

STUDY OF TRADITIONAL GAMES ABOUT PHYSICS ETHNOSCIENCE LEARNING IN TAMBUSAI DISTRICT

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Abstract; *Traditional games come from traditions and culture in each region by utilizing the surrounding natural environment as a means to play. The purpose of this study is to determine the study of traditional games about physics ethno science learning in the Tambusai district. This research is a survey research using the descriptive research method. This research was conducted in Tambusai district in February-June 2021. The sampling technique used purposive sampling. the data used interviews, questionnaires, observations, documentation, audio, and video recordings. The data obtained were then analyzed, verified, and reduced then reconstructed into scientific knowledge and interpreted into science concepts in physics learning. The results showed that traditional games played by the community can be interpreted into scientific knowledge and implemented in physics learning.*

Keywords: *Traditional Games, Ethno science, Learning, Physics*

1. Introduction

Government's regulation number 17 year of 2010 chapter 35 section 1 and 2 states that education is conducted with the advantage of competitive/comparative territory, and city administration executes or facilitates educational program based on local quality. Rokan Hulu is one of the regencies in Riau province whose natural resources are various, such as tribe, language, culture and local wisdom. All these various cultures have their own uniqueness and superiority compared to any region or district which is available in Rokan Hulu regency.[1]

Tambusai is one of the districts existing in Rokan Hulu that is rich on local wisdom and potency. There are several types of local wisdom potency in Tambusai district, for example building, tradition, working tool and traditional games such as Sepak Agu, Gasiang, Layang-Layang, Galah Panjang, Bodie, Tarik upih pinang, Simbang batu, Patok lele, Bola kasti, Guli, Yeye, Adu buah para, Setinjau, Tarik tambang, Serunai, Baliang-baliang and Ketapel.

Traditional games are games growing and developing in some area [2]. Inside traditional games, there are some games which are tightly related to physics learning concept, two of which are Gasing and Perahu Pelepah Pisang that is related to physics concept, especially by rotating concept as well as pressure[3]. Then, Makhmudah also explains that traditional game which belongs to Dayak Ngaju tribe called Balago game and Habayang. These games contain momentum physics material and impulse[4]. Same opinion that Tarik tambang is traditional game containing some physics materials, such as kinematics, dynamics, exertion and energy material, and momentum as well as impulse, rigid body balance and so on[5].

In this era of globalization, students are more familiar to foreign cultures than our own local customs and games owned by their living vicinity, so the knowledge of traditional games is so low. The reality that happened to the youngsters nowadays is that they are more interested in modern games, for example playstation and online games inside their smart phones, and traditional games are neglected. This phenomenon certainly contradicts with the spirit contained in Government's regulation number 17 year of 2010, which wants to actualize education whose basis is local wisdom.

To make cultural existence and local wisdom, such as traditional games, still exist, students, the next generation of this country, have to learn love towards culture and local wisdom by appointing the students' knowledge to traditional games as well as integrating cultural knowledge, particularly the education of Ethno

science physics. Therefore, a breakthrough in education is required by combining culture and science. It is also known as Ethno science [6].

Ethno science is a set of knowledge had by a certain society/tribe/race that is owned by a specific method, becoming a certain society/tribe/race, the truth can empirically be tested or guaranteed[7]. Ethno science encourages teacher and educational agent to teach science which is based on culture and local wisdom. In reality, many teachers are not able to utilize regional culture as a subject for teaching to physics learning. Some factors creating this problem are the difficulty to decide a relevant learning material with regional culture and the lack of teachers' understanding towards Ethno science learning [8].

If learning based on Ethno science were not conducted as early as possible, fast technology would replace local wisdom inside the society in the future when the improvement of education and technology will be so fast. This transfer happens because there is no significant limitation between local and foreign wisdom. This condition illustrates that education needs to apply learning which is oriented to local wisdom, being a conceptual idea which lives, grows and develops in the society continuously.

Changing from the problem of the students' lacking knowledge towards traditional games and the teachers' deficient comprehension to Ethno science learning, a further assessment effort is required to be done in a certain area, especially Tambusai district, in order to teach the advantages of local wisdom at schools.

According to the statement above, to promote an area's traditional games and to preserve positive values included in society's culture and to review the content of Ethno science physics learning, the author is interested in conducting a research with title "Study Of Traditional Games About Physics Ethno science Learning In Tambusai District".

2. Research Method

This research had been done in Tambusai district. The type of this research is survey research with descriptive research method. Survey research is research conducted using a questionnaire as a research tool conducted on large and small populations [9]. Reconstruction process is focused on society's knowledge towards traditional game connected to scientific knowledge. Data collection is through interview, questionnaire, observation, documentation, audio and video recording. The data obtained is analyzed, reduced, presented, verified and reconstructed to scientific knowledge.

3. Result And Discussion

According to interview result with public and young figures in Tambusai district and the response result from research questionnaire, the results of society knowledge reconstruction to be scientific knowledge are acquired.

Table 1. The Results of the Reconstruction of Community Knowledge Into Scientific Knowledge in the Gasiang Game

No	Question	Society science	Scientific science
1	Why is the bottom, top of the top leg (paksi) pointed and given a paci (Mimis)?	So that it can spin and so that it takes a long time to spin	To minimize friction so that the top can rotate longer. $P = \frac{F}{A}$
2	How does the number of turns of the rope affect the length of the top rotation?	The more turns of the rope, the longer the top spins	The number of turns of the rope to provide optimum force when the top is released from the rope $\tau = R \times F$
3	Why does the top rotate on its axis?	Because the weight is balanced and the top is huge and made from the top itself	Because the top applies the concept of rotational dynamics and rigid body equilibrium
4	How does a given throw affect the spin of the top?	The stronger the throw, the faster and longer the top spin	The acceleration of the top when it falls to the ground is proportional to the magnitude of the force applied (throw)

In the gasiang game there is a physics ethno science learning concept of circular motion material, which can be explained from the circular gasiang trajectory, the rotational dynamics & rigid body equilibrium material is in

the gasiang rotation, the force material can be explained from the gasiang which moves and has a certain acceleration, fluid law material (pressure) can be explained from the pointed toe of the weave.

Table 2. The Results of the Reconstruction of Community Knowledge into Scientific Knowledge in the Bodie Game

No	Question	Society Science	Scientific Science
1	Why do bodie bullets come out when fired?	Because the bullet fits and the influence of the wind thrust	Because when the bodie bullet pushes the bullet, there will be pressure in the body cavity so that the bodie bullet moves out
2	What is the effect of the thrust force on bodie bullet fire?	The stronger you push, the faster the bullet shoots	$F = m \cdot a$ The magnitude of the applied force is proportional or directly proportional to the received acceleration
3	How is the relationship between bamboo species and bodie bullets?	The type of bamboo used is small and strong, such as thorny aur bamboo, while the bullets used are those that fit the size of the bamboo such as kopadan fruit.	$P V = nRT$ $P V = \text{Constant}$ If the temperature of a gas is kept constant, the pressure of the gas will be inversely proportional to its volume
4	What is the shape of the body's trajectory when fired?	The trajectory is straight, because it will hit the target's friend	When a bodie bullet is fired from a certain height from the ground, the resulting bodie bullet trajectory does not form a straight line, but forms a parabolic trajectory.

In this bodie game, it can be related to the concept of learning physics in terms of the kinetic theory of gases, momentum & impulses, parabolic motion and pressure. The concept of gas kinetic theory is contained in the volume and air pressure in the body cavity, while the concepts of momentum, impulse and collision when the bodie bullet comes out and has a certain speed and can make a sound. The concept of parabolic motion is the trajectory formed by the body bullet in the form of a parabolic trajectory.

Table 3. Results of the Reconstruction of Community Knowledge into Scientific Knowledge in the Game of Setinjau

No	Question	Society Science	scientific science
1	What is meant by displacement?	Displacement is no longer in the original position	Displacement is a change in the position of an object. Displacement is a quantity that has both a value and a direction
2	Why do Sijinjaw players fall?	Because you can't balance your weight	Because the resultant force $\neq 0$
3	How does the tilt of the bamboo affect when playing Sijinjaw?	Before stepping into an upright bamboo position, after a glance the bamboo position becomes tilted/leaning forward so that players don't fall backwards	If two bamboos have different slopes, then the player must apply force in the same direction. It means one bamboo is pulled and one bamboo is pushed
4	What to do when one of the bamboos changes angle (left and right sides are not the same anymore)?	Readjust the distance between steps	Return the angle, change the other bamboo angle, change the value or direction of the force, do a combination of these methods so that the left and right sides are the same

In the game in this Sitingjau, it can be related to the ethnoscience of physics learning the material of quantities in straight motion and rigid body equilibrium. The quantities in straight motion that can be explained from the game in this Sitingjau are displacement, velocity and acceleration. The angle of the bamboo so that it doesn't fall when playing a Sitingjau.

Table 4. The Results of the Reconstruction of Community Knowledge into Scientific Knowledge in the Baliang-Baliang Game

No	Question	Society science	Scientific science
1	Why do the Baliang-baliang rotate?	Due to the influence of the already wrapped rope	Because there is a change in the frictional force into a movable force
2	How does the length of the rope affect the time the Baliang-baliang rotates?	The longer the rope, the longer the Baliang-baliang rotates	$T = 2\pi \sqrt{\frac{L}{g}}$ The length of the rope affects the period because the relationship between the length of the rope and the period is directly proportional, the longer the rope, the greater the period
3	How is the speed of pulling the rope related to the number of turns of the Baliang-baliang?	The faster it is pulled, the longer the Baliang-baliang spins	$v = 2\pi r f$ Linear speed is directly proportional to frequency (the faster the string is pulled, the more turns it produces)
4	How is the rotation of the rope related to the rotation of the Baliang-baliang?	The rope that has been wrapped around rotates, causing the propeller to spin	The relationship of the wheels is centered. Same $\omega_1 = \omega_2$ angular velocity and same direction of rotation

In this baling-baling game, it can be related to the learning of physics innocence in the matter of force, namely the change of frictional force in motion. Then the material for circular motion is to explain the period, frequency and relationship of the concentric wheels. The period can be proven by the longer the rope, the longer the propeller rotates, while the frequency is proven when the faster the propeller pulls the rope, the more rotations it produces. the propeller. Then the relationship of the concentric wheels can be explained from the rotation of the rope and the rotation of the propeller having the same speed.

Table 5. The Results Of The Reconstruction Of Public Knowledge Into Scientific Knowledge In The Game Of Tarik Uph Pinang

No	Question	Society science	Scientific science
1	Why is the upih used in the Tarik upih pinang game, the old upih?	Because it has fallen, it is easy to pick up, no need to climb	Because the old upih has a smaller mass than the young upih
2	Why can upih pinang move when pulled?	Because the person being pulled is lighter	Because the external force acting on the upih is greater than the frictional force
3	How does friction affect the speed of the upih moving?	Runs out fast and hard to move	The rougher the floor surface, the greater the friction. The greater the frictional force, the slower the upih moves.
4	How is the relationship between the speed of pulling upih and the distance traveled by upih?	The faster you get up, the faster you get to the finish line	Speed is directly proportional to the distance traveled, and inversely proportional to the interval

In this Tarik upih pinang game, it can be related to the ethnoscience of physics learning the material of force and motion in a straight line. The material of the force that can be explained from the upih can move because the external force acting on the upih is greater than the frictional force, and the velocity of the upih moving is

affected by friction. While the material of straight motion can be explained from the speed upih when it is pulled.

Table 6. The Results of the Reconstruction of Community Knowledge into Scientific Knowledge in the Serunai Game

No	Question	Society science	Scientific science
1	Why can Serunai make a sound?	Because it was blown	Because there is a sound source. Sound is produced by a vibrating object. Serunai can make a sound because there is a puff coming from the player's mouth, causing the broken part of the rice stalk to vibrate and cause a sound to come out.
2	What affects the high and low sound on the Serunai?	Blowing power. The stronger the blow, the louder the sound	The height of the sound is influenced by the frequency. The higher the frequency, the higher the pitch of the sound
3	How does the length of the chrysanthemum affect the frequency of the sound of the Serunai?	The shorter the serunai the bigger the sound	The high and low pitch of the sound is inversely proportional to the length of the serunai
4	Why is the Serunai wrapped in sugarcane leaves?	To make it sound louder	Increase the amplitude. The bigger the amplitude, the bigger the sound you hear

In the serunai game, it can be related to the ethnosience of sound wave physics learning. This Serunai game can explain the characteristics of sound, high and low, sound intensity, Doppler effect and open organ pipes.

4. Conclusion

Based on the results of research and discussion, it can be concluded that traditional games played by the community can be interpreted into scientific knowledge and implemented in physics learning. The gasing game can be related to the basic material of circular motion, pressure, Newton's law, balance and rotational dynamics. Bodie games have concepts, physics of the matter, kinetic theory of gases, parabolic motion, momentum and impulses. The game in Sitingjau can be related to the physics of straight motion, balance and rotational dynamics. While in the baliang-baliang game there are the physics concepts of Newton's laws and circular motion. Then the game of Tarik upih pinang can be related to the subject matter of Newton's laws and straight motion. While the game Serunai can be associated with sound waves.

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6. References

- [1] Depdiknas. 2010. Peraturan Pemerintah RI Nomor 17 Tahun 2010, tentang *Pengelolaan dan Penyelenggaraan Pendidikan*. Jakarta: Kemendiknas.
- [2] Mulyani, N. 2016. *Super Asyik Permainan Tradisional*. Yogyakarta: Diva Press.
- [3] Widyaparamita, I.W. Darmadi & S Saehana, 2021. The effect of physics learning with the use of gasing and boat toys media on student learning outcomes. *National Seminar of Physics Education Journal of Physics: Conference Series*. IOP Publishing. 1760 (2021) 012055. DOI:10.1088/1742-6596/1760/1/012055
- [4] Makhmudah, N.L., Subiki & Supeno. 2019. Pengembangan Modul Fisika Berbasis Kearifan Lokal Permainan Tradisional Kalimantan Tengah Pada Materi Momentum dan Impuls. *Jurnal Pembelajaran Fisika*. 8 (3): 181-186. DOI: <https://doi.org/10.19184/jpf.v8i3.15222>
- [5] Danang & Setiabudi. 2020. Analisis Matematis Fenomena Fisik Permainan Tarik Tambang. *Jurnal Pendidikan Kesehatan Rekreasi*. 6 (2) : 138-145.

- [6] Mayasari, T. 2017. Integrasi Budaya Indonesia dengan Pendidikan Sains. *Seminar Nasional Pendidikan Fisika III 2017. "Etnosains dan Peranannya dalam Menguatkan Karakter bangsa"*. Program Studi Pendidikan Fisika, FKIP, Universitas PGRI Madiun.
 - [7] Sudarmin. 2014. *Pendidikan Karakter Etnosains dan Kearifan Lokal*. Semarang: FMIPA Unnes.
 - [8] Shidiq, A. S. 2016. Pembelajaran Sains Kimia Berbasis Etnosains untuk Meningkatkan Minat & Prestasi Belajar Siswa. *Seminar Nasional Kimia & Pendidikan Kimia VIII (SN KPK UNS)*.
 - [9] Sugiyono, 2013. *Metode Penelitian Kuantitatif, Kualitatif dan R & D*. Bandung: Alfabeta.
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