Analysis of Physics Concepts in Games Traditional Tajog

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Abstract. The development of increasingly advanced technology has an impact on the erosion of local wisdom owned by Indonesia. Therefore, the thing that must be done is to preserve the local wisdom by integrating it into physics learning. The traditional game of tajog is one of local wisdom which in its use there is a physics concept, namely kinetic energy. This study aims to analyze the concept of physics in the traditional game of tajog. This research is a qualitative descriptive study with an ethnographic approach. Data were collected through direct observation, interviews and documentation in the field. Furthermore, the data obtained were analyzed descriptively qualitatively. The results showed that in the traditional game of tajog there is one concept of physics, namely kinetic energy that can connect modern science with ethnoscience. The concept of kinetic energy is found in the movement of the traditional game of tajog.

Keywords: ethnoscience · traditional games · tajog · kinetic energy

1 Introduction

Local wisdom is a knowledge of the local community, local intelligence, and local policies [1]. The rapid development of science and technology that occurs today has an impact on the erosion of local wisdom and one day it will disappear because it is considered different between local science and science. Whereas local wisdom can be imitated and developed into physics learning from elementary, junior high and high school. Traditional games are one of the local wisdoms that can be integrated into physics learning at school. Traditional games are one of the elements of local culture in the countryside. Besides that, traditional games are not only limited to games but can also develop cognitive, motor, and health abilities. Traditional games do not only provide recreational or fun value. More than that, traditional games also have physical education values, and even social values. This is because traditional games contain elements of sportsmanship, honesty, accuracy, agility, accuracy in determining steps, and the ability to work together in groups [2].

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Traditional games generally contain the concepts contained in learning such as science, social studies, regional languages, physical education, and even religion. Learning concepts contained in traditional games can help make it easier for teachers to deliver learning to students [3]. Therefore, it is necessary to study the philosophy of the traditional game technique. Learning in the 2013 curriculum which is still valid at this time requires teachers to use a scientific approach. However, what is currently happening is that the learning carried out by teachers has not fully used a scientific approach. Whereas in learning especially physics requires students to understand science from the surrounding environment. But the learning carried out by some teachers so far only provides general examples or even rarely known to students and the learning carried out is only rote, so that it has an impact on students' insensitivity to events that occur in their environment, even though these events are related to physics.

Physics is a part of science that explains observed events based on rational thinking, human experience, and through experiments. Events in everyday life are very close to physics, such as in traditional games that contain many physics concepts that can be analyzed, therefore it is necessary to integrate them into physics learning at school. The traditional game of tajog is one of the many traditional games in Indonesia that need to be preserved. The traditional game of tajog in Bali is known as "metajog". The traditional game of tajog contains the value of tenacity, sportsmanship and hard work in playing it [3]. In addition, in the traditional game of tajog there are also several physics concepts that can be integrated into physics learning, one of which is kinetic energy.

Based on the background described above, the purpose of this study is to analyze the concept of kinetic energy in the traditional game of tajog.

2 Methods

This research is a qualitative descriptive study with an ethnographic approach. The ethnographic approach aims to describe and analyze culture based on intensive field research [4]. The ethnographic approach in this study is used to describe, explain and analyze the physics concepts found in the traditional game of tajog. Data were collected through observation, interviews and documentation. Furthermore, the data obtained were analyzed by first, reducing the data from observations and interviews. Second, presenting the data in the form of descriptive text. Third, draw conclusions.

3 Results

Based on the results of interviews with two respondents and observations made, it was found that in the traditional game of tajog there are physics concepts that can be used as physics learning materials in schools. The interpretations of the two resource persons will be presented and compared with the concepts of physics, and in this study also compare local and modern science knowledge. The results with the first respondent revealed that this traditional game of tajog uses two bamboos shaped like sticks and there is a footstool. The bamboo used is 2 m long, with a bamboo diameter of 3 cm, and the height of the footing used varies from 25 cm, 35, and 45 cm. It was also conveyed that this tajog game requires the strength of the leg and hand muscles that are used when

Table 1. Tajog Traditional Game Movement

Physics Concept	Movement	Information
Kinetic energy	Lifting/riding tajog	In the traditional game of tajog there is a style that causes the tajog game to run at a certain speed
	Holding tajog	
	Pushing tajog	
	Rotating motion/turn	
	Walking on tajog	
	Pulling the arms towards the body	
	Bend arms, legs and body	
	The mass of tajog players	

Table 2. Experimental Result of Tajog Game with angle and mass of 40 kg

Arm Position	t (seconds)	v (m/s)	E_k (Joule)
Down	15,20	1,425	40,613
Straight	12,10	0,912	16,635
To the top	12,90	0,975	19,013

walking. Then for the second respondent revealed that the technique. This traditional game of tajog begins with steps including (1) preparing the tajog, (2) straightening the tajog right in front of the player and the position of the tajog slightly leaning forward, (3) holding the tajog according to the right player's arm, (4) lifting the wrong one foot on the tajog step, and followed by the next foot, (5) adjust the balance and start walking to the end, (6) if you feel you will fall, then lower your foot between the tajog, (7) try to play in a wide area.

Based on these results and field observations, they are presented as in Table 1.

From the experimental results of tajog players with an angle and body mass of 40 kg, it can be presented as Table 2.

The handle is perpendicular to the bamboo, the speed of the tajog player will be faster with the same mass of objects. It is then followed by an up and down grip. This can be illustrated as in Fig. 1. For different object masses, the kinetic energy can be presented as in Table 3.

Based on Table 3 shows that the kinetic energy possessed by tajog players depends on the mass of the players and their speed. The greater the mass and velocity, the greater the kinetic energy and vice versa.

Table 3. Experimental Results of Kinetic Energy with Different Mass

Mass (kg)	t (seconds)	v (m/s)	E_K (Joule)
40	9,872	0,886	15,699
47	8,250	0,698	11,449
54	10,750	0,989	26,409

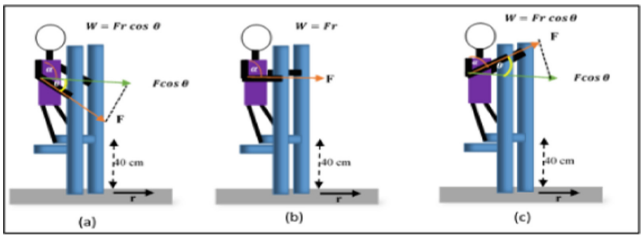

Fig. 1. Illustration of the traditional game of tajog

4 Discussion

Based on Table 1 shows that the traditional game of tajog is currently running, the related physics concepts are work and energy. Effort is the work done by the player to get up to the tajog footing and the work to move the tajog from the initial position to the final position. One of these energies is kinetic energy.

Kinetic energy is the energy possessed by an object due to its motion. The motion of an object is a result of the forces acting on it. The size of the kinetic energy is indicated by the force exerted by the tajog player which can be interpreted as the speed of the tajog when moving. If seen from the illustration Fig. 1 indicates that a tajog player should choose the illustration in Figure no b, because the straight arm position will produce a large speed so that the kinetic energy is also greater than the down or up hand position which produces a small speed. If analyzed with the concept of physics, Fig. 1 (a) shows the position of the player's forearm which tends to be downwards, which forms an angle $= 115°$ when measured between the upper arm and the forearm and forms an angle to the applied force. This position produces a force of F cos. For Fig. 1 (b) is the position of the forearm of the player straight ahead, this condition forms an angle of $= 90°$ when measured between the upper arm and forearm, so that the resulting force is F. While Fig. 1 (c) is the position of the forearm of the player upwards or forms an angle of approximately $= 45°$ when measured between the player's upper arm and forearm and forms an angle to the applied force, in this position it produces a force of F cos. The greatest force in the game of tajog is when the arm position is straight forward, while when the arm is tilted down or up, the force will be smaller. Based on the above, it can be concluded that the size of the tajog player's style affects the work value W and also affects the kinetic energy it produces. Besides that, the size of the force also affects the speed of the ongoing tajog game. The effect of the speed of the tajog player on the kinetic

energy it produces can be seen in the difference in the height of the tajog footing. Each tajog footing height affects the player's comfort and the resulting speed.

Besides speed, the mass of the tajog player also affects the kinetic energy it produces. This can be seen as in Table 3, the greater the mass and velocity, the greater the kinetic energy. Mathematically kinetic energy can be found with the following equation:

$$E_K = \frac{1}{2}mv^2$$

The research on the concept of kinetic energy that has been described above is in accordance with research [5] to increase kinetic energy, it requires a certain particle effort and speed and in research [2] that the greater the mass of the object, the greater the kinetic energy produced. Kinetic energy in physics, depends on the mass and velocity of the object. Thus the study of local knowledge of kinetic energy in the traditional game of tajog has the potential to increase knowledge and preserve the values of local wisdom in Indonesia. When viewed from an educational perspective, identification of local knowledge related to physics concepts can be used by students, teachers, and the community for physics learning materials in schools. Learning in schools that integrates local knowledge into modern knowledge can have a positive impact on students because it can connect the concepts of physics with contextual daily life.

The subject matter essentially contains messages to be conveyed to students to achieve learning objectives [6]. The message conveyed can be in the form of ideas, concepts, data or facts, writing, images, symbols and so on. However, of all these messages, not all students understand them well, so it is necessary to convey the message associated with contextual problems experienced in everyday life, so in the implementation of learning it should be associated with local wisdom, one of which is through the traditional game of tajog.

Learning materials based on local wisdom in the traditional game of tajog in accordance with research conducted by [7] found that the development of science modules based on local wisdom on business and energy materials is effective for improving student learning outcomes and learning activities. [8] found that the development of local wisdom-based physics student books was feasible and easy to understand by students, and [9] the implementation of local wisdom-integrated inquiry worksheets could improve students' critical thinking skills.

5 Conclusions

Based on the results of the research and discussion above, it can be concluded that one of the concepts of kinetic energy physics is found in the traditional game of tajog. Therefore, the traditional game of tajog needs to be preserved by integrating it with local knowledge and modern science in physics learning at school.

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