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An Ethnoscience Exploration of *Terbang Gembrung* Percussion From Kampung Naga, West Java and the Potential as Local Context in Physics Education

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Abstract: This research aims to explore the ethnoscience of the *Terbang Gembrung* percussion instrument of the indigenous community in Kampung Naga, Tasikmalaya, West Java, and its potential as a local context in physics education. The *Terbang Gembrung* percussion instrument of Kampung Naga employs an acoustic membrane of goat leather with an air column of *albasia* or *manglid* wood. The research methodology encompasses qualitative descriptive methods, including literature study and interviews, as well as observation methods involving the measurement of sound frequency generated using the *Decibel X* smartphone application under conditions where the instrument produces typical sound. The *Terbang Gembrung* tradition holds religious value and is commonly performed during significant celebrations such as Eid al-Fitr, Eid al-Adha, and other religious festivities. Based on the observation results, it was found that four types of percussion instruments produce sound frequencies at four harmonic levels according to the membrane size. The first harmonic has a frequency of approximately 199.0 Hz, the second harmonic around 211.5 Hz, the third harmonic approximately 231.5 Hz, and the fourth harmonic around 261.0 Hz. The design of the percussion instrument is in the form of a half-spherical cone, with the cross-sectional area decreasing from the membrane to the end of the air column. The potential application of science principles to the *Terbang Gembrung* percussion instrument makes it a cultural artifact that can serve as a local context in physics education at the high school level, focusing on the topics of sound waves, especially sound intensity and sound frequency.

Keywords: Ethnoscience; *Terbang Gembrung*; Sound Frequency; Local Context.

Introduction

According to the National Education Law Number 20 of 2003, Article 4 specifies that one of the values that must be upheld in the implementation of education is the cultural value and diversity of the nation. With the implementation of the Kurikulum Merdeka (new curriculum today), it is hoped that contemporary learning can prepare students to face global challenges while considering local needs and wisdom[1]. However, learning within the context of local wisdom remains insufficiently explored [2]. Yet, numerous local wisdoms can be integrated into the learning process [3]. Although there are existing projects aimed at strengthening students' Pancasila Profile in school-based projects, the integration of local wisdom within learning, particularly in science classrooms, still requires exploration [4]. The purpose of implementing this local wisdom theme is to cultivate students' curiosity and inquiry skills to explore the phenomena of everyday life and improve their attitude toward the culture [5]. Students are expected to learn the concepts and values contained in local arts and traditions and then reflect on these values so that they can be applied in life [6].

To provide local wisdom-based learning that can improve student learning outcomes, especially in applying scientific concepts and scientific literacy, is ethnoscience-based learning [7-9]. Etymologically, ethnoscience derives from the word "ethnos," meaning nation, and "*scientica,*" meaning knowledge. Ethnoscience emphasizes knowledge specific to particular communities, distinct from others [10]. Meanwhile, Vlaardingerbroek (1990) identifies ethnoscience as the study of expertise within the cultural context, as the cultural adaptation to one's environment and its practical application in daily life [11].

Various studies indicate that ethnoscience-based learning positively impacts students, enhancing their understanding of concepts [12] and their critical thinking skills [13]. Integrated ethnoscience learning improves students' scientific literacy [14-15]. Therefore, it is essential to understand the culture or traditions of the surrounding community to utilize them as scientific contexts in the learning process [16].

One of the cultures held by the indigenous community of Kampung Naga, located in Tasikmalaya Regency, West Java, is *Terbang Gembrung*. The percussion instrument used in the *Terbang Gembrung* tradition in Kampung Naga differs in size and dimensions from those commonly used in other regions. The uniqueness in size, resulting in different frequency tones, makes the *Terbang Gembrung* percussion instrument highly suitable for cultural and scientific study. Therefore, this research will explore how the *Terbang Gembrung* tradition is practised in Kampung Naga and how indigenous knowledge and scientific principles can explain this phenomenon. Finally, the potential use of *Terbang Gembrung* in physics education, particularly at the high school level, will be discussed by describing examples of teaching approaches. Therefore, this research aims to investigate how the

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tradition of *Terbang Gembrung* is carried out in Kampung Naga, what is the indigenous knowledge of the community regarding *Terbang Gembrung*, what materials are used to make percussion for *Terbang Gembrung*, what the frequency produced by each percussion size and what are the recommendations learning that can be implemented in ethnoscience-based learning using *Terbang Gembrung.*

Research Methods

The research methodology employed in this paper comprised a qualitative study based on a field literature review and interview. Another methodology employed observation with simple experiments to measure the frequency of the percussions using a smartphone application called *Decibel X*. The research procedure is illustrated in Figure 1.

In the first step, a literature review was conducted by examining various journals concerning the significance of the *Terbang Gembrung* within the indigenous community of Kampung Naga. Subsequently, field observations were carried out in Kampung Naga, Tasikmalaya, West Java. These observations were conducted to observe the tools used in the Terbang Gembrung performance directly and to conduct interviews with local guides in Kampung Naga.

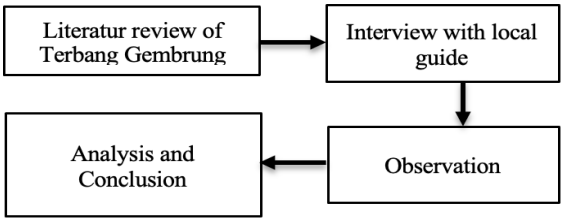


Figure 1. Research procedure [17]

The interview activity aims to explore the implementation of the *Terbang Gembrung*, its performance's purpose, the performance's process, and the techniques of playing the musical instruments used. The interview was conducted with a local guide in Kampung Naga named Mr Iji on March 6, 2024. The questions are provided in Table 1.

Table 1. List of Questions' Interview

Questions
Would you like to explain the *Terbang Gembrung* tradition? What is the value of the performance or songs played on *Terbang Gembrung*?
What instruments are used in *Terbang Gembrung*?
How to make the instrument process?
How to play the *Terbang Gembrung*?.
What is the function of each part of the instrument?
Can I measure the instrument frequencies?

After the interview, the next step involved observation, including analyzing the dimensions (size) and materials used in the percussion instruments of the *Terbang Gembrung*. Dimensional analysis was conducted by measuring the diameter and height of the air column and the materials used. Following dimensional measurements, frequency measurements were performed for each instrument when struck with the appropriate playing technique or the customary tunes played during performances.

Based on data collection, analysis was carried out based on relevant theories of acoustic physics to determine whether the resulting frequency aligns with existing theories of acoustic physics or engenders new ones. From the results of the analysis, conclusions were drawn regarding the acoustic physics equations applicable to the percussion instruments of *Terbang Gembrung* and their relation to the prevalent philosophy within the indigenous community of Kampung Naga.

After finding the science principal inside the *Terbang Gembrung* tradition, the recommendation on how to use Terbang Gembrung in physics education was provided in the lesson design.

Results and Discussion

Kampung Naga is a region in the West Java Province, precisely in the Neglasari Village, Salawu District, Tasikmalaya Regency. It lies amidst a valley surrounded by hills, and it is 444 steps from the main road from where you can access this area. The indigenous people of Kampung Naga steadfastly uphold their traditions and reject external interventions, including the avoidance of modern conveniences and external cultures, such as the avoidance of electricity. The number of families in Kampung Naga is deliberately maintained at no more than 99 households [18].

Three types of customary practices in Kampung Naga utilize ethno-acoustics: *Terbang Gembrung, Terbang Sejak,* and *angklung.* Unlike *Terbang Sejak* and *Angklung*, which lean more towards entertaining the community, *Terbang Gembrung* holds religious values. *Terbang Gembrung*, also known as *"terbangan"* or *"ngapung"* in Sundanese, is associated with the belief that The Great Allah resides in the seventh heaven. Thus, to reach there, one must fly *(ngapung),* symbolized by the use of a musical instrument [19]. Terbang Gembrung's tradition is present in the indigenous community of Kampung Naga and several regions of Central and East Java. However, the *Terbang Gembrung* instrument in Kampung Naga differs from that in the other areas.

Based on interview findings, it is explained that *Terbang Gembrung* performances typically occur during religious occasions such as Eid al-Fitr, Eid al-Adha, the Prophet Muhammad's birthday (Maulid Nabi), and the Islamic New Year. During Eid al-Fitr and Eid al-Adha, *Terbang Gembrung* accompanies the *takbiran* activities (A night before Eid al-Fitr and Eid al-Adha). Not only are the instruments used in the community hall, but residents also bring their own *Terbang Gembrung* instruments. Approximately 20 to 40 individuals participate in playing *Terbang Gembrung* during the Eid al-Fitr and Eid al-Adha takbiran nights. The recitations during the *takbiran* signify the glorification of the name of the One God, the Greatest. Meanwhile, during the Prophet's Birthday and Islamic New Year events, recitations of *"sholawat"* are sung, praising God and the Prophet Muhammad.

The residents themselves craft the instruments used in the Terbang Gembrung performance in Kampung Naga. The percussion instruments used are similar to those used in *tagoni* art and other *Terbang Gembrung* in different

regions. Still, the dimensions and shapes of the *Terbang Gembrung* instruments in Kampung Naga are highly distinctive. The performance of Terbang Gembrung occurred during the spread of Islam by the Saints (Wali) to assimilate local cultures with the civilization of Islam [19]. The *Terbang Gembrung* instruments are depicted in Figures 2 and Figure 3. On the posterior aspect of the percussion instruments depicted in Figures 2 and Figure 3, subtle differences in the diameter of the orifices are apparent, albeit with central positioning from the membrane surface. Consequently, a slight variance in shape is observed, with the left portion exhibiting a more spherical contour while the right portion demonstrates a more conical morphology.

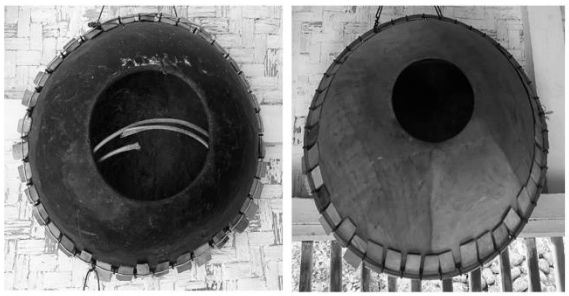


Figure 2. Back view of *Terbang Gembrung* Percussion

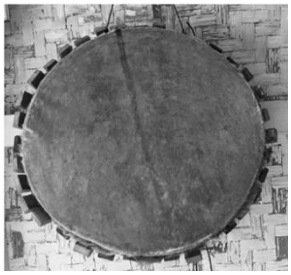


Figure 3. Front view of *Terbang Gembrung* Percussion

The *Terbang Gembrung* instruments are crafted from albizia wood (*Albizia falcataria)*, manglid wood *(Manglietia glauca)*, and goat skin as the membrane. The crafting process involves hand-carving without standardized measuring tools but rather by comparison with existing percussion instruments. The diameter of the wood determines the size of the percussion instrument to be made. With this method, each percussion instrument differs slightly from the others. However, based on measurements of several *Terbang Gembrung* percussion instruments stored in the community hall, there are four types of membrane diameter and two types of hole diameter, as shown in Table 2. The two-dimensional representation of the *Terbang Gembrung* percussion instrument can be illustrated as depicted in Figure 4.

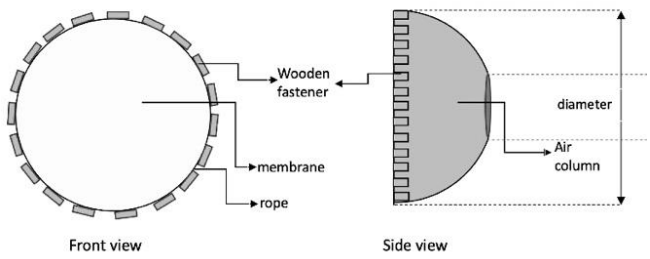


Figure 4. 2D Illustration of *Terbang Gembrung* Percussion

Table 2. The Size of *Terbang Gembrung* Percussion in Kampung Naga

Type of Percussion	Membrane Diameter (cm)	Hole Diameter (cm)
Biggest	55 - 56	25 - 26
Big	51 - 52	15 - 16
Medium	49 - 50	15 - 16
Small	42 - 43	15
Smallest	26	15

However, based on literature findings, it is stated that the *Terbang Gembrung* instruments in Kampung Naga consist of four types: *tingting* (the first *Terbang Gembrung*), which is smaller in size than *kemprang* (the second *Terbang Gembrung*), *kemprang* smaller than *bangpak* (the third *Terbang Gembrung*), and *bangpak* smaller than *brungbrung* (the fourth *Terbang Gembrung*) [19]. According to the dimensions measured and interviews with the local guide, the medium and large sizes in Table 2 represent the third *Terbang Gembrung* instrument, with a membrane diameter of approximately 50 cm and a hole diameter of about 15 cm, intended to produce the same frequency tone. Inaccuracy in dimensions arises due to manual crafting without modern technological tools. To address this, thin bamboo is inserted along the sides of the membrane circumference to ensure consistent sound production. The function of this circular bamboo (refer to Figure 1 on the left) is to tighten the membrane and produce a resonant sound.

The *Terbang Gembrung* tradition is typically performed in the community hall (*bale kampung)*, a space at the village's centre near residents' houses. Consequently, the *Terbang Gembrung* instruments are stored by hanging them on the walls of the community hall. The bamboo within the holes is detached from the membrane to prolong its durability or maintain its sound quality over time. Figure 5 illustrates the *Terbang Gembrung* instruments hanging on the walls of the community hall, aimed at ensuring longevity.

Figure 5. *Terbang Gembrung* Percussion are stored by hanging them on the wall

Tabel 3. Wood Taksonomy of *Terbang Gembrung*

Taksonomy	Albasia Wood	Manglid Wood
Class	Magnoliopsida	Magnoliopsida
Ordo	Fabales	Magnoliales
Family	Fabaceae	Magnoliaceae
Genus	Falcataria	Manglietia
Species	*Falcataria moluccana Albizia falcataria*	Manglietia glauca

The community's indigenous knowledge and scientific knowledge regarding the *Terbang Gembrung* percussion instrument can be seen in Table 4.

The types of wood used for the *Terbang Gembrung* percussion instruments are *albizia* wood and *manglid* wood. According to the indigenous guide, these woods are preferred due to their durability and abundant availability, making them easy to obtain. *Albasia* and *manglid* woods are plantation commodities cultivated by the residents of Kampung Naga. However, when felling these trees, the community still needs to consider the age or diameter of the wood, and replacement trees must be prepared beforehand. The taxonomy of *albasia* and *manglid* woods is presented in Table 3.

Table 4. Indigenous and Scientific Knowledge of *Terbang Gembrung* Kampung Naga

Theme	Indigenous knowledge	Scientific knowledge
Diameter of percussion	There are four types of percussion instruments in the art of *Terbang Gembrung*, namely *tingting*, *kemprang*, *bangprak*, and *bungbrung*, each of which produces a different sound; the *tingting* sound is the shrillest.	The sound frequency of a percussion instrument that uses a membrane is inversely proportional to the diameter of the membrane; the smaller the membrane diameter, the higher the frequency. Therefore, the *tinting* (most minor diameter) produces the shrillest sound, which means the frequency is the highest.
Wood selection	The wood used to make the *Terbang Gembrung* percussion instrument is *albizia* wood and *manglid* wood, which are cut down in the old season (enough age) to last longer.	*Albasia* wood has a density of 0,4 g/cc at a moisture content of 15%, while *manglid* wood has a thickness of 0,3 – 0,45 g/cc. Although these two types of wood are sturdy, they are lighter, so they are suitable for making musical instruments because they are solid but light to lift. Scientifically, it can be explained that in the old season (enough age), the wood has enough strength, and the water content is not much, so it is not easily affected by termites.
Membrane	The part that is hit is made of goat skin to make it more durable and flexible.	Goat skin has good elasticity. This elasticity makes goat skin more durable when used as an acoustic membrane compared to other types of membranes.
Air Column design	The design is made to resemble a half-spherical cone; the front is large, and the back is smaller, so the sound is loud.	Based on sound intensity, the smaller the surface area, the greater the intensity. The column is made smaller to produce a greater sound intensity.
Bamboo tongs	Bamboo tongs are used to clamp goat skin to produce the right sound when hit.	The greater the membrane tension (goat skin), the greater the frequency produced. When the membrane is not clamped or not given tension, the resulting frequency will not be as it should be.

Albasia wood and *manglid* wood are types of wood widely cultivated in the plantation areas of Kampung Naga, Tasikmalaya. *Albasia* wood, also known as *sengon* wood, has a density of approximately 0.4 g/cc [20]. Meanwhile, manglid wood has a density ranging from 0.30 to 0.45 g/cc [21]. With this low density, *albasia* and *manglid* woods are characterized as strong yet lightweight and more durable compared to other wood species.

The use of goat skin as an acoustic membrane can be scientifically explained by goat skin having a tensile strength almost equivalent to cowhide but at a lower cost. Cowhide typically has a tensile strength ranging from 10 MPa to 40 MPa [22], depending on species, tanning process, and thickness. This tensile strength enables the skin to withstand tearing due to tensile forces on the membrane ranging between 10 to 40 x 10^6 N per square of surface area. The strength and elasticity of the skin make it an excellent material for acoustic membranes in percussion instruments.

Acoustic Analysis

An ideal membrane bounded by a rigid body becomes a resonator with its characteristic resonance modes. The fundamental frequency of a perfect circular membrane satisfies the equation [23]:

$$f_{01} = \frac{2{,}405}{\pi d}\sqrt{\frac{\tau}{\sigma}}$$

Where d represents the membrane diameter, τ is tension, and σ is superficial density. To understand the characteristics of the membrane used in the *Terbang Gembrung* percussion instrument and its resulting sound frequency, sound frequency measurements were conducted using the *Decibel X* application, available for free on the Apple Store and Google Play Store. Frequency measurements were taken while the membrane was struck by a resident of Kampung Naga, with the criterion that the produced sound was typical. During these measurements, tension and superficial density were not measured; thus, further study is required to determine their constants.

Using the *Decibel X* application for measurement, the acoustic spectrum for the instrument with the first size dimensions, the largest diameter (between 55-56 cm), resulting data as depicted in Figure 6.

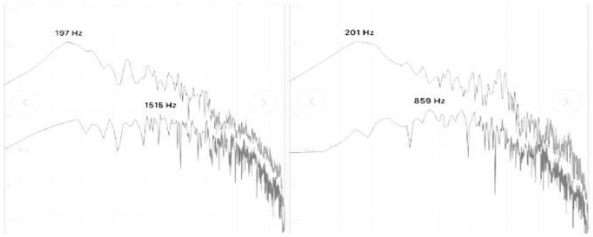


Figure 6. Acoustic spectrum for membrane diameter of 55 - 56 cm

The measurements were conducted during daylight hours in outdoor conditions without filtering, resulting in significant noise. Based on the graph in Figure 4, it can be observed that for the maximum intensity, which is the sound intensity produced by the percussion instrument membrane, frequencies between 197 and 201 Hz were generated. Meanwhile, for the percussion instrument of the second size type with a diameter ranging between 49 and 52 cm, the sound spectrum obtained is depicted in Figure 7.

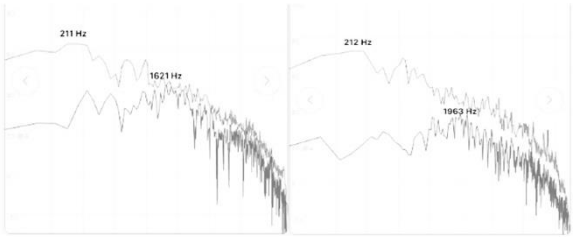


Figure 7. Acoustic spectrum for membrane diameter 49 – 52 cm

Based on the graph in Figure 6, we can observe that the frequencies generated range between 211 and 212 Hz. Upon reviewing the sound frequencies produced by the first type of instrument, it is evident that the resulting frequencies become progressively smaller. Similarly, the sound frequencies produced by the third type of instrument exhibit a frequency spectrum, as depicted in Figure 8.

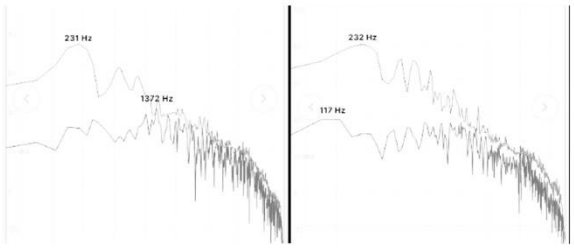
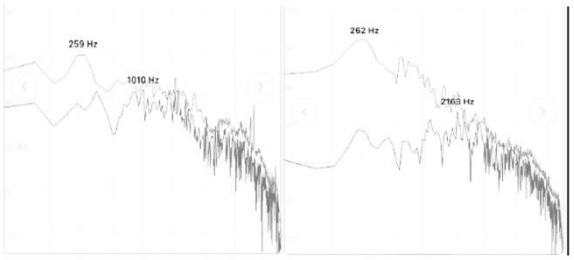


Figure 8. Acoustic spectrum for membrane diameter 42 - 43 cm

For diameters between 42 – 43 cm, the sound frequencies generated between 231 – 232 Hz are greater than the frequencies produced by instruments of the second size. Meanwhile, for the final measurement, the frequency generated by the percussion instrument with a diameter of 26 cm is approximately 259 – 262 Hz, as depicted in Figure 9.



Gambar 9. Acoustic spectrum for membrane diameter 26 cm

Based on each membrane diameter size and the resulting frequency, a summary can be made as in Table 5. The pattern of increase in frequency data, there is one exciting pattern, namely the increase in the first harmonic to the second harmonic (Δf_{12}) of 12.5 Hz, from the second harmonic to the third harmonic (Δf_{23}) increases by 20 Hz and from the third harmonic to the fourth harmonic (Δf_{34}) by 30 Hz.

Table 5. Frequency resulted by *Terbang Gembrung*

Membrane diameter/cm	Frequency / Hz	Average Frequency / Hz
55 - 56	197 - 201	199.0
49 - 52	211 - 212	211.5
42 - 43	231 – 232	231.5
26	259 – 262	261.0

In terms of the design of the air column, which differs from other percussion instruments, it is designed in the shape of a semi-spherical cone, as illustrated in Figure 3 from the side view. Starting from the membrane, the cross-sectional area gradually decreases towards the end of the air column. Based on the concept of sound intensity, the smaller the cross-sectional area, the sound intensity is more significant for the constant of the acoustic power,

$$I = \frac{P}{A}$$

Where I is the acoustic intensity (Watt/m^2), P is the acoustic power (Watt), and A is the cross-sectional area (m^2). A column made to resemble a semi-spherical cone will produce a louder sound because the intensity is more significant when it comes out of the air column.

Potential use of the *Terbang Gembrung* in physics education

The context or phenomena in science learning is one factor that can enhance the meaningfulness of learning. Students will find it easier to understand scientific concepts if they are relevant to their lives. *Terbang Gembrung*, as a tradition widely practised in several regions of Java Island, is one of the contexts of local wisdom that can be utilized as a learning resource. By considering the scientific principles outlined in the preceding section, learning outcomes and objectives that can serve as references for designing ethnoscience-based learning are evident in Table 6.

An example of an ethnoscience-based learning design using *Terbang Gembrung* as the local context can be seen in Table 6 and Table 7.

Table 6. Learning Objectives on Sound Wave in High School

Learning Outcome	Learning Objectives
Students can apply the concept of sound waves in solving problems	applying sound intensity in solving everyday life
	Applying the sound frequency of some instruments

Table 7. Lesson Design -1

Learning Activities
Orientation and Motivation Teachers prepare students to learn and motivate students by showing phenomena related to sound waves. For example, by showing the music that students like, change the volume of the sound so that students can hear the sound of the music with different intensities. The music played has a local wisdom theme according to each region.
Prior Knowledge Identification: Identify students' prior knowledge regarding sound waves, including sound intensity and sound intensity levels, by relating the sounds they hear. Conduct brainstorming to get students' prior knowledge in more detail to determine the next learning steps.
Contextualizing and Problem Statement Students watch a video of the life of the people of Kampung Naga Tasikmalaya, who are not allowed to use electricity and modern technology. Allow students to ask questions about the phenomena in the video. The teacher directs the learning question: how do the people of Kampung Naga provide information/announcements to residents, for example, when it is time for the call to prayer, even though there are no speakers there.
Construct knowledge The teacher continues the video of the life of the people of Kampung Naga by showing some of the tools used, such as (*kentongan*) the gong and (*bedug*) traditional percussion. Then, we will show the *Terbang Gembrung* tradition and the instruments. The teacher asks questions related to the concept of sound intensity produced by a sound source with a specific power when propagating in an area. The teacher and students demonstrate a substitute instrument (for example, *tagoni* / percussion) and then ask the students to measure the resulting intensity level at a distance of 1m, 2m, and 3m using the decibel X *smartphone* application. Students were allowed to discuss conclusions from the results of the sound intensity level data at each point. Several student representatives presented the results of their discussions in front of the class. The teacher provides reinforcement regarding sound intensity, which is inversely proportional to the surface area through which sound waves pass and the sound intensity level as a logarithmic value of the sound intensity ratio from the sound source and the sound threshold intensity.
Application In groups, students were asked to analyze the design of the tools used by the people of Kampung Naga to create sound to reach the entire village and how the science contained in it was applied. Each group presented the results of their discussion, and then the teacher provided corrections and strengthened the design of the Terbang Gembrung percussion instrument, which is related to sound intensity.
Reflection Students are allowed to reflect on their learning, for example, by telling or writing down what was interesting during learning, what they have understood, and what they have not understood.
Assessment Students are given a cognitive assessment to see their understanding.

Table 7. Lesson Design -2

Learning Activities
Orientation and Motivation Teachers prepare students to learn and motivate students by showing various types of musical instruments that exist in Indonesia.
Prior Knowledge Identification Identify students' prior knowledge of sound frequency from various sound sources.
Context and problem statements Students watched a video of Terbang Sejak and Terbang Gembrung traditions, which are usually carried out in Kampung Naga, Tasikmalaya, West Java. Allow students to ask questions about learning problems. The teacher directs learning questions on how each percussion instrument with different sizes produces different notes.
Construct Knowledge The teacher shows several pictures of sound sources in the form of pipes, strings, and percussion. The teacher asks students to explore the frequencies produced by each sound source through simulations. Students explore what factors will influence each sound source. Student representatives present the results of their discussion, and then the teacher provides reinforcement that in strings, the frequency is influenced by the string tension and type of string; in organ pipes, the frequency is influenced by the length of the pipe and the speed of sound in the air column, while in percussion the frequency is influenced by membrane tension, membrane diameter and height—the air column.
Application In a group, students were asked to analyze the frequencies produced by each *Terbang Gembrung*

percussion instrument. Each group presented the results of their discussion, and then the teacher provided corrections and strengthened the design of the Terbang Gembrung percussion instrument, which is related to sound frequency. The results of observations in Table 2 and Table 5 can become facts used in adaptive inquiry activities.
Reflection Students are allowed to reflect on their learning, for example, by telling or writing down what was interesting during learning, what they have understood, and what they have not understood.
Assessment Students are given a cognitive assessment to see their understanding.

According to Table 6 and Table 7, the lesson design is based on the assumption that it is impossible for students and teachers to direct visits to the Kampung Naga area, West Java. So, learning activities are directed using adaptive inquiry, namely by presenting facts or observations of scientists in the field that are to be shown in classroom activities. However, as an alternative, teachers and students can immediately go on a study visit to the Kampung Naga area, and the students will directly take direct measurements of the dimensions or size of each *Terbang Gembrung* percussion, learn how to play it, and measure its frequency directly. Several studies have concluded that implementing ethnosciences in science education designed as inquiry activities can enhance students' scientific literacy [24-26]. Inquiry-based learning with ethnosciences can also improve secondary school students' awareness of culture[27]. Likewise, for the mastery of scientific concepts, ethnoscience learning with guided inquiry methods can improve concept mastery with criteria in the moderate category [28]. Ethnosciences-based learning combined with inquiry can also enhance the critical thinking skills of prospective teacher students [29]. Even when learning is conducted online, ethnosciences with inquiry methods can make learning more engaging, increase curiosity, and motivate participants to understand scientific, technological, mathematical, and engineering literacy, as well as cultural contexts [30]. Thus, the use of ethnosciences, such as *"Terbang Gembrung"*, with inquiry methods in physics education, can potentially provide significant positive effects for students.

Conclusion

The *Terbang Gembrung* in the Kampung Naga region, Tasikmalaya, West Java, is a cultural tradition commonly performed during major events such as Eid al-Fitr, Eid al-Adha, and other religious festivals. The percussion instruments used in *Terbang Gembrung* are made of goat skin as the acoustic membrane and *albizia* wood or *manglid* wood as the air column. The instrument's design resembles a semi-spherical cone, with the cross-sectional area decreasing from the membrane to the end of the column by the principle of sound intensity. There are four sizes of *Terbang Gembrung* percussion instruments, each producing different frequencies. The first harmonic produces a frequency of approximately 199.0 Hz, the second around 211.5 Hz, the third around 231.5 Hz, and the fourth at 261.0 Hz. Thus, each increase in pitch generates a regular pattern of frequency change (harmonic). From the concept of acoustic physics, the magnitude of the frequencies produced is inversely proportional to the diameter of the membrane. The application of physics concepts in the *Terbang Gembrung* percussion has great potential as an ethnoscience-based science learning resource.

References

[1] Dirgantoro, K. P. S., & Soesanto, R. H. (2023). Towards a Paradigm Shift: Analysis of Student Teachers' and Teacher Education Institutions' Readiness on Kurikulum Merdeka. *Jurnal Pendidikan dan Kebudayaan*, *8*(2), 185-201.

[2] Novitasari, L., Agustina, P. A., Sukesti, R., Nazri, M. F., & Handhika, J. (2017, August). Fisika, etnosains, dan kearifan lokal dalam pembelajaran sains. In *Prosiding SNPF (Seminar Nasional Pendidikan Fisika)* (pp. 81-88).

[3] Mahardika, A. (2017). Penanaman karakter bangsa berbasis kearifan lokal di sekolah. *Jurnal Pendidikan Kewarganegaraan*, *7*(2), 16-27.

[4] Dwipayana, P. A. P., Redhana, I. W., & Juniartina, P. P. (2020). Analisis kebutuhan pengembangan multimedia interaktif berbasis konteks budaya lokal untuk pembelajaran IPA SMP. *Jurnal Pendidikan dan Pembelajaran Sains Indonesia (JPPSI)*, *3*(1), 49-60.

[5] Prasasti, P. A. T. (2017). Implementation of Science Learning Based on Local Wisdom to Provide Cultural Literacy. In International Conference on Islamic Education (ICIE) (Vol. 1, No. 1).

[6] Satria, et. Al. (2022). Panduan Pengembangan Projek Penguatan Profil Pelajar Pancasila. *BSKAP Kemendikbudristek Republik Indonesia*

[7] Pertiwi1b, U. D., & Firdausi1a, U. Y. R. (2019). Upaya meningkatkan literasi sains melalui pembelajaran berbasis etnosains. *Indonesian Journal of Natural Science Education (IJNSE)*, *2*(1), 122-124

[8] Damayanti, C., Rusilowati, A., & Linuwih, S. (2017). Pengembangan model pembelajaran IPA terintegrasi etnosains untuk meningkatkan hasil belajar dan kemampuan berpikir kreatif. *Journal of Innovative Science Education*, *6*(1), 116-128.

[9] Wibowo, T., & Ariyatun, A. (2020). Kemampuan literasi sains pada siswa sma menggunakan pembelajaran kimia berbasis etnosains. *Edusains*, *12*(2), 214-222.

[10] Sudarmin. (2014). Pendidikan Karakter, Etnosains dan Kearifan Lokal. *Fakultas Matematika dan IPA. Universitas Negeri Semarang*

[11] Vlaardingerbroek, B. (1990). Ethnoscience and science teacher training in Papua New Guinea. *Journal of Education for Teaching*, *16*(3), 217-224.

[12] Ardianti, S. D., & Raida, S. A. (2022). The effect of project based learning with ethnoscience approach on science conceptual understanding. *Journal of Innovation in Educational and Cultural Research*, *3*(2), 207-214.

[13] Sudarmin, S., Mursiti, S., & Asih, A. G. (2018, April). The use of scientific direct instruction model with video learning of ethnoscience to improve students' critical thinking skills. In *Journal of Physics: Conference Series* (Vol. 1006, No. 1, p. 012011). IOP Publishing.

[14] Atmojo, S. E., Kurniawati, W., & Muhtarom, T. (2019, November). Science learning integrated ethnoscience to increase scientific literacy and scientific character. In *Journal of Physics: Conference Series* (Vol. 1254, No. 1, p. 012033). IOP Publishing.

[15] Atmojo, S. E., Lukitoaji, B. D., & Muhtarom, T. (2021, March). Improving science literation and citizen literation through thematic learning based on ethnoscience. In *Journal of Physics: Conference Series* (Vol. 1823, No. 1, p. 012001). IOP Publishing.

[16] Dewi, C. A., Khery, Y., & Erna, M. (2019). An ethnoscience study in chemistry learning to develop scientific literacy. *Jurnal Pendidikan IPA Indonesia*, *8*(2), 279-287.

[17] Creswell, John W. & Guetterman, Timothy C. (2019). Educational Research Sixth Edition. Planning, Conducting, and Evaluating Quantitative and Qualitative Research. New York : Pearson

[18] Ningrum, E. (2012). Dinamika Masyarakat Tradisional Kampung Naga di Kabupaten Tasikmalaya. *MIMBAR: Jurnal Sosial dan Pembangunan*, *28*(1), 47-54

[19] Sumawinata, S., Aryanti, D. R., & Azzahra, M. (2021). Tradisi Terbang Gembrung sebagai Salah Satu Sarana Penyebaran Islam di Kampung Naga. *El Tarikh: Journal of History, Culture and Islamic Civilization*, *2*(2), 94-106.

[20] Sukma, A., Darmawan, D., & Qurthobi, A. (2017). Kuantifikasi Jenis Kayu Berdasarkan Sifat Elektrik. *eProceedings of Engineering*, *4*(3).

[21] M. Siarudin & Ary Widiyanto (2012). Sifat fisika Kayu Manglid (*Manglieta glauca* Bl.) Pada Arah Aksial dan Radial. *Penelitian Hasil Hutan* Vol. 30 No. 2, Juni 2012: 135-143

[22] Singaraj, S. P., Murali, R. C., Kumaresan, A., & Gunasekaran, B. (2023). Characteristic Analysis of Sisal Fabric and Cow Nubuck Leather for Developing Leather Lifestyle Accessories. Journal of Natural Fibers, 20(2).

[23] Fontana, F., & Rocchesso, D. (1996). Simulations of membrane-based percussion instruments. In *Proc. Workshop: Sound Synthesis by Physical Modeling,(Firenze, Italy), Centro Tempo Reale*.

[24] Hastuti, P. W., Setianingsih, W., & Widodo, E. (2019). Integrating inquiry based learning and ethnoscience to enhance students' scientific skills and science literacy. In *Journal of Physics: Conference Series* (Vol. 1387, No. 1, p. 012059). IOP Publishing.

[25] Fathonah, S., & Subali, B. (2020, June). The analysis of ethnoscience-based science literacy and character development using guided inquiry model. In *Journal of Physics: Conference Series* (Vol. 1567, No. 2, p. 022045). IOP Publishing.

[26] Wati, S., Al Idrus, A., & Syukur, A. (2021). Analysis of student scientific literacy: study on learning using ethnoscience integrated science teaching materials based on guided inquiry. *Jurnal Pijar Mipa*, *16*(5), 624-630.

[27] Sudarmin, S., Selia, E., & Taufiq, M. (2018, March). The influence of inquiry learning model on additives theme with ethnoscience content to cultural awareness of students. In *Journal of Physics: Conference Series* (Vol. 983, No. 1, p. 012170). IOP Publishing.

[29] Prayogi, S., Ahzan, S., Rokhmat, J., & Verawati, N. N. S. P. (2023). Dynamic Blend of Ethnoscience and Inquiry in a Digital Learning Platform (e-Learning) for Empowering Future Science Educators' Critical Thinking. *Journal of Education and e-Learning research*, *10*(4), 819-828.

[28] Sarwi, S., Yusnitasari, A., & Isnaeni, W. (2020, June). Concept mastery of ethnoscience-based integrated science and elementary students' life skills using guided inquiry. *In International Conference on Science and Education and Technology* (ISET 2019) (pp. 517-522). Atlantis Press.

[30] Mursiti, S., Sarwi, S., & Listiaji, P. (2021, June). Secondary metabolite learning model from Taxus sumatrana with ethnoscience integrated inquiry using online system and google form application. In *Journal of Physics: Conference Series* (Vol. 1918, No. 3, p. 032025). IOP Publishing.