Ethnoscience analysis of “lemang bamboo” Sumatera traditional food

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Abstract. Lemang bamboo is a Sumatera traditional food made from glutinous rice that cooked in bamboo. Melemang is one of the Jambi community traditions that has been passed down for generations. This study aims to analyze science concepts and map basic competencies that can be integrated with the process of making lemang bamboo. This research was a qualitative research through ethno science studies. The research subjects were lemang sellers in Muaro Jambi and Batanghari city. Data collected through interviews and observations. Data were analyzed descriptively and reconstructed into scientific knowledge. The results of this study indicate that indigenous knowledge about the process of making lemang bamboo which can be reconstructed into scientific knowledge. The concept of science found in the process of making lemang bamboo were measurement, classification of living things, temperature and heat. The process of making lemang bamboo can be used as a source of learning science.

1. Introduction
Indonesia is a country with a lot of culture and local wisdom. Each region has a culture and local wisdom that characterizes the area. The local culture and wisdom can be reconstructed into scientific knowledge through the ethno science approach [1]. Ethno science is an activity that associates the knowledge of society with scientific knowledge. Based on the results of interviews with some science teachers in SMPN Muaro Jambi Regency obtained information that the teacher is still having difficulty integrating local wisdom in Jambi in science learning. This is because there is no science book integrated with local wisdom. In addition, the teacher is still struggling to analyze the concept of science in local wisdom objects that will serve as a source of learning science.

To overcome these gaps, it is necessary to do the reconstruction of indigenous knowledge and local wisdom into scientific knowledge so that it can be used as a learning resource. Some research on ethno science analysis has been conducted against several local wisdom objects in Indonesia. Basuki et al. [2] conducted a potential analysis of local wisdom of Senamat Ulu village as an electric self-contained village. Local wisdom of the village community in maintaining indigenous forests and village forests makes the village an electric self-contained village. The concept of science found in local wisdom from an electric self-reliant village is environmental conservation, environmentally friendly technology, changes in energy and energy sources.

Sumarni et al. [1] perform the reconstruction of indigenous knowledge into scientific knowledge on the production process of palm sugar done in the community Hamlet Lendoh, Desa Leban, District Boja, Kabupaten Kendal, Central Java, Indonesia. The process of production of palm sugar that is a
legacy of ancestral knowledge, there is a lot of community science that can be reconstructed into scientific knowledge that can be a source of science learning for students. Found there are 16 original sciences that can be explained with scientific knowledge that is divided into 48 science concepts. Sudarmin et al. [3] conducted a culture analysis of Nginang in STEM context integrated with ethnoscience. Nginang culture is able to strengthen the teeth, because in the betel contains essential oils and phenyl propanoid tanin compounds. The mixing of betel leaves with some chemicals contains a mixture of chemical concepts, acid-base reactions, and substance changes.

Nuroso et al. [4] conducts original science identification in the process of making bricks through ethno science studies in the village of Penggaron, Semarang and in the village of Welahan, Jepara. The results showed that the original science in the process made bricks that included materials composing, printing, drying, burning and the quality of bricks testing. The process of brick making can be integrated into environmental physics.

One of the local wisdom of Jambi that has the potential to be used as a source of learning science is the tradition of lemang bamboo. Lemang bamboo is a traditional food typical Malay tribe in Sumatera made from glutinous rice cooked in bamboo. The culture of *melemang* (making lemang bamboo) is one of the traditions of Jambi people that have been inherited by hereditary. Lemang bamboo usually is served during traditional event, wedding party, feast day, and as food open during the holy month of Ramadan.

The culture of *melemang* has begun to get less attention from the younger generation. Many young generations do not know how to make lemang bamboo. Therefore, the culture of *melemang* must return to the young generation so that they know and love the culture of the ancestors. The process of making lemang bamboo traditionally done by utilizing natural potential to demonstrate indigenous knowledge in interacting with the environment. The indigenous knowledge of the process of making lemang bamboo can be reconstructed into scientific knowledge. The results of the reconstruction can be used as the basis for mapping basic competencies in school curriculum. The concept of science in the process of making lemang bamboo can be integrated in science learning. This research aims to reconstruct the community's original knowledge of the tradition of making lemang bamboo into scientific concepts through ethno science studies. The results of this research are expected to bridge the difficulties of teachers in analysis scientific concepts that are found in the tradition of making lemang bamboo.

2. Methods

This research was a qualitative study. This research was conducted to reconstructed indigenous knowledge about the process of making lemang bamboo into scientific knowledge. The key informants of this research were two makers of lemang bamboo namely (G and S) in the Muaro Jambi Regency. Data collection was done with in-depth interviews with key informants, observation, and documentation of the Lemang bamboo making process. Data was analyzed intensively through reduction, interpretation, and verification of data. Data that does not contain the concept of science was reduced. Data that contains the concept of science was interpreted and reconstructed into scientific knowledge [1]. Data verification is done by repeated data retrieval and discussion with competent experts in ethno science [3].

3. Results and discussion

Lemang bamboo is a traditional food originating from the region of Sumatera, Indonesia. Lemang bamboo made from glutinous rice cooked in bamboo coated with banana leaves cooked in a way roast in the furnace for 3-4 hours [5,6]. Based on the results of interviews to two lemang bamboo craftsmen in Muaro Jambi regency obtained information of the process of making lemang bamboo. The main ingredient used to make lemang bamboo is glutinous rice, coconut milk, banana leaves and bamboo. The process of making lemang bamboo begins with preparing bamboo as a container for cooking of lemang.
The Bamboo used is a medium size with a length of about two bullies and a diameter that is not too large. Bamboo is cut with one of the open ends and the other ends covered with bamboo section. Then the cavity on the bamboo is cleaned by washing using clean water. The next step is to soak glutinous rice for a few hours. After soaking, glutinous rice and coconut milk are inserted in a bamboo cavity coated with young banana leaves. The bamboo that contains glutinous rice and coconut milk is then baked on the burning. The lemang bamboo roasting is done by indirectly burning on fire, but by giving a distance of about a single inch between the bamboo and the coals. The roasting process is carried out for 3-4 hours.

The process of making lemang bamboo is an indigenous society that has evolved into local wisdom inherited by generations. The process of making lemang bamboo is associated with the concept of science that can be reconstruction into scientific knowledge [1]. The relation between local wisdom and science is called Ethno science. Ethno science is an activity to relate the science of science with the knowledge of society derived from hereditary beliefs and still contains myths [7,8]. Ethno scientific analysis was conducted to excavate the original knowledge of the community and to become a science scholarship for the study in school. The concept of science identified in the process of making lemang bamboo is classification of living creatures, measurements, temperature and heat.

3.1. Classification of living thing
The main ingredient of making bamboo lemons is bamboo, banana leaves, sticky rice, and coconut (coconut milk). Four types of plants can be utilized in learning the concept of classification of living creatures.

3.1.1. Bamboo Talang (Schizostachyum Brachycladum). Bamboo is a plant of herbaceous grasses with number and sections on its trunk. The type of bamboo used to make lemang is bamboo talang (Schizostachyum Brachycladum). It has a green stem with a slippery surface, the straight length reaches 8-15 meters, a long section between 35-60 cm and a thick wall about 4-5 mm. Bamboo Talang in Todore Islands utilized for the making of ‘nasi jaha’ (bamboo rice), to make winnowing rice (sosiru), woven bamboo, ceiling, mat, lamp ornament, water reservoir, fruit basket, tissue box, as tools and materials for traditional ceremonies, and cultural dance attractions [9]. The Taxonomy of bamboo talang's is Kingdom (Plantae), Division (Spermatophyta), Class (Monokotiledon), Ordo (Graminales), Family (Gramineae), Genus (Schizostachyum), and Species (Schizostachyum Brachycladum) [10].

3.1.2. Banana (Musa Paradisiaca). According to the key informant (G and S), banana leaves are used to make a lemang bamboo, namely Kepok banana. The kepok banana leaves are not easily torn, thick, wide, giving a distinctive aroma and food delights. Banana leaves are used to coat glutinous rice when cooked in a bamboo. It aims to make the lemang not sticky with bamboo and the aroma is more fragrant. Banana leaves are commonly used as natural packaging because they contain antioxidant and
antibacterial that can kill germs [11,12]. The Banana leaf also contains several important compounds such as polifenols, lignin, hemiselulose, proteins, allantoin [13]. Various uses of banana leaves for food packaging in Java namely Tempe, Botok, Pepes, Lupis, Lemet, Arem-Arem, and Lontong [14]. The Kepok Banana (Musa paradisiaca var. Bluggoe L) belongs to the family Musaceae of the order Scitaminae. Banana is a monootyl plant. The tree is composed of false trunks. Bananas breed in a vegetative manner. A fork of the sympodal-type plant with its elongated end meristem and forming flowers and fruit. The Banana's taxonomy are the Kingdom (Plantae), divisions (Spermatophyta), classes (Monocotiledonae), ordo (Zingiberales), Faml (Musaceae), Genus (Musa), and Species (Musa Paradisiaca L).

![Bananas Tree and bananas Leaves.](image)

3.1.3. Glutinous rice. Glutinous rice is one of the rice varieties included in the Graminae family. Rice grains consist mainly of starch (about 80-85%). Glutinous rice (100 gr) contains energy of 362 kilocalories, 6.7 gram protein, carbohydrate 79.4 gram, fat 0.7 grams, calcium 12 milligrams, phosphorus 148 milligrams, and iron 1 milligrams. The Keta rice contains 16.24% water content, 6.81% protein, 0.19% fat, 0.28% fibre, and carbohydrate 76.24% [15]. The taxonomical of glutinous rice is the Kingdom (Plantae), Divisio (Spermatophyta), Class (Angiospermae), order (Graminales), Family (Graminea), Genus (Oryza), species (Oryza sativa L), varieties (Oryza sativa glutinosa).

![Glutinous rice.](image)

3.1.4. Coconut. Coconut (Cocos nucifera L.) is a strategic commodity that has social, cultural, and economic roles in the lives of Indonesian society. Coconut (Cocos nucifera L.) belongs to the family Palmae of the genus Cocos. Coconut plants are plants that have high economic value as almost all parts of the tree, roots, stems, leaves, and fruit can be used for the needs of human life. Coconut plantation parts are widely utilized is 53% fruit, root 2%, stem 22%, and leaves as much as 23%. Coconut milk is a product which is based on coconut meat. Coconut milk is a milky white liquid
derived from grated and filtered old coconut meat. Coconut milk is a raw material for making bamboo lemang. The content of phenol in coconut milk is the same as 34.80 mg/Kg and the antidote for free radicals is 73.48% [16].

![Coconut tree and coconut milk](image1)

**Figure 4.** (a) coconut tree and (b) coconut milk.

### 3.2. Measurement

The application of measurement in the process of making lemang bamboo is measurement of length, mass, time, temperature, and volume. Lemang bamboo Craftsmen have applied the concept of long measurement on bamboo that will be used to make lemang. The length of bamboo used is usually two. Bamboo is selected which has relatively the same diameter. The measurement concept applied is to use not raw units. After measuring using the ruler and long-term, the average length of bamboo used is ± 40 cm and diameter ± 4.5 cm. The strengthening of glutinous rice is done using a glass dose of 2 cups. After measuring the scale, the mass of glutinous rice is ± 450 gr. Volume measurements are performed on the volume of coconut milk used. The Volume of coconut milk used by using a glass of 1 1/2 glasses. The result of volume measurement of coconut milk with a measuring cup is ± 300 ml.

Time-reducing application is found during the bamboo roasting process. Lemang bamboo in bake for ± 3 hours. The length of time is the influence of organoleptic value of taste and saturation while aroma [17]. The application of temperature measurement concept also found in bamboo Lemang roasting process.

![Length measuring using non-standard units and standard units](image2)

**Figure 5.** (a) The length measuring using non-standard units standard and (b) standard units.
3.3. Temperature and heat

The lemang is cooked by roasting position as in Figure 6. The lemang roasting is carried out for 3-4 hours. The ripe of lemang can be known from the bamboo color that turns into dried brownish and the coconut milk already drying. Lemang bamboo roasting process apply the concept of heat transfer by convection and radiation. The heat transfer occurs because there is a temperature difference between the coal and the bamboo Lemang. Convection is a heat transfer due to the movement of air particles with a higher temperature towards a place with a lower temperature. Convection rate of heat transfer is proportional to the convection coefficient (h), the surface area of the body (A), and the temperature difference (∆T).

Radiation is a heat transfer that does not require intermediate medium. In the process of roasting the heat occurs radiation. The rate of heat radiation of an object is comparable to the rank of four absolute temperatures (T 4). The Bamboo that contains glutinous rice and coconut milk absorbs the heat from the coal. Temperature warming at the time of cooking lemang affect the value of organoleptic, namely aroma, flavor and smoothness [18].

Figure 6. The roasting process of lemang bamboo.

In addition, there is a concept of change exists. The heat given to the substance can alter the form of the substance. Changes in the form of bamboo lemang are chemical changes. Chemical changes are a material change that results in different types and properties of material. Glutinous rice and coconut milk before cooking has different characteristics with a lemang. The macronutrient analysis in the Lemang contains 3.98% protein, 4.93% fat and 23.45% carbohydrate [19].

Figure 7. Lemang bamboo.

Based on the results of ethno science analysis, obtained that indigenous knowledge about the process of making lemang bamboo can be reconstructed into a scientific concept. The outcome of the reconstruction was made the basis in mapping basic competencies in science learning. The results of
basic competency mapping associated with the process of making lemang bamboo is indicated in table 1.

| Basic competency | Science Concept of Lemang Bamboo |
|------------------|---------------------------------|
| 3.1 Applying the concept of measuring various quantities using standard units. | The concept of measuring various quantities using standard and non-standard units related to tools and materials in the process of making lemang bamboo. |
| 3.2 Classifying living things and objects based on observed characteristics. | The classification of plants (bamboo, glutinous rice, banana tree, coconut tree) is used in the process of making lemang bamboo. |
| 3.4 Analyzing the concepts of temperature, expansion, heat, heat transfer and its application in everyday life including the mechanism of maintaining a stable body temperature in humans and animals. | The concept of temperature, heat, heat transfer in the process of making lemang bamboo. |

4. Conclusions
Lemang bamboo is a Sumatera traditional food made from glutinous rice that cooked in bamboo. The indigenous knowledge about the process of making lemang bamboo can be reconstructed into a scientific concept. The concept of science identified in the process of making lemang bamboo is classification of living creatures, measurements, temperature and heat. The outcome of the reconstruction was made the basis in mapping basic competencies in science learning. The process of making lemang bamboo can be used as a source of learning science.

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