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Article

The Local Wisdom of "*Ladu Malangbong*": An Ethno-science Perspective and Its Relationship with Physics Concepts

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Abstract: This study aims to identify the physics concepts involved in the process of making *Ladu Malangbong* from Garut. Ethno-science is the study of the indigenous knowledge of local communities that has existed since ancient times, and *Ladu Malangbong* can also be categorized as a traditional food with distinct procedural steps. This research is a field study using a qualitative approach. Data collection was carried out through interviews, direct field observation, and photography of the *Ladu Malangbong* making process. The results of this study show that the process of making *Ladu Malangbong* involves various physics concepts, such as momentum, frictional force, differences in density, pressure, heat, and convection. Therefore, by delving into the ethno-science aspects of physics, particularly in the context of making *Ladu Malangbong*, physics learning can be made more tangible, practical, and conceptual.

Keywords: Ethnoscience, Ladu Malangbong, Local wisdom, Physics concepts

1. Introduction

In this advanced era, many school-aged children are more familiar with foreign customs and have limited knowledge of the wealth and diversity of their own nation, which our country possesses in abundance. As a result, they have started to forget the sense of nationalism. To ensure that students maintain local wisdom, it is necessary to integrate local knowledge with the learning stages. The wealth of each region, local characteristics, and the life surrounding where they live can contribute significantly to the learning experience, especially in terms of cognitive, affective, and behavioural aspects. These three aspects must be possessed by every student in order to bring about educational changes that connect culture with knowledge [1-3].

Ethno-science is derived from both Greek and Latin, specifically from the word ethnoscience, which consists of two words: *ethnos*, meaning nation, and *scientia*, meaning knowledge. Based on this linguistic understanding, ethno-science can be defined as knowledge derived from a specific region, which can be implemented within a learning system that develops three aspects of learning: cognitive, psychomotor, and affective [4-6]. Ethno-science can also be interpreted as a scientific approach recommended for education in Indonesia today, as it emphasizes cultural aspects, language, customs, and morals, while still keeping pace with the times by utilizing technology as wisely as possible in the learning process [7].

The ethno-science approach is a strategy for acquiring knowledge and a process of gaining learning experiences by linking local wealth with the scientific process as a

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foundation for the learning stages [8-9]. The culture of a region reflects the local wisdom that becomes the unique characteristic of that area. Local wisdom can be understood as something embraced and practiced by the people of the region. There are many ways to enhance the uniqueness of a region, one of which is by applying it to learning in formal institutions. Learning science through ethno-science education can bridge both aspects, namely learning alongside culture. This is considered to improve students' appreciation of their regional culture and increase their interest in learning. This is further supported by a study that found that ethno-science can motivate educators in imparting knowledge, particularly based on the regional diversity possessed by the local community, leading schoolchildren to quickly grasp the process of understanding scientific knowledge and implementing it in their surrounding environment [10], [11].

Learning through ethno-science is based on the acceptance of local uniqueness as an essential aspect for education, serving as a means of expressing and conveying ideas for the development of knowledge, particularly science [5], [12]. Learning with the ethno-science approach is a science education that develops scientific knowledge based on the knowledge of the community. The use of the ethno-science approach in learning is very important, as Indonesia has approximately 370 ethnic groups, yet this wealth has not been fully utilized as a learning resource [6], [11], [13].

Garut Regency is one of the many regencies in West Java Province, rich in flora and fauna, ranging from lowlands to highlands. Equally important, there are many traditional foods originating from Garut, such as dodol, kerupuk kulit, sambal Cibiuk, Ladu Malangbong, and many others. To preserve the cultural diversity in Garut, specifically its traditional foods, there is a need for a re-identification of the understanding of these local dishes among the younger generation [14-16]. One of the traditional foods of Garut is Ladu Malangbong. Ladu Malangbong is a snack unique to Garut, with a sweet taste similar to dodol, another popular snack from Garut. However, there is a significant difference: Ladu Malangbong has a firmer texture compared to Garut's dodol. In terms of flavor, Ladu Malangbong is slightly savory due to the addition of grated coconut, while dodol is sweeter and creamier.

The purpose of this study is to reveal the local wisdom embedded in Ladu Malangbong as a form of scientific knowledge possessed by the local community. By exploring the traditional process of making Ladu Malangbong, this research aims to highlight how indigenous practices can reflect scientific principles and contribute to the enrichment of educational content, particularly in the integration of ethno-science into learning. This study also seeks to preserve and promote cultural identity by recognizing traditional knowledge as a valuable resource in the development of science education that is contextually relevant and culturally rooted.

2. Materials and Methods

The research I conducted is a field study, which prioritizes the collection of data obtained from informants. In the implementation process, data collection involved site visits, photography, and interviews [17-18]. The focus of this research is on the processing of Ladu Malangbong from Garut. This study employs a qualitative descriptive method. Qualitative descriptive research, as a form of investigation, is characterized by its ability to depict things as they are [19-20]. This method is used to visualize a real condition or situation through words, which are then summarized for analysis.

The results of the research were obtained through three main activities: a) Interviews, b) Field Observation, and c) Photography. During the interviews, the focus was solely on questions related to the traditional food of *Ladu Malangbong* from Garut. The field observation was carried out by directly observing and participating in the process of making *Ladu Malangbong*, from the ingredients and tools to the entire production process. Documentation was done by taking photos and videos related to the *Ladu Malangbong* processing. This documentation served as an addition to the interviews and field observations that were carried out during the qualitative research. The analysis of the

results was done through three steps: 1) Data Reduction, which focused on the results already obtained. This step began with the fieldwork and interviews until the results were gathered [21]. 2) Data Display, which, in qualitative descriptive research, involves presenting data in a detailed and easy-to-understand format, often using words and tables [22]. 3) The extraction of key points, where the main points are innovations presented descriptively from the previous object to clarify the prior research.

3. Results

Ladu Malangbong is a traditional dry cake made from glutinous rice, coconut, and palm sugar. It is one of the signature foods of Garut, originating from the Malangbong district in Garut. There are two theories regarding the naming of Ladu Malangbong. One theory suggests that the name comes from Gunung Ladu, the mountain where the food was first made. The other theory proposes that the name "Ladu" is derived from the type of banana called pisang ladu, which means ripe or cooked. What is clear is that Ladu Malangbong has been produced since the 1930s by a housewife named Musti'ah. She was a skilled homemaker known for making dry cakes, one of which included sugar-based treats like noga and tengteng, among many others. Over time, Ladu Malangbong was produced to be served to guests visiting homes, especially government officials. It is commonly served at special occasions such as weddings and funerals.

In the making of Ladu Malangbong, several ingredients are used, such as glutinous rice, palm sugar, and coconut. The scientific name of glutinous rice is Oryza sativa L. Van Glutinosa, a variety of rice. The distinction between glutinous rice and regular rice lies in their chemical composition. Glutinous rice contains starch with a high amylopectin content and a low amylose content, whereas regular rice has the opposite. The protein, fat, and vitamin content of glutinous rice is lower compared to its carbohydrate content. Carbohydrates play an important role in determining the characteristics of materials, such as flavor, color, texture, and more. Glutinous rice, with its high amylopectin starch content of about 97%, is chosen as the main ingredient for Ladu Malangbong because of its sticky texture. The next key ingredient is palm sugar, known scientifically as Arenga pinnata, which is widely used in Indonesia. Palm sugar is produced from the sap of the male flowers of the sugar palm tree. It has many health benefits, such as being a great source of energy, boosting the immune system, and soothing stomach aches. Sugar is a primary source of simple carbohydrates often used as a base for strength. Palm sugar is a natural sweetener that is used in Ladu Malangbong to enhance its sweetness (Afriza et al., 2019). Lastly, the final main ingredient is coconut (Cocos nucifera L.), a plant belonging to the genus Cocos and the Arecaceae family. Although coconuts are found in various wet tropical regions, about 94.64% of coconut production comes from the Asia-Pacific region. In this area, Indonesia is the largest producer of coconuts, followed by the Philippines and India.

The process of making Ladu Malangbong can be linked to the indigenous knowledge of the local community, incorporating various scientific principles, particularly those of physics. The traditional method of preparing Ladu Malangbong involves heating and mixing ingredients like glutinous rice, palm sugar, and coconut. These processes can be examined through the lens of physics concepts such as heat transfer, energy conversion, and material properties. For example, the use of heat in cooking causes the sugar to melt and the glutinous rice to become sticky, which is a demonstration of heat energy being absorbed and transferred within the ingredients. The sticky texture of the rice, which is crucial to the final product, can be explained by the properties of amylopectin, the starch compound in glutinous rice, which behaves differently under heat compared to regular rice starch.

The process of making Ladu Malangbong is a tangible example of the application of local wisdom, rich with practical knowledge passed down through generations. Each stage of the Ladu Malangbong production process, from soaking the glutinous rice to shaping the dough, involves actions that are intrinsically related to the principles of

physics. The knowledge used by the local community in making Ladu Malangbong, though traditional, is grounded in scientific concepts that can be explained through physics, such as frictional forces, pressure, heat transfer, and more. Therefore, by linking the process of making Ladu Malangbong with physics concepts, we not only preserve cultural heritage but also provide a deeper understanding for younger generations about the relationship between local culture and scientific knowledge. Table 1 below presents a comparison between the indigenous knowledge used in the production of Ladu Malangbong and the underlying physics concepts involved in each step of the process.

Table 1. Indigenous Knowledge Becomes Physics Science

No.	Step	Indigenous Knowledge	Scientific Knowledge
1	Soaking glutinous rice for 12 hours to speed up the grinding process. 	Soaking glutinous rice helps in hydration, causing the moisture content to rise to about 62-65%, making the rice texture softer.	During the soaking process, the glutinous rice sinks and does not float, because the density of glutinous rice is higher than the density of water. This process prevents the rice from hardening when ground [23], [24]
2	Pounding glutinous rice to make the rice grains fine, turning it into glutinous rice flour. 	Pounding glutinous rice involves impact and friction forces, where the rice grains collide with the mortar and pestle. The speed of pounding is directly proportional to the momentum. Faster pounding increases the momentum.	Pounding glutinous rice involves friction and momentum transfer. The faster the pounding, the greater the momentum [25], [26]
3	Sifting the flour to separate the coarse and fine particles. 	Sifting is a process of separating the mixture based on particle size, relying on the difference in density. The larger particles remain on the sieve, while the finer ones pass through to form glutinous rice flour.	Sifting separates the mixture based on particle size, relying on density differences. Larger particles stay on the sieve while finer ones pass through to form flour [23], [27]
4	Grating coconut to blend it into the glutinous rice flour mixture. 	During the grating process, frictional forces act between the coconut and the grater. The greater the friction, the greater the pressure applied to the grater.	Friction between the grater and coconut generates pressure that increases as the friction force increases [23]

No.	Step	Indigenous Knowledge	Scientific Knowledge
5	Cutting palm sugar to mix with the glutinous rice flour more easily. 	Cutting the palm sugar involves friction between the knife and the sugar. The smaller the knife surface area, the greater the pressure exerted	Cutting palm sugar involves friction between the knife and the sugar. A smaller knife surface area leads to greater pressure [23]
6	Roasting glutinous rice flour to make it last longer and prevent odor. 	This stage involves heat transfer by conduction. Heat spreads through the pan, even in areas not directly exposed to the flame	This stage involves heat transfer by conduction. Heat spreads from the pan, even in areas not directly exposed to the flame [23]
7	Making palm sugar syrup (kinca) to mix with the flour and grated coconut more easily. 	When cooking palm sugar syrup with water, heat transfer (calor) occurs from the fire to the pan, a process of convection	Cooking palm sugar syrup involves heat transfer (calor) from the flame to the pan, a convection process [23]
8	Mixing glutinous rice flour, grated coconut, and palm sugar syrup to ensure even texture and consistency. 	Mixing requires force and effort. In physics, force transferred by an object changes the position of that object. The ingredients (glutinous rice flour, grated coconut, and palm sugar syrup) will mix thoroughly	Mixing requires force and effort, with the force transferring the ingredients and causing them to blend [23]

No.	Step	Indigenous Knowledge	Scientific Knowledge
9	Shaping the mixture into a triangular shape. 	This stage involves compacting the mixture, which increases particle density and alters the shape	Compacting the mixture increases particle density and alters the shape [25]

Scientific knowledge in the process of making *Ladu Malangbong* based on local wisdom can be implemented in physics education. The theme of local wisdom in the Merdeka curriculum can serve as a platform for students to enhance their personal development in line with the progress of the local community [28-29]. The integration of local wisdom in learning can act as a filter for various global fields that interact with the lives of the community [30]. Moreover, this theme presents an opportunity to develop innovative learning approaches [31]. We can turn each ingredient and its process into scientific knowledge. For example, the main ingredients, such as glutinous rice, palm sugar, and coconut, all play a role. Glutinous rice contains amylopectin, which contributes to the process of gel formation and compaction. Glutinous rice flour contains a relatively low amount of gluten, making it chewier and elastic. The starch content in the flour also contributes to its unique flavour and aroma [32]. Another key ingredient, coconut, when fully matured, yields higher amounts of protein, carbohydrates, and fats, while the water content decreases. The higher fat content contributes to the delicious and savory sweet taste of *Ladu Malangbong* [33].

The final ingredient is palm sugar, which significantly affects the taste, color, and texture of *Ladu Malangbong*. The more palm sugar added, the sweeter, firmer, and darker the Ladu Malangbong will be. Conversely, if less sugar is added, the color will be lighter, and the sweetness will be milder [34-35]. When the palm sugar syrup (kinca) is heated above its melting point, around 160°C, it causes the caramelization of sucrose. During the production of this traditional Garut food, *Ladu Malangbong*, various physics concepts are involved, such as pounding (friction and momentum), sifting (mixture segmentation), grating coconut (friction and pressure), cutting palm sugar (pressure), roasting glutinous rice flour and coconut (heat transfer and calorimetry), making the palm sugar syrup (convection process), mixing the three main ingredients (effort and heat concepts), and finally, shaping the mixture into a triangle (particle density).

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