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Ondel-ondel: ethno-physics-based learning media to achieve meaningful learning on rigid body equilibrium material

Dwi Susanti[1]*, Slamet Maulana[2]

[1]Department of Physics Education,, Universitas Negeri Jakarta, Indonesia

[2]Labschool Cibubur High School, Bekasi, Indonesia

**E-mail: dwisusanti@unj.ac.id*

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ABSTRACT

Ondel-ondel is one of the well-known local cultures from Jakarta. However, the role of ondel-ondel is not only in switching ceremonies and rituals but can be used as learning media. In addition to local cultural problems that are still not optimal in learning, the learning process must be carried out meaningfully. So, this study aims to analyze ondel-ondel culture from the point of view of Physics (especially on rigid body equilibrium material) and to implement it as learning media in Physics learning to achieve meaningful learning. This research is a mixed method research. Based on the results and discussion obtained, ondel-ondel has many physics concepts. In ondel-ondel, rigid body equilibrium is of special concern because equilibrium is the main focus so that the ondel-ondel remains stable when played without falling. In ondel-ondel culture, the concept of circular motion and heat also applies. The second conclusion obtained from this study is that the implementation of ondel-ondel as a learning medium is proven to realize meaningful learning for students. Achieving meaningful learning through implementing an ondel-ondel as learning media has very good criteria.

Keywords: Ethno-physics, meaningful learning, ondel-ondel, rigid body equilibrium.

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INTRODUCTION

Local culture is a national identity or cultural personality that allows a nation to assimilate and process cultures from outside/other countries into its character and abilities. Local culture is also a characteristic of ethical and cultural values in a society passed down from generation to generation. Local culture embodies ideas and values and views that are wise, full of wisdom, andmbedded and followed by every community member (Saputri et al., 2021). The expression local culture refers to the accumulated experience of a community that is then passed down

from generation to generation (Rosilawati et al., 2020).

Despite all that, local culture has proven to have several positive impacts. This has been established from several existing studies. Local culture in an area can certainly make the area creative (Yuliastuti & Sukmawati, 2020). For example, the Kudus community's local culture turned out to be able to prevent radicalism in the era of globalization (Suciati & Erzad, 2018). The level of critical thinking ability and communication skills in groups of students whose learning is based on local culture in the field of science is higher when compared to groups of students whose learning uses conventional models (Hikmawati et al., 2021).

As a multicultural nation rich in various local cultures, Indonesians have the basis for the importance of local cultural integration in education in building a culture of life (Hasriyanti, 2021). However, education about local culture is still very lacking. Educational practices based on local culture in educational institutions are considered not optimal.

Local cultural material is often considered supplementary material, so it receives less attention from educators (Rusydiyah & Rohman, 2020). Local culture can be learned through mathematics, science, Indonesian, art, and social studies (Suardana et al., 2018). Local culture is a benchmark and starting point for teaching intercultural communication to students (Saraswati et al., 2018).

Ondel-ondel is one of the well-known local cultures from Jakarta. Ondel-ondel is a giant doll viewed by the Betawi people as a sacred culture and used for ritual offerings to ancestral spirits (Ardiansyah, 2021; Paramita, 2018; Purbasari et al., 2019). Ondel-ondel is moved by the person inside. The person then moves the giant doll so that it appears from the outside that the big doll is moving. However, the role of ondel-ondel is not only in switching ceremonies and rituals but can be used as learning media.

In addition to local cultural problems that are still not optimal in learning, the learning process must be carried out meaningfully. Meaningful learning occurs when learning is active, constructive, intentional, authentic, and cooperative (Mystakidis et al., 2019). Meaningful learning can improve student learning outcomes (Irmawan et al., 2021). Meaningful learning connects new knowledge with students' previous knowledge and real-world workflows (Luo & Kalman, 2018).

This hands-on experience learning fits perfectly with the concept of education proposed by John Dewey (Diesel et al., 2017). John Dewey offers contextual learning as one form of creating meaningful learning in the classroom (Senn et al., 2019), so contextual learning through ondel-ondel culture as a learning media is one of the efforts to realize meaningful learning in the classroom.

Based on previous studies, it appears that local culture provides many benefits in the learning process in the classroom. Nevertheless, the use of local culture in the learning process is still fairly minimal. This is because local culture is still not the main focus of learning but only as a complement to the material. In addition, implementing local culture in learning makes it possible to realize meaningful learning in the classroom.

So, this study has two aims. The first aim is to analyze ondel-ondel culture from the point of view of Physics, especially on rigid body equilibrium material. The second aim is to implement it in Physics learning in the classroom to achieve meaningful learning. Through this research, it is expected to provide benefits to sharing parties. The predicted use of this research is to understand the study of ethno-physics in ondel-ondel culture. In addition, this research is

also expected to be a reference for teachers in using local culture as a medium for learning Physics in the classroom to realize meaningful learning.

RESEARCH METHODS

This research is a mixed method research. This research was conducted with two aims. The first aim is to analyze ondel-ondel culture from the point of view of Physics, especially on rigid body equilibrium material. The second aim is to implement it in Physics learning in the classroom to achieve meaningful learning. The local culture analyzed is ondel-ondel culture with the primary material being rigid objects' equilibrium.

The research was conducted at Labschool Cibubur High School. The respondents in this study were grade 11 students majoring in mathematics and natural sciences who studied rigid body equilibrium material. The number of respondents used in this study amounted to 123 students.

The study began by analyzing the ondel-ondel culture. The research was conducted by visiting several resource persons who deeply understood ondel-ondel culture. The research technique was carried out through interviews related to the ondel-ondel culture. In addition, this study also invites experts in the field of Physics to analyze Physics concepts in ondel-ondel culture, especially in rigid body equilibrium material.

This research continues with random class selection. As for the selected class, it has been tested normally and homogeneously in advance. After the class is declared normal and homogeneous, the class will begin learning by implementing an ondel-ondel as learning media. After the learning process is complete, the group of students will be given a questionnaire to measure the achievement of meaningful learning for rigid body equilibrium material.

This research used several research instruments: interview guidelines, the learning implementation plan, and meaningful learning questionnaires. Interview guidelines are used as a reference in conducting interviews with sources focused on ondel-ondel culture to get a detailed explanation from the source. The learning implementation plan contains exact steps regarding implementing classroom learning that applies the ondel-ondel as learning media. The learning model used is the discovery learning model. Discovery learning is suitable for science materials because it allows students to obtain material through the surrounding environment (Sunarsih et al., 2020). The meaningful learning questionnaire sheet contains several statements showing how much meaningful learning is achieved in the rigid object equilibrium material from the implementation ondel-ondel as learning model.

The instruments' validity and the data to be obtained are also considered. The validity of the interview data was obtained by triangulating. The triangulation technique used is to conduct interviews with several sources. So that, in the end, the similarity of interview data was obtained. The validity of the learning implementation plan and meaningful learning questionnaire is obtained from theoretical validity by several experts, namely teachers and lecturers, as many as five people each. The validity of the data from filling out meaningful learning questionnaires also uses triangulation techniques. The triangulation technique is to ask students to complete questionnaires at different times.

RESULTS AND DISCUSSION

Ethno-Physics Analysis on Ondel-Ondel

The learning process begins with observations and interviews with several speakers. The method of observation and interviews was carried out to dig deeper into the ondel-ondel culture. The observations show that the local culture of ondel-ondel is massive, with a width of about 80 cm and a height of about 2 m. Ondel-ondel has a different fashion look, depending on the maker and the needs of the ondel-ondel itself.

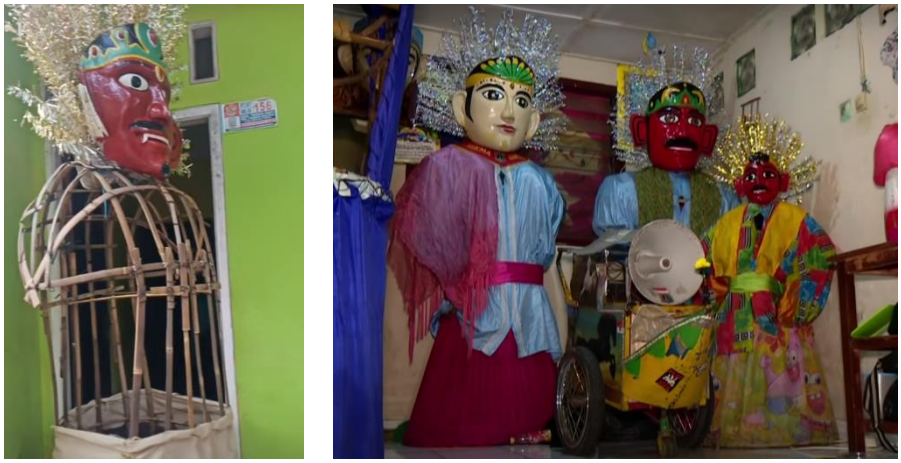
The results of interviews with resource persons who understand ondel-ondel culture support the observations in this study. The source stated that in the past ondel-ondel had the name barongan. They then changed the name to “ondel”. But because ondel is always a pair (male and female), it turns into “ondel-ondel.” The characteristics of the ondel-ondel can be seen between the male and female ones. The male ondel has a red face color, while the female ondel have a white face color. Ondel-ondel has a height of about 2 m and a diameter of about 80 cm. Ondel-ondel also has mass about 25 kg.

Ondel-ondel has a wide range of functions. In the past, ondel-ondel functioned as repellents of hosts or evil spirits to eliminate disease outbreaks. Nowadays, the role of ondel-ondel has shifted and is often used as entertainment at folk parties, Betawi tribal wedding celebrations, and circumcision, to just entertainment arts. Nevertheless, the existence of ondel-ondel is still high among the people. There are even more and more ondel-ondel shows nowadays. The community states that they still accept the fact of ondel-ondel today as long as it does not damage the wrong image of the ondel-ondel culture itself.

The interview was deepened by analyzing the potential of ondel-ondel in learning. The resource person mentioned that ondel-ondel can be a tool in the classroom that will attract students. However, bringing ondel-ondel into the classroom is very difficult, given their enormous size.

Ondel-ondel culture has scientific knowledge in it, especially in physics. In ondel-ondel culture, the person who enters and moves the ondel-ondel must know the equilibrium of the rigid object to keep the ondel-ondel from falling. It didn't end there, when the ondel-ondel started to move, one of the movements made was circular. This is another example of the scientific concept in the ondel-ondel culture. The manufacture of ondel-ondel is inseparable from the idea of engineering in it. The creation of the ondel-ondel skeleton is intimate from how an ondel-ondel maker chooses a technique to keep the ondel-ondel sturdy.

Ondel-ondel culture clearly shows high artistry. Ondel-ondel still exists today with its function in ritual ceremonies, entertainment at folk parties, Betawi tribal wedding celebrations, circumcision, and just entertainment arts. The creation of ondel-ondel is inseparable from the mathematical concepts in them. With the shape of a three-dimensional skeleton, the volume of the structure must be well measured so that when entered, people will not be disturbed.



(a) (b)

Figure 1. (a) Ondel-ondel skeleton; (b) Ondel-ondel finished result.

A large size (height of 2 meters and diameter of 80 cm) and large mass (25 kg) makes ondel-ondel a problematic object to play. However, ondel-ondel can be played from the point of view of Physics. Inside the ondel-ondel, someone will go into them to move the ondel-ondel. When inside, the person will maintain the equilibrium of the ondel-ondel, so that the ondel-ondel will not fall.

Not only limited to people who maintain balance, the structure of ondel-ondel is also made in such a way that symmetry. It aims to provide a balance that spreads out and focuses on the center. So, people who control ondel-ondel become more accessible to play.

Nevertheless, the concept of physics that applies is not only the concept of equilibrium of rigid bodies. In ondel-ondel culture, the concept of circular motion and heat also applies. This makes ondel-ondel full of knowledge and can be one of the recommendations for Physics learning media in class.

In ondel-ondel culture, it applies the concept of circular motion. When the ondel-ondel player starts playing the ondel-ondel, occasionally, the person will make a circular motion. If analyzed carefully, the circular movement must be carried out so that the ondel-ondel does not fall. This shows that centripetal force must be considered carefully when a person begins to make a circular motion of ondel-ondel.

In addition to the concept of circular motion, ondel-ondel also applies the concept of heat, precisely to the concept of radiation. In general, ondel-ondel consist of male ondel-ondel and female ondel-ondel. Ondel-ondel players stated that they prefer to play women's ondel-ondel. They say that men's ondel-ondel tend to be hotter. After in-depth analysis, it appears that male ondel-ondel use dark colors (such as black), while female ondel-ondel use light colors (such as white). Of course, this aligns with the concept of radiation, where the blacker an object is, the greater the heat radiated.

Meaningful Learning by Using Ondel-Ondel as Learning Media

The results of observations and interviews about ondel-ondel culture are then used as a learning media and as a reference in developing a learning plan. The extended learning plan implements a discovery learning model integrated into ethno-physics with ondel-ondel local culture on rigid object equilibrium material.

Students will be invited to listen and observe ondel-ondel culture from Jakarta. After that, the student will be given a case based on the phenomenon. In addition, students will be given a direct opportunity to explore the ondel-ondel brought into the classroom. At this stage, students will be given a stimulus.

The next stage is the problem statement, where the student is asked to respond to the case being listened to. Students are guided to express opinions regarding the physics concept in both cultures. The concept of physics in the focus is the equilibrium of rigid objects.

At the data collection stage, students collect information related to the material being studied. Students explore information about physics concepts being checked with the phenomenon of ondel-ondel culture. At this stage, students will be guided to make miniature ondel-ondel. So that data collection can be observed from the results of crafts that students have made.

Figure 2. Miniature ondel-ondel as a student work.

In the data processing stage, students discuss problems regarding the studied material. Students process each other's information on the physics concept regarding the equilibrium of rigid objects in ondel-ondel culture that has been obtained, both from the given case and the miniatures made.

In the verification stage, several students give presentations about the material studied and its relation to everyday life, such as in technology and engineering. After expressing an opinion, the next stage of generalization is where students confirm the conclusions about the material learned from the teacher. Then, the teacher reflects on the learning process, gives feedback on the learning process and outcomes, and delivers the lesson plan at the next meeting.

Discovery learning models have been shown to have a positive impact, such as improving science literacy (Pursitasari et al., 2019; Winarni et al., 2020), the ability to observe, discuss, and acquire knowledge (Yurniwati & Hanum, 2017), even to the ability to think creatively, critical thinking skills, communication skills, and the ability to collaborate (Amin et al., 2021). The learning process using the discovery learning model is also able to improve student learning outcomes (Alimuddin et al., 2021; Brata et al., 2021; Fadlilah et al., 2020; Mayub et al., 2020; Thao et al., 2020).

The application of discovery learning models in several studies can be pretty good (Widodo et al., 2021). The discovery learning model confronts students directly with real situations combined with precise initial knowledge that can lead to the character value of honesty (Sugiarti & Husain, 2021). Discovery Learning is suitable for science materials because it allows students to obtain material through the surrounding environment (Sunarsih et al., 2020).

The results of implementing ondel-ondel as a learning medium in the discovery learning model in the classroom also show the same thing. The implementation results showed that students responded positively during the lesson because they could directly observe the ondel-ondel. In addition, ondel-ondel as a learning medium also guides students to improve learning outcomes. Not only that, implementing ondel-ondel as a learning medium also fosters students' attitudes and characters.

A meaningful learning questionnaire was given to all students to measure the achievement of meaningful learning by implementing an ondel-ondel as learning media in the

Ethno-Physics-based discovery learning model. The questionnaire results obtained an average score of 79.24% with good criteria. This informs that achieving meaningful learning through implementing an ondel-ondel as learning media in an Ethno-Physics-based discovery learning model is very good. The details are as follows.

Table 1. Results of meaningful learning questionnaires.

Indicator	Score
The learning process reminds me of the material that has been studied before	75.88%
The learning process becomes more interesting	81.18%
The teacher becomes the main figure who can be trusted with the knowledge gained during the learning process	80.59%
There is an exchange of ideas and opinions during the learning process	80.59%
The material can be more easily understood by integrating local culture into the classroom	77.65%
Materials can be constructed more easily	75.88%
Realizing the role of material concepts in local culture culture	82.94%

The questionnaire results show that the learning process by implementing ondel-ondel as learning media that has been carried out can remind the material that has been studied previously with good criteria. The learning process also becomes more interesting with excellent criteria. In addition, the teacher can be a source of knowledge that can be trusted by students and cause an exchange of ideas and opinions during the learning process with excellent criteria.

With the implementation ondel-ondel as learning media, it turns out to make students aware of the role of material concepts in everyday life with very good criteria. Likewise, the process of understanding the material and constructing the material by students who are integrated with local culture also have good criteria.

Meaningful learning improves students' and teachers' knowledge and skills (Sailin & Mahmor, 2018). Meaningful learning is proven to influence student grades (Mubarok et al., 2022). Meaningful learning is based on more than what is transmitted by the teacher: reconstructing knowledge from learners' experiences, feelings, and exchanges with other learners (Sharan, 2015).

Meaningful learning in education should be an essential outcome of quality education (Mystakidis et al., 2019, 2021). Meaningful learning engages students in dynamic instructional activities that can facilitate learning in the 21st century, encouraging the growth of holistic human characteristics (Ghazali & Nordin, 2019). In meaningful learning, new knowledge in students' cognitive structure gives rise to understanding and meaning in the cognitive system of students that offers importance according to its usefulness in everyday life (Agra et al., 2019).

Meaningful learning is directed to equip students with critical, innovative, and creative thinking skills to answer various problems that will arise in the future (Hanani, 2020). Meaningful learning is connecting new information with relevant concepts in cognitive structures (Karnela et al., 2018). Meaningful learning is an active process that promotes a broader and deeper understanding of concepts. It results from the interaction between new and

previous knowledge and generates a long-term change in knowledge and skills (Cadorin et al., 2017).

Through contextual learning put forward by the philosopher John Dewey and meaningful learning, there will eventually be an increase in the student's desire to learn (Husin et al., 2020). Integrating ethnoscience in problem-based learning can improve contextuality and meaningful learning and can be applied to preserve local cultures (Suciyati et al., 2021).

Based on the results of implementing ondel-ondel as a learning medium, it is clear that students get meaningful learning. This has been proven by the questionnaire's average score, which shows very good criteria. Of course, this answers that implementing ondel-ondel as a learning medium is proven to be able to realize meaningful learning for students.

CONCLUSION

Based on the results and discussion obtained, this study produces two conclusions. The first conclusion is that ondel-ondel has many physics concepts in them. In ondel-ondel, rigid body equilibrium is of special concern because equilibrium is the main focus so that the ondel-ondel remains stable when played without falling. In ondel-ondel culture, the concept of circular motion and heat also applies. In the circular motion concept, the centripetal force must be considered carefully when a person begins to make a circular motion of ondel-ondel. In the heat concept, especially in the radiation concept, it is known that where the blacker an object is, the greater the heat radiated. The second conclusion obtained from this study is that the implementation of ondel-ondel as a learning medium is proven to realize meaningful learning for students. Achieving meaningful learning through implementing an ondel-ondel as learning media has very good criteria. However, research related to ondel-ondel culture can still be re-developed. The following research recommendation is to re-implement ondel-ondel as a medium for learning Physics in the classroom to maximize 21st-century skills that students must have, such as critical thinking skills and creative thinking abilities. The first aim is to analyze ondel-ondel culture from the point of view of Physics, especially on rigid body equilibrium material. The second aim is to implement it in Physics learning in the classroom to realize meaningful learning. Conclusions are only sufficient to answer the problem or research objective. May add implications or suggestions. It should be written in paragraph form, not in item list/numbering style.

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