 2.

Table 2. Rotation on the center point (0,0) and (a,b)

No	Center Point	Starting Point	Rotation Angle	Results Point
1	(0,0)	A (2,1)	90°	A' (1,-2)
		B (4,1)	90°	B' (1,-4)
		C (4,4)	90°	C' (4,-4)
		D (2,4)	90°	D' (4,-2)
2	(3,5)	A (2,1)	90°	A' (3,6)
		B (4,1)	90°	B' (3,4)
		C (4,4)	90°	C' (6,4)
		D (2,4)	90°	D' (6,6)

Table 2 presents a comparative analysis of a rotational transformation on a set of initial points forming a plane, namely A(2,1), B(4,1), C(4,4), and D(2,4) with a rotation angle of 90 degrees. This table outlines two scenarios based on the center of rotation. In the first scenario, the rotation is performed around the origin point (0,0), which maps the points to the new coordinates A'(-1,2), B'(-1,4), C'(-4,4), and D'(-4,2). In the second scenario, the rotation with the same angle is applied around an arbitrary center point, (3,5). This shift in the center point mathematically alters the rotational path, resulting in a different mapping of the final coordinates, namely

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$A'(7,4)$, $B'(7,6)$, $C'(4,6)$, and $D'(6,6)$. Overall, this table demonstrates how the location of the axis of rotation affects the final position of a geometric object, which in the context of martabak preparation represents the technique of rotating the dough on the pan.

Translation (Shift)

Behind the technique of sliding martabak on a pan to even out the temperature and reduce the oil content lies a tangible change in the concept of geometric transformation, namely translation. This activity precisely moves the coordinate position of an object on a flat plane without changing its angle orientation or physical dimensions. As a result, martabak in its initial position (t_0) is proven to be perfectly congruent with martabak in its final position (t_1), proving that the deliciousness of martabak is built on consistent mathematical principles. This can be seen in Figures 6a and 6b.

Figure 6a. Temperature Leveling Process

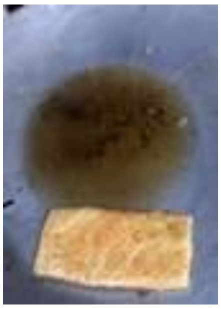

Figure 6b. Process of Reducing Temperature Levels

The phenomenon of geometric transformation, particularly translation, is clearly observed in martabak cooking procedure documented in Figures 6a and 6b. The mechanical activity of shifting objects on the surface of the pan serves as a method of optimizing temperature and reducing oil residue, which is theoretically consistent with the principle of coordinate shifting. This translation process is the displacement of the center point P(x,y) by translation T(a,b). A comprehensive explanation of this shifting mechanism is presented visually in the image 7 below.

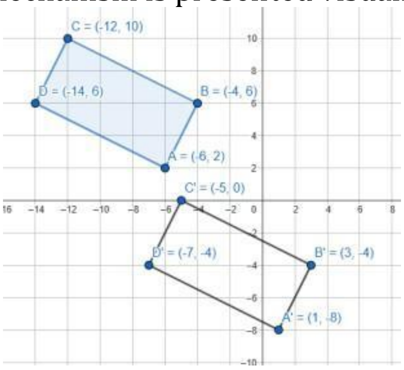

Figure 7. Translation in the Process of Cooking Martabak at Point (x,y) as Far as (a,b)

The movement of martabak can be visualized using vectors that link the center of mass through each phase of transfer. The distance traveled and direction of shift are represented by arrows (vectors) connecting the center of mass of the martabak before and after transfer. The mathematical formulation of this shift is expressed as $x' = x + a$ and $y' = y + b$. Empirical evidence in the form of an annotated flowchart showing the translation vector can be seen in Figure 7, with details of the displacement coordinates presented in Table 3.

Table 3. Translation at point (x,y) by (a,b)

No	Starting Point	As Far As the Point	Results Point
1.	A (-6,2)	(7,-10)	A' (1,-8)
2.	B (-4,6)	(7,-10)	B' (3,-4)
3.	C (-12,10)	(7,-10)	C' (-5,0)
4.	D (-14,6)	(7,-10)	D' (-7,-4)

Table 3 presents the data of translational transformations on four distinct coordinate points, namely A(-6,2), B(-4,6), C(-12,10), and D(-14,6). All these points are subjected to a uniform translation by (7,-10). This process results in the mapping of the following final points: A'(1,-8), B'(3,-4), C'(-5,0), and D'(-7,-4). Mathematically, this transformation demonstrates the displacement of point positions without altering the object's shape or size, which, in the context of Martabak Telur preparation, represents the movement of the dough from one position to another on the hot pan surface.

Reflection (Miroring)

The concept of reflection or mirroring is defined as a transformation that maps points on a plane using the properties of mirror images. Through analysis of the presentation stage, the cutting patterns intuitively applied by sellers reflect the precise application of the principle of folding symmetry, which effectively bridges formal mathematical theory with traditional culinary practices. The most significant empirical evidence of this concept is found in the geometric configuration of Martabak Telur during the presentation stage. This description is clarified in the following image 8a, 8b, 8c and 8d.

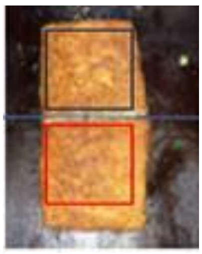

Figure 8a. Vertical Cutting

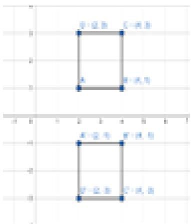

Figure 8b. Illustration of Vertical Cutting

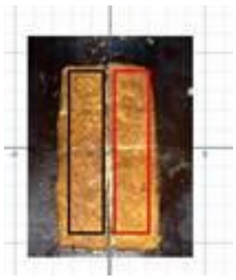

Figure 8c. Horizontal Cutting

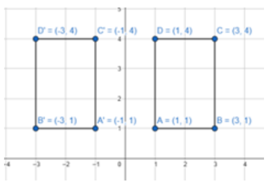

Figure 8d. Ilustration of Horizontal Cutting

The existence of a symmetry axis on the main cutting line, shown in Figure 8, proves the inherent concept of congruence in the object. The visual documentation

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in Figure 8 illustrates the martabak cutting mechanism; the integration between vertical slices (Figures 8a and 8c) and horizontal slices (Figures 8b and 8d) explicitly forms a congruent division of the area. In accordance with the (Dubeau, 2022), this phenomenon can be confirmed through coordinate analysis: the reflection of a point on the horizontal axis (X-axis) produces P(x,-y), while the reflection on the vertical axis (Y-axis) produces $P'(-x, y)$. The coordinate validation data of the points before and after reflection are summarized in Table 4.

Table 4. Reflection of point (x,y) on the X-axis and Y-axis

No	Reflection on	Starting Point	Results Point
1	X-axis	A (2,1)	A' (2,-1)
		B (4,1)	B' (4,-1)
		C (4,3)	C' (4,-3)
		D (2,3)	D' (2,-3)
2	Y-axis	A (1,1)	A' (-1,1)
		B (3,1)	B' (-3,1)
		C (3,4)	C' (-3,4)
		D (1,4)	D' (-1,4)

Table 4 presents an analysis of point reflection on the Cartesian plane across the X-axis and Y-axis. In the first scenario, a reflection is performed across the X-axis for a set of points A(2,1), B(4,1), C(4,3), and D(2,3). This process maps each initial point to the resulting coordinates A'(2,-1), B'(4,-1), C'(4,-3), and D'(2,-3), demonstrating that the ordinate (y) changes sign while the abscissa (x) remains constant. In the second scenario, a reflection is performed across the Y-axis for points A(1,1), B(3,1), C(3,4), and D(1,4), resulting in the points A'(-1,1), B'(-3,1), C'(-3,4), and D'(-1,4). In this case, the abscissa (x) changes sign while the ordinate (y) remains constant. Practically, this reflection represents the process of cutting the Martabak Telur symmetrically, where each piece is positioned in balance against the cutting line to produce identical portions.

The findings of this exploration reveal that the production process of Tegal-style egg martabak is a tangible manifestation of ethnomathematics, where abstract concepts of geometric transformation are inherently integrated into the community's culinary practices (Meeran et al., 2024). This knowledge is passed down through generations as *tacit knowledge* (unwritten knowledge). For the vendors, geometric transformations are understood instinctively as a means to achieve efficiency, flavor balance, and visual appeal. Every movement, such as spreading or folding the dough, functions as a form of 'automatic calculation' where the vendor's hands accurately determine dimensions to ensure a perfect final result. This activity holds cultural significance as a symbol of the meticulousness and dedication of the Tegal community to product quality.This is in accordance with D'Ambrosio's (2016) theory, which states that mathematics grows and develops in the daily activities of certain cultural groups through unique methods (Selepe & Mphahlele, 2025). This phenomenon is also observable in modern religious architectural design, where geometric principles are intentionally integrated to represent cultural and religious values (Cahyani & Hidajat, 2025).

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The process of making martabak dough involves the concept of dilation, which is not merely a physical shape change but a manifestation of the vendor's habitus. When flattening the dough using a rolling tool, the vendor instinctively determines the appropriate scale factor to transform the dough into a thin, wide sheet (El Bedewy et al., 2024). This instinct is crucial because the application of a large scale factor ($k > 1$) is intended to achieve optimal thinness, which directly correlates with the crispiness of the martabak (Zhan et al., 2024). Mathematical analysis shows that this dilation is centered at O (0,0) and O (a,b). Furthermore, to ensure even cooking, rotational transformation is applied. Vendors manipulate the dough clockwise with a 90° rotation angle relative to the rotation center, a geometric action that has been technically validated (Näslund-Hadley et al., 2025).

Beyond size dimensions, geometric analysis also encompasses movement dynamics(Abar et al., 2024). Concepts of translation and rotation are applied not as random movements, but as functional strategies to ensure food quality. This phenomenon occurs due to the technical necessity of managing heat distribution and separating oil residue on the hot pan surface; essentially, the vendor's movements constitute a "culinary algorithm" aimed at maximizing the product's sensory quality. Translation vector T (a,b) occurs when the vendor shifts the *martabak* from the center to the edge of the pan: this is a deliberate drying mechanism to separate oil residue from the product. Rotational strategies using 90° or 180° angles are applied gradually to ensure optimal heat distribution and uniform cooking across all quadrants of the dough. This procedural sequence culminates in the presentation stage, which integrates the mathematical concept of reflection. Cutting the martabak along the X and Y axes is performed to achieve a symmetric cutting configuration while maintaining consistency in shape and size between portions (Gerla & Miranda, 2020). The theoretical contribution of this research is to validate that ethnomathematics is not limited to static patterns but also encompasses dynamic geometry, which serves as a logical foundation for the sustainability of traditional cultural practices.

Ethnomathematics studies by Gula & Jojo (2024) and Nguyen et al. (2025) have explored geometry and visual patterns in traditional clothing, but most still focus on static end products. Similar trends are seen in the batik analysis by Novikasari & Febriana (2024) and studies on traditional games by Owusu & Obuo Addo (2023) and Abah & Chinaka (2025), which largely focus on the visual and arithmetic aspects of physical objects. This gap, coupled with the importance of integrating local knowledge into STEM according to Matindike & Ramdhany (2025), opens space for exploration into the aspects of dynamic geometry.

Pedagogically, the primary challenge of this research lies in the transition from intuitive ethnomathematical findings to formal instructional design; this gap can be addressed by integrating the *Martabak Telur* context into 9th-grade geometric transformation topics (dilation, rotation, and translation) through the *Realistic Mathematics Education* (RME) framework. As a strategic follow-up, this research proposes the development of Student Worksheets (LKPD) designed to guide students in performing horizontal mathematization, where each artisan's movement is mapped onto a Cartesian coordinate system. This approach allows abstract concepts of transformation to be constructed independently by students,

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providing a framework for a concrete and meaningful mathematics learning experience.

Conclusion and Suggestion

Based on comprehensive analysis, this study concludes that the process of making Tegal's signature *Martabak Telur* is a concrete manifestation of transformation geometry including dilation, rotation, translation, and reflection which bridges abstract mathematical concepts with local wisdom while serving as a means of cultural preservation in education. To bridge the gap between this theoretical exploration and formal classroom practice, it is recommended that future research focuses on the design and empirical implementation of RME-based Student Worksheets (LKPD) tailored for this context.

Furthermore, future studies should employ an experimental design to quantitatively measure the effectiveness of this ethnomathematics-based approach on students' learning outcomes and conceptual understanding compared to conventional methods. Finally, it is advisable to broaden the range of participants and topics to test the adaptability of this learning model across diverse school environments, as well as to conduct longitudinal studies to assess the long-term impact of integrating local contexts on student retention and engagement in learning mathematics.

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