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Ethnophysics Study of Sound Waves from Process Making Putu Cake as a Medium Physics Learning

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Abstract

Putu cake is a traditional snack that is rarely liked by the public. One uniqueness of the putu cake is the sound of the steam produced. Making putu cake can be related to the concept of physics. This study aims to examine the concept of sound waves in the process of making putu cakes for physics learning media. This study uses a qualitative method with an ethnographic approach. Sources of data were obtained through interviews and observations. The collected data is then analyzed and presented as descriptive text. The results obtained are that the larger the mass of the putu cake, the smaller the frequency and amplitude, according to Marsenne's Law. The frequency value is directly proportional to the amplitude but inversely proportional to the surface area. In making putu cake, humans can hear frequencies ranging from 1,400 Hz to 1,800 Hz. The concept of physics in the process of making putu cakes can be used as a physics learning media for sound wave material that is useful for teachers.

Keywords: Ethnophysics; Physics Learning Media; Putu Cakes; Sound Waves

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INTRODUCTION

Local wisdom is knowledge in the form of local communities' activities to solve problems and meet hereditary needs (Njatrijani, 2018). Furthermore, Njatrijani, (2018) explained that local wisdom is a fairly broad and diverse phenomenon that is difficult to be limited by space. Local wisdom can be seen as ideas, beliefs, rules and dimensions in a material (Laksana et al., 2016).

The development of the Times makes local wisdom technology increasingly faded and lost because local science and science are considered different (Rumiati et al., 2021) and the degradation of the heritage of noble values (Niman, 2016). Furthermore, Niman (2016) added that this happened because of the fading of indigenous cultures with noble values and the entry of foreign cultures that are not following the local culture. The waning of local wisdom will eliminate the parts that form the morals and identity of the nation (Wafiqni & Siti, 2018).

If this is left alone, it will be very dangerous for the life of the nation and the state (Harefa, 2017). Students will tend to be less sensitive to cultural plurality because they lack an

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understanding of the meaning of local wisdom. Furthermore, Harefa (2017) explained that the effort to print a responsive young generation could only be answered by the implementation of education with integrity. Optimizing international students' learning environments may not only benefit students' well-being and academic progress (Upsher et al., 2022)

According to (Wafiqni & Siti, 2018), integrity education is an education that can relate to the values of local wisdom. Furthermore (Wafiqni & Siti, 2018) explained that understanding education with local wisdom became the basic capital of the educational growth process. The importance of local wisdom should be considered as one of the supporting efforts in an environment that are decreasing in nature (Astuti et al., 2021). Local wisdom values can be implemented in the science section as knowledge and experience values (Bria et al., 2020; Hartini et al., 2018; Misbah et al., 2020). One of the local wisdom that can besf associated with education is traditional snacks.

Traditional snacks are typical foods from ancestors used for events or traditions (Kusumaningtyas et al., 2013). Further Kusumaningtyas et al. (2013) explain that traditional food, also called traditional snacks in the past, is often found in traditional markets. Types of traditional snacks are very diverse, ranging from sweet and salty to spicy. One of the traditional snacks is Putu cake.

Putu cake is a traditional snack made from rice flour in the form of coarse grains and brown sugar inserted in small moulds from bamboo (Wening, 2020). Furthermore, Wening (2020) added that Putu cake sellers usually go around with a typical siual sound from the steam produced by putu cake. The concept of sound waves can explain the resulting sound.

Traditional snacks have many benefits: maintaining stamina and energy, high fibre content and lower fat. In addition to the many benefits of traditional snacks, there are also concepts in general learning, one of which is natural science physics in traditional snacks. The sound produced in making putu cake can be a physics lesson on sound waves. Physics concepts in traditional snacks can make it easier for teachers to convey physics learning (Samiha, 2020; Wati et al., 2017).

The fact that physics learning often appears is that there are still many teachers who have not integrated local wisdom with physics learning, so educational goals have not been achieved, and students do not understand local wisdom in the environment (Hartini et al., 2017; Niman, 2016; Oktaviani et al., 2017). The teacher still cannot master the pedagogical, social, professional, and personality competencies as an educational agent. Almost 90% of teachers desired to develop culture-based learning, but only 20% could carry it out (Ismiyanti & Afandi, 2022).

By integrating physics learning with local wisdom, students can make direct observations so that they are trained to find their own concepts that are studied thoroughly, meaningfully, authentically, and actively (Miranti et al., 2021). Physics learning can bridge student culture and scientific power in school. Students will learn to understand their environment based on existing problems (Harefa, 2017). The use of culture in physics learning. Learning by using culture or local wisdom will be easier to accept (Sundari & Sumarni, 2018; Wati et al., 2019; Wati et al., 2020).

Based on the above description, The purpose of this study is to study the concept of sound wave ethnophysics in making putu cake. With the application of concepts, local wisdom is expected to

be used as a medium for learning physics by teachers.

METHOD

The research method used is qualitative with a descriptive ethnography approach. Ethnographic research describes how individuals use their culture to interpret reality and construct social interactions among individuals and groups (Ellingson, 2009; Wimmer & Dominich, 2006). Descriptive ethnography describes reality through analysis, disclosure of patterns, and creation of typologies and categories, which aims to describe in detail and holistically the characteristics of the object. Through this method, researchers can describe issues discussed clearly and Comprehension (Nurhidayat et al., 2020)

This research method uses several grooves. The details of the research flow can be seen in Figure 1.

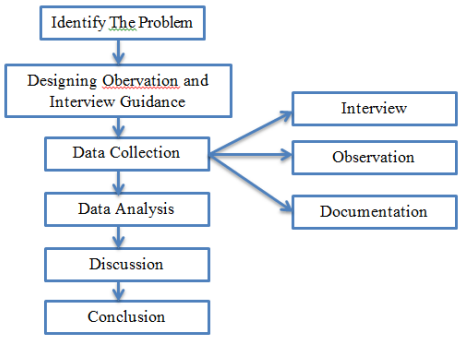

Figure 1 Research Flow

At the identification stage, the researcher divided tasks on the discussion of the objectives, indicators, instrument design, and activities to be carried out in analyzing the concept of ethnophysics in making putu cake. At the implementation stage, the researchers conducted interviews, observations and documentation within two months. Interviews and observations are based on guidelines containing a grid of observed activities and questions that will be asked to the speaker cake maker putu. Data that has been collected and then analyzed by step; (1) reduce the data from interviews and observations; (2) present the data in the form of tables and descriptive text; and (3) conclude.

The research was carried out in October and November 2021 in 4 different places located in Jember Regency as follows:

1. October 6, 2021, on Thursday, time 17.30-18.00. The research place is located at Jl.Fatahilah, Shot, Kepatihan, Kec.Kaliwates, Jember Regency, East Java 68131.
2. October 6, 2021, on Thursday, time 18.30-19.00. The research is at Jl. Glass Plate No.148, Central Gebang, Gebang, Kec. Patrang, Jember Regency, East Java 68117.
3. November 4, 2021, on Saturday, time 16.00-16.15. The research place is located at Jl. Semeru, Tegal Boto Kidul, Sumbersari, Kec. Sumbersari, Jember Regency, East Java 68121.
4. November 5, 2021, time 14.00-15.00/ Research place is at Jl. Gajah Mada, Curahancar, Rambipuji, Kec.Rambipuji, Jember Regency, East Java 68152.

In this study, the types of data used are divided into two, namely subject data and documentary data. The subject Data can be classified based on the responses and responses given by the traders of Putu cake. Verbal responses are given in response to questions in the interview, and expression responses are obtained from the observation process.

Documentary

Data is research data that contains everything involved in the incident. Based on the source, the data used in this study are primary data and secondary data.

Data collection was carried out for approximately two months from the interview process with the seller of putu cake and the process of observation on the manufacture of putu cake to analyze the concept of ethnophysics in the

manufacture of putu cake. Primary Data was obtained from interviews, and secondary data were obtained from literature on the web and journals. The data obtained is then analyzed, verified, reduced, constructed to scientific knowledge, and interpreted to the physics concept in physics learning.

RESULT AND DISCUSSION

The development of science and technology is growing, demanding innovation and creativity of teachers in using Learning media (Pangestu et al., 2019). Physics learning can be a guiding bridge between student culture and scientific power in schools. Students will learn to understand their environment based on existing problems (Harefa, 2017)

Culture is the identity of the region as a manifestation of local wisdom. Local wisdom is an action or something that is done and followed by the local community (Miranti et al., 2021). Learning media will provide students 'learning interest to help students understand compared to listening to the teacher's explanation (Anggeraeni et al., 2021). Learning physics based on local wisdom can be a guiding bridge between student culture and the power of science in school. Students will learn to understand their environment based on existing problems (Harefa, 2017). The whistling sound process produced by putu kue is listed in Table 1.

Table 1 The Process of Whistling Sound Produced by Putu Cake

No	Dosing Treatment of Putu Cake Pressing	Result			
		Taste	Texture	Frequency	Amplitude
1	2 tbsp rice flour, 1 tsp brown sugar and covered with 2 tbsp rice flour	Sweet evenly	Soft	1381 Hz	-31,7 dB
2	3 tbsp rice flour, 1 tsp brown sugar and covered with 1 tbsp rice flour	Very sweet from the beginning to the middle	Very Soft	1281 Hz	-24,6 dB
3	3 tbsp rice flour, 2 tsp brown sugar and covered with 1 tbsp rice flour	The excess sweetness from the beginning to the end	Very Soft	1312 Hz	-29,2 dB

The importance of learning based on local wisdom following the purpose of education as an effort of cultural inheritance that underlies the value of character education (Miranti et al., 2021). It is hoped that by doing this, a sense of nationalism will grow in the younger generation (Astuti et al., 2021)

Historically, Putu cake is one of the traditional Indonesian snacks taken from Wanamarta Village, East Java province. Wanamarta villagers make Putu cake, a typical dish that is eaten when guests come and eat in the morning with a delicious taste (Hernita, 2019). This traditional snack of Putu cake is made from rice flour combined with brown sugar and sprinkled with coconut on top. The characteristic of this cake lies in the whistling sound produced in the process of making putu cake (Herryani, 2019)

In the first research on the effect of the measure on taste, texture, frequency, and
amplitude, the relationship between the concept of physics and the
results found can be seen. Based on the research conducted, the taste and texture will be sweeter and soft in the manufacture of Putu cake, with the

addition of rice flour and brown sugar. This is because the sweet taste of brown sugar, then added a dose, will make it taste sweeter. Likewise, with the resulting texture, the added measure will be softer.

According to the concept of sound wave physics, Mersenne's law states that "when the density of an object is smaller, the frequency produced is higher (Rizal, 2018). The greater the density of the body, the greater the resulting frequency. If this is associated with research in the first and third treatments, adding a dose of brown sugar and rice flour will decrease the value of the frequency produced. A frequency of 1381 Hz, while using three tablespoons and two tablespoons of red, produces a smaller frequency value of 1312 Hz. , the smaller the frequency generated (Sains, 2017).

According to (Wahyudi et al., 2015), frequency is the number of waves that occur in 1 second with Hertz units. Frequency and amplitude measurements are generated with the help of the "Sound Frequency Analyzer". Application. Based on the results in Table 3, humans can hear the sound of putu cake in the frequency range of 1281 Hz to 1381 Hz. Based on the results obtained from the research conducted following the study (Pangestu et al., 2019), sounds are classified into three types: infrasound, audio sonic and ultrasonic. Humans are an audio-sonic group that can hear frequencies between 20 Hz – 20,000 Hz.

The Process Of Whistling Sound Produced By Putu Cake

The following is a Figure 2 of the process of the whistling sound produced by Putu Cake.

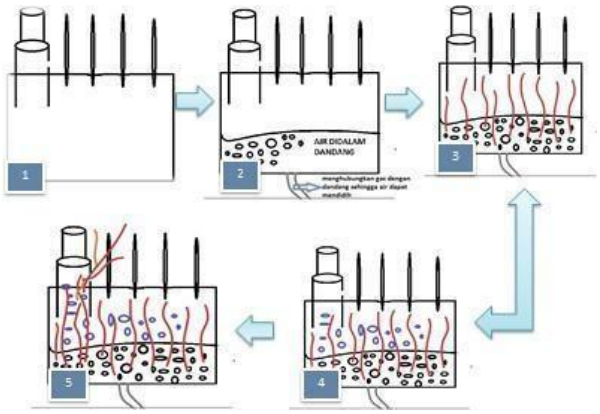

Figure 2 The Process of Whistling Sound by Putu Cake

Description:

1. When the condition of the Cormorant is clean and sterile
2. Enter water into the boiler and connect the boiler with gas using a regulator
3. When heat gives propagation to the boiler, the water will boil and cause water vapour due to heat
4. The water vapour will rise upward and urge the particles to move out
5. Water vapour comes out by producing a distinctive whistling sound in the process of making putu cake

Sound waves are longitudinal waves because energy makes particles tight or stretched (Wahyudi et al., 2015). In this way, energy can propagate throughout space (sound). In making putu cake, you hear loud steam like a whistle. The concept of physics can explain this event. Sounds that propagate from sound sources through solid, liquid or gaseous media (Sundari & Sumarni, 2018).

The sound produced from the steam in making putu cake can be analyzed through a large cake mould putu used.

Figure 3 Bamboo Mould with A Diameter of 3.5 cm and A Height of 7 cm

The sound produced in the manufacture of putu cake comes from the sound that propagates from the liquid. A special vessel making putu cake filled with water will be heated with gas connected to the regulator. When the water boils, the water particles will collide with each other and collide. An unstable jet of water vapour tries to escape by rising upwards by pushing particles that collide and close together so that when the water vapour comes out, it will produce a distinctive and unique sound like a whistle. it will form an unstable spurt causing a whirlpool. The Whirlpool will produce air like a whistle. The instability of the steam escaping and hitting the wall causes sound waves such as whistling (Wening, 2020).

Based on research, it can be known that factors can affect the whistle. The first is density. The greater the density value, the more frequency will increase, so the sound is heard louder. As the frequency increases, the amplitude value also increases. If you use a lower boiler, it will result in a higher frequency value.

Physics learning is influenced by the learning media used (Anggraini et al., 2020). Learning Media directly related to everyday life and being able to explain the concept of physics can make students easily understand the concept and application of sound waves to make the classroom atmosphere more active. Events in making putu cake can be studied with various physics concepts with a sub-material understanding of sound, the nature of sound waves, sound wave classification and wave propagation. Each manufacturing process has a different study of physics. Making putu cake can be used as a medium of learning physics based on local wisdom and sound waves.

Learning physics on the concept of sound waves by associating it with the traditional cake Putu cake will make learning more interesting and meaningful (Sundari & Sumarni, 2018). The use of culture in learning physics makes students make direct observations so that they are trained to find their own concepts learned thoroughly, meaningful, authentic, and active. Learning by associating with student science will increase student motivation and achievement in learning outcomes (Harefa, 2017). Learning using local culture or wisdom will be easier to accept (Sundari & Sumarni, 2018).

The application of econophysics has the potential to develop student-centred learning. Ethnophysics can make students appreciate culture and be actively involved in learning physics. Students ' understanding of learning with a petrophysical approach can make students more actively involved than conventional learning. Increased understanding will be successful if learning is active. Learning using local wisdom on physics concepts will explore and develop student activities and creativity (Hadi & Ahied, 2017).

CONCLUSION

Based on the results of the study, the event of making putu cake has a uniqueness that is a distinctive sound caused in the process of making putu cake. The sound generated from the process of making putu cake can be studied with the physics of the concept of sound waves. The greater the mass of

Putu cake, the smaller the frequency and amplitude produced, according to the law of Marsenne. The frequency value is directly proportional to the amplitude but inversely proportional to the surface area. In making a cake putu man can hear the frequency ranges from 1,400 Hz – 1,800 Hz. The concept of physics in making putu cake can be used as a medium of learning physics sound wave material that is useful for teachers.

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