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Using the Saoraja Lapinceng Traditional House as a Media for Local Wisdom Based-Physics Learning on Equilibrium of Rigid Body

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Abstract: This study aims to analyze the components of the Saoraja Lapinceng traditional house which can be used as a rigid body equilibrium material. The type of research is descriptive qualitative. Data obtained from interviews, observations, and documentation were analyzed by data reduction, data display, and verification/conclusion drawing. The results showed (1) Supporting poles (Aliri') which can be used as a center of gravity material, the center of gravity of the house is called posi bola which has the meaning of the center of everything, according to the calculation of the house weight point is located at G = (11.75m); (5,5 m); (2,5 m). (2) Foundations (Pallangga) are used as material for the inertia moment of rigid body with a rectangular shape following the philosophy of Sulapa appa, Inertia moment of pallangga is I= 416,67 (3) Pattolo' and Arateng can be used as examples of rigid body equilibrium of cantilever beams, the results of the analysis are known that pattolo' and arateng have the following equilibrium equations $\sum\tau = 2{,}5F_A - 0{,}12mg = 0$, (4) Stairs (Addengeng) can be used as an example of rigid body equilibrium on a ladder, The stairs have an angle of 40° which is the ideal angle for stairs and have the following equilibrium equations $\sum\tau = 3\,mg - 0{,}2\,F_A = 0$, (5) Timpa' Lajja can be used as an example for understanding the concept of a force moment which has a slope angle of 30° and signifies a sign of balusu power, namely tellu boccoe, force moment of timpa' lajja is $\vec{\tau}$=0,5 $\vec{F}$.

Keywords: physics learning, equilibrium of rigid bodies, local wisdom.

Abstrak: *Penelitian ini bertujuan untuk menganalisis komponen rumah adat Saoraja Lapinceng yang dapat dijadikan sebagai materi kesetimbangan benda tegar. Jenis penelitian yaitu kualitatif deskriptif. Data diperoleh dari hasil wawancara, observasi, dan dokumentasi yang dianalisis dengan cara data reduction, data display, dan verivication atau conclution drawing. Hasil penelitian menunjukkan bahwa (1) Tiang penyangga (Aliri') yang dapat dijadikan materi titik berat, titik berat rumah disebut posi bola yang memiliki makna pusat segalanya yang sesuai hasil perhitungan titik berat badan rumah terletak di G=(11,75m);(5,5 m);(2,5 m). (2) Pondasi umpak (Pallangga) dijadikan materi momen inersia benda tegar dengan bentuk segi empat mengikuti falsafah Sulapa Appa, momen inersia dari pallangga sebesar I = 416,67 M (3) Pattolo' dan Arateng dapat dijadikan contoh kesetimbangan benda tegar dari penerapan balok kantilever, hasis analisis diketahui bahwa pattolo' dan arateng memiliki persamaan kesetimbangan sebagai berikut* $\sum\tau = 2{,}5F_A - 0{,}12mg = 0$, *(4) Tangga (Addengeng) dapat dijadikan contoh kesetimbangan benda tegar dari penerapan kesetimbangan pada tangga, tangga memiliki sudut 40° yang merupakan sudut yang ideal untuk tangga dan memiliki persamaan kesetimbangan sebagai berikut* $\sum\tau = 3\,mg - 0{,}2\,F_A = 0$, *(5) Timpa' Lajja dapat dijadikan contoh untuk pemahaman konsep momen gaya yang memiliki sudut kemiringan susunan atap kemiringan 30° dan menandakan tanda kekuasaan balusu yaitu tellu boccoe, momen gaya timpa' lajja sebesar* $\vec{\tau}$=0,5 $\vec{F}$.

Kata kunci: *pembelajaran fisika. kesetimbangan benda tegar, kearifan lokal.*

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▪ INTRODUCTION

Francesco Bandarin as Assistant Director General of UNESCO in 2017 stated that Indonesia is a superpower country in the field of culture. It is not surprising because Indonesia has 1,340 ethnic, 2,500 types of languages , and thousands of cultural heritages (Maylasari et al., 2018). The unity of culture forms Indonesia's national identity and if one culture is lost, the national identity will also be eroded. The threat of the erosion of Indonesia's national identity is triggered by the development of technology and information in the digital era, people can easily know the culture of other countries (Wijaya et al., 2022). Some changes in behavior that occur such as the trend to follow the western lifestyle known as Americanization, Starbucks, McDonaldization, and many more (AYKAÇ, 2021). So that every citizen must an active role in advancing culture (Fatmawati, 2021; B. N) in accordance with Law Number 5 of 2017 concerning the promotion of culture. The law is expected to be a stimulus for people with personality in accordance with the noble values of the nation's culture so that they are able to respond positively to modernization as a manifestation of national development and support the Sustainable Development Goals/SDGs (Zheng et al., 2021).

One way to promote culture is to use it in education. The use of culture in education plays an important role in building the character of the younger generation in accordance with the values of culture. Learning that is presented according to science material while preserving local local culture is called ethoscience (Budiarti & Wardani, 2022; Jannah & Putra, 2022; Putra, 2021). This learning can provide a good understanding of science material and its relationship with the environment and can also increase literacy in Indonesia which is still lacking, increase the character of love for Indonesia and have an important role in the process as a bridge between social sciences and natural sciences (Diegues, 2014; Solheri et al., 2022; Ardianti et al., 2019).

Cultural relevance with curriculum and learning materials is needed so that the implementation of character building can be realized (Ghufron, 2011; Yunianto et al., 2020). This is in accordance with the 2013 curriculum which is directed at empowering all competencies possessed by students so that they can master and have competencies that are expected to be able to change the character of students (Oktarina, 2018; Triono et al., 2020). The use of culture in education is supported by the scientific literacy movement (Zaenab et al., 2020). This literacy movement is the main key to facing challenges in the 21st century, where one of the basic principles of scientific literacy is contextual, in accordance with local wisdom and the times (Fananta et al., 2017).

The information presented needs more contextually and in accordance with the times. No exception to the teaching materials delivered to students. An assessment of objects that are in accordance with local wisdom is also identified in order to fulfill the literacy principle. One of the local objects in Barru Regency, South Sulawesi, is the traditional house of Saoraja Lapinceng. The Saoraja Lapinceng traditional house building has a form, structure, and function of space that represents religious, social, and cultural values. In addition, the Saoraja Lapinceng Traditional House also contains the concept of physics on the material of rigid body equilibrium (Arsyi et al., 2021).

Rigid body equilibrium is one of the important but complex materials in physics because students are required to study rotational motion and the causes of motion and it is difficult for students to understand. This is in accordance with Permendikbud No 37

of 2018 explaining that students at the upper secondary education level are required to master the concept of equilibrium of rigid bodies contained in Basic Competence 3.1, namely applying the concepts of torque, moment of inertia, center of gravity, and angular momentum to rigid bodies (static and dynamic) in everyday life and is contained in basic competence 4.1, namely making works that apply the concept of center of gravity and equilibrium of rigid bodies. So based on KD, the sub-material can be seen in Table 1.

Tabel 1. Basic competency analysis on equilibrium of rigid body (Permendikbud No. 37 Tahun 2018)

Basic competencies	Materials
3.1 Apply the concepts of torque, moment of inertia, center of gravity, and angular momentum to rigid bodies (static and dynamic) in everyday life	concepts of torque
	moment of inertia
	Angular momentum
	center of gravity
	Equilibrium of Rigid Bodies
	Types of Equilibrium of Rigid Bodies

Several studies have shown that students have difficulty understanding rigid body equilibrium, especially rotational dynamics (Ortiz et al, 2005; Rimoldini and Singh, 2005; Unsal, 2011; Mashood and Sigh, 2012; Close et al, 2013; Khasanah et al, 2016; Rahmawati et al. , 2016; Rahmawati et al., 2017). These difficulties include 1) distinguishing the magnitude of speed at several points on a wheel that rolls without slipping, 2) distinguishing between torque and force, 3) interpreting the relationship between total torque and angular acceleration (Rimoldini & Singh, 2005; Rahmawati et al., 2016; Rahmawati et al., 2017). When the traditional house is used as physics learning, students can also understand the values contained in the Saoraja Lapinceng traditional house so that it is expected to increase the competence of spiritual attitudes, that is recognizing religious values at home, competence in social attitudes, that is caring for the environment, and competence in knowledge, that is understand factual knowledge by observation. This traditional house is also very close to students so that students will be easier and more motivated in understanding and learning it.

Research related to the search for scientific material in culture and developing it has been carried out by several researchers. First Kencanawati & Angela, (2022) entitled Reconstruction of Community Knowledge in the Process of Making Potato Dodol Kerinci on the Criteria of Product Halalness Using Ethnoscience Approach. second (Sulistri et al., 2020) entitled The Development Of Digital Pocketbook Based On The Ethnoscience Of The Singkawang City To Increase Students' Scientific Literacy On Heat Matter And Its Transfer. Third (Sudarmin et al., 2019) entitled The Development Of Pbl-Based Worksheets Integrated With Green Chemistry And Ethnoscience To Improve Students' Thinking Skills.

Based on this description, the research question is how is the concept of rigid body equilibrium in the components of the Saoraja Lapinceng traditional house in Barru Regency?. This study examines the concept of rigid body equilibrium in the components of the Saoraja Lapinceng traditional house which is expected to increase students' spiritual, social, and knowledge competencies according to the 2013

curriculum, increase learning motivation and make it easier for students to receive physics material.

▪ METHOD

Research Design

This research is qualitative research with ethnographic approach. Qualitative research was used to explore and analyze the concept of rigid body equilibrium in the Saoraja Lapinceng traditional house. Exploring the concept requires a description and in-depth analysis of the culture of the Saoraja Lapinceng traditional house so the ethnographic approach is the right approach for this research. Ethnography is a research design derived from anthropology and sociology in which the researcher investigates the patterns of behavior, language, and actions of a cultural group in the natural environment over a long period of time (Creswell, 2014).This research was conducted from June 2021 to February 2022 in Balusu Village, Balusu District, Barru Regency, Balusu village was chosen because Saoraja Lapinceng traditional house is located there.

Participants

The purpose of this study is to analyze the components of the Saoraja Lapinceng traditional house which can be used as a material for rigid bodies equilibrium material so that informants are needed who understand the components of the house and its philosophy. So the technique for determining the informants in this study is the purposive sampling technique. The informant of this study is a man who lives in the traditional house of Saoraja Lapinceng and is a descendant of the king of Balusu named Andi Ibrahim, when interviewing Andi Ibrahim was accompanied by Bau Bunga and Bau Selo who is also a descendant of the king of Balusu.

Data Collection Techniques

The data was collected by combining observations, interviews and documentation techniques. Observation techniques are carried out by observing and recording information directly or indirectly to obtain an overview of the physics concepts contained in the Saoraja Lapinceng traditional house. The purpose of the semi-structured interviews is to find out more in-depth information about the participants in interpreting the situations and phenomena that occur, especially regarding the values of local wisdom in the Saoraja Lapinceng traditional house. Documentation techniques are used to archive data in the form of images or photos which will become data when observing and searching for documents such as books, journals, and photos at regional libraries and on the Internet.

Instrument

The key instrument of qualitative research is the researcher himself. There are two other instruments used to support researchers in collecting research data, namely interview guidelines and observation sheets that have been validated by experts. The indicators include the various components that make up the Saoraja Lapinceng traditional house, the philosophy and history of the Saoraja Lapinceng traditional house, especially its components, the shape of the components of the Saoraja Lapinceng traditional house, the dimensions of the components of the Saoraja Lapinceng traditional house, the process of compiling the components of the house

Data analysis Techniques

The analysis technique used to find out the physics concept of the components of the Saoraja Lapinceng traditional house refers to Miles and Huberman, namely data reduction, data display, and conclusion drawing/verification. Testing the validity of the data used includes testing the credibility of the data (internal validity) by triangulating the data and testing the reliability (reliability) of the data by reviewing all the data obtained in the field.

▪ RESULT AND DISSCUSSION

Figure 1. Lapinceng saoraja traditional house

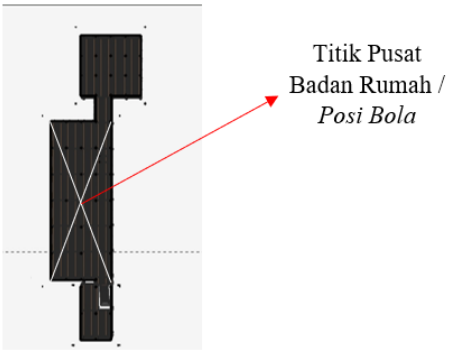
The Saoraja Lapinceng traditional house is located in Balusu which has the territories of Bone, Soppeng, and Wajo or called the Bosowa or Telluboccoe area. The traditional house of Saoraja Lapinceng was designed and done by the Wajo people, it can be seen that from the Barru to Wajo areas the house designs are almost the same, namely rectangular except in the Sidrap area, so to know the arrangement you can see the process of making other Bugis traditional houses by the Wajo people. This is in accordance with the research of Zulkarnain and Hildayanti (2018); Beddu and Isaac (2009); and Nawawi (2020) who said that the construction of Bugis traditional houses was carried out in the form of mutual cooperation. The Bugis ethnic community knows the terms Panrita Bola or Sanro Bola and Panre Bola which means Panrita (expert), Sanro (shaman), Panre (craftsman), Bola (house). The construction of the house is guided by a Panrita Bola/Sanro Bola, who acts as an architect with hidden knowledge and the construction of the house is controlled by a traditional house builder with the title Panre Bola. Panrita/Sanro bola for the traditional house of Saoraja Lapinceng came from Wajo and Panre bola came from Barru.

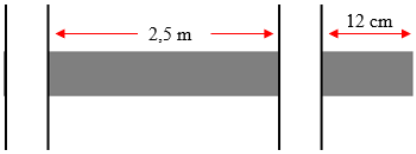
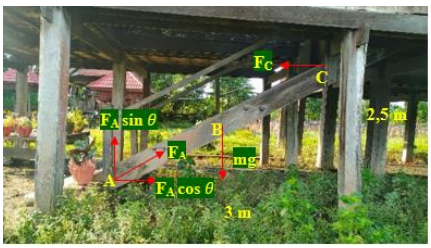
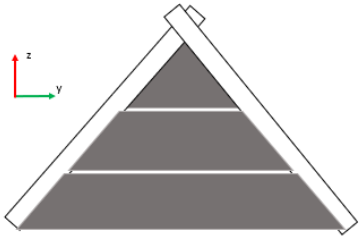
Panrita/Sanro bola designs houses that show harmony and conformity with the natural environment (Nawawi, 2020). The philosophy of building houses has existed before and was followed by the traditional house of Saoraja Lapinceng. This philosophy is still mixed between the teachings of Islam and animism. There are rituals that are still being debated, for example, the mapatteto bola ritual, some hanging bananas, etc. To this day it is still mixed, from the other side, the traditional procession needs to be maintained but the ritual is not Islamic. The construction of the Saoraja Lapinceng

Traditional House adheres to the Sulapa Appa principle that exists in the Bugis community. Sulapa Appa was a value that was switched at that time so that Bugis houses were generally rectangular in shape. The time of making this traditional house has entered the Islamic era so that there are Islamic influences, including Islam tends to use a quadrilateral, one of which refers to 4 friends. Another Islamic influence is the use of odd numbers, people believe that if you choose an odd number, then God will fulfill it.

Each component of the Saoraja Lapinceng Traditional House forms a system that contains concepts that can be used as physics lessons on rigid body equilibrium material as shown in Table 2.

Table 2. The concept of the equlibrium of rigid objects in the saoraja lapinceng traditional house

Science Component	Indigenous Knowledge	Physics Concept
Aliri'	 The main house of Saoraja Lapinceng has 35 pillars, 5 poles sideways, and 7 poles backward. 3 posts from the back and 2 from the side that is the center of gravity or *posi'bola*. The central pillar of the house is also a support for the upward ridge which is considered the center of everything.	 *posi'bola* traditional house of Saoraja Lapinceng is located at the center of gravity of the house. When the support of a rigid body is at its center of gravity, the object is in static equilibrium and will not fall.
Pallangga	 Pallangga is rectangular in shape which follows the philosophy of *Sulapa Appa.*	 *Pallangga* can be used as an example of the moment of inertia of a rectangular slab having area a x b.

Science Component	Indigenous Knowledge	Physics Concept
Pattolo dan *Arateng*	 *Pattolo* is a support that is inserted into a pole or by punching a hole in the back, while *Arateng* is a support that flanks a house pole from the side. *Pattolo* and *Arateng* function to keep the house from shifting to the side.	 In physics *Arateng* and *Pattolo'* is an example of applying the concept of rigid body equilibrium to a cantilever beam.
Addengeng	 The stairs or *Addengeng* for the Saoraja's house must face forward, which means that when facing the king, you don't change your mind	 in physics Stairs can be used as an example of an object's equilibrium on an inclined plane.
Timpa'lajja	 *Timpa'lajja* rumah ini memnandakan tanda kekuasaan raja mencakup bone soppeng wajo, dengan dibentuk sudut kemiringan 30°.	 *Timpa'lajja*, the traditional house of Saoraja Lapinceng, can be used as an example of applying the moment of force to an inclined object.

The following is a discussion of the physics concept of the components of the Saoraja Lapinceng traditional house:

Timpa'Lajja

The concept of force moment was found in the timpa'lajja of the Saoraja Lapinceng traditional house. The moment of force is something that causes an object to rotate (Abdullah, 2016). The moment of a force at a point is defined as the product of the force acting and the distance of the force to the center or center of rotation.

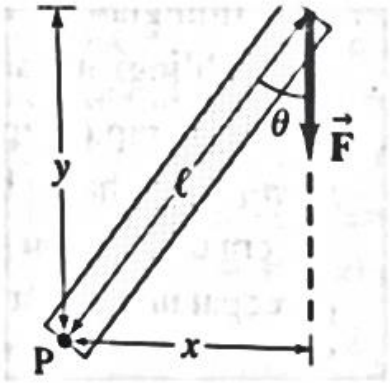


Figure 2. A Block
Source: Giancoli, 2005

Figure 2 shows an image of a beam that has a slope of 37° so that the moment of force acting on the beam is:

$$\vec{\tau} = \vec{F} \sin 37^O \, I$$

Same as the figure 2 According to Naing, (2020) timpa'laja are roof arrangements according to the social stratification of the Bugis community which has a slope of 30°, the Saoraja Lapinceng traditional house has 3 layers of roof which signify the sign of the Balusu power, namely tellu boccoe, bone soppeng wajo. When the angle of timpa'lajja is 30° and the length is 1 meter for each board, then,

$$\vec{\tau} = \vec{F} \sin 30^O \, I$$
$$\vec{\tau} = \vec{F} \sin 30^O \, (1 \, m)$$
$$\vec{\tau} = 0.5 \, \vec{F}$$

From the calculation results, it is known that the moment of force on each timpa'lajja board is equal to 0.5 F →.

Pallangga

The concept of the moment of inertia was found in Pallangga, the traditional house of Saoraja Lapinceng. The moment of inertia is a measure of the magnitude of the tendency to rotate which is determined by the state of the object or its constituent particles (Abdullah, 2016). One example of the moment of inertia of an object can be seen in Figure 3 which shows a rectangular plate having an area a x b.

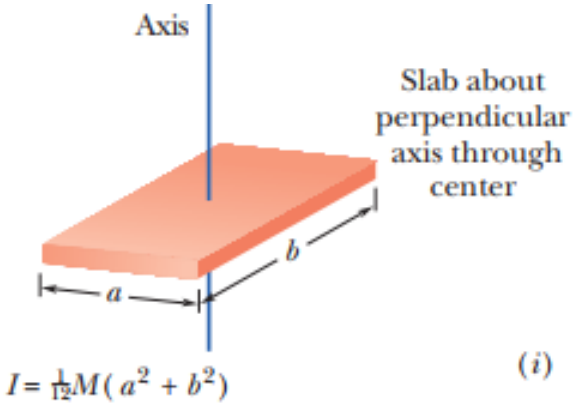


Figure 3. Moment of inertia of a plate (Halliday, 2013)

Just like figure 3, the concept of the moment of inertia can be seen in the Palangga of the Saoraja Lapinceng traditional house. The Pallangga are rectangular in shape according to the philosophy of Sulapa Appa and the size of the Pallangga is adjusted to the size of the pillars, one of the Pallangga is 50x50 cm2.

$$\boldsymbol{I = \frac{1}{12} M\,(a^2 + b^2)}$$
$$\boldsymbol{I = \frac{1}{12} M\,(50^2 + 50^2)}$$
$$\boldsymbol{I = \frac{1}{12} M\,(5000)}$$
$$\boldsymbol{I = 416.67\,M}$$

From the calculation results, the moment of inertia of Pallangga at the Saoraja Lapinceng traditional house is 416,67 M.

Aliri'

The concept of center of gravity is on the pillars of the Saoraja Lapinceng traditional house. The center of gravity is a single point which is the resultant of all gravitational forces directed vertically downwards. When the support for a rigid object is at its center of gravity, the object is in static equilibrium and will not fall (Kanginan, 2006). Determining the location of the center of gravity of a homogeneous object that has a symmetrical axis can be determined through the center of the object as shown in the following figure

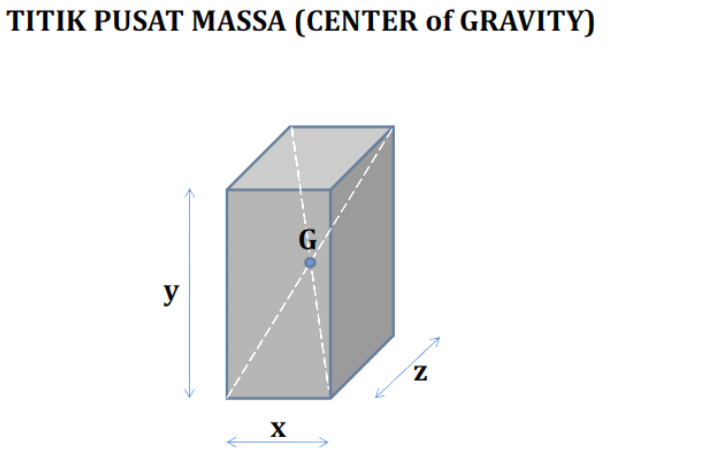


Figure 4. The location of the center of gravity of various homogeneous objects (Ristadi, 2016)

As for the center of gravity of the object in Figure 4, it shows similarities to the inside of the house.

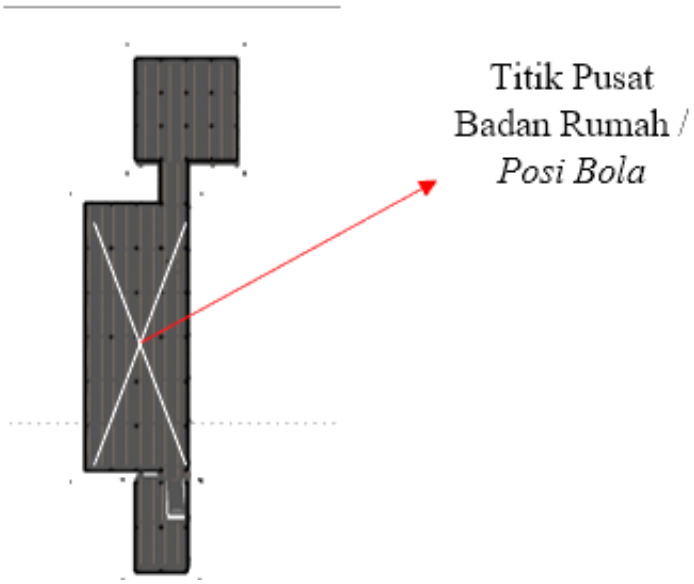


Figure 5. Location of the Center Point of House or *Posi Bola*

Figure 5 illustrates the location of the center of the house or ball position. The main house of Saoraja Lapinceng has 35 pillars, 5 pillars sideways, 7 pillars backwards. 3 poles from behind and 2 from the side that's the center pole. The central pillar of the house is also a support for the roof over the posi' bola (center pole) which is considered the center of everything. The body of the house has a length of 23.50 m, a width of

about 11 m and a height of 5 m so that the location of the center of gravity of the house is:

$$G = \frac{1}{2}\,x\,, \frac{1}{2}\,y\,, \frac{1}{2}\,z$$
$$G = \frac{1}{2}\,(23.50\,m), \frac{1}{2}\,(11\,m)\,, \frac{1}{2}\,(5\,m)$$
$$G = (11.75m); (5.5\,m); (2.5\,m)$$

It is known that the center of gravity of the house is located at G = (11,75m); (5,5 m); (2,5 m).

Pattolo' and Arateng

The concept of rigid body equilibrium was found in Arateng, pattolo, and Addengeng of the traditional house of Saoraja Lapinceng. An example of a rigid body equilibrium related to Arateng and Pattolo is as follows:

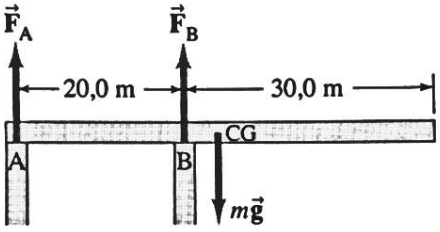


Figure 6. Beams and supports
Source : Giancoli, 2014

Figure 6 shows the forces acting on a homogeneous beam that extends beyond its support, a beam like this is called a cantilever. Just like in figure 6, the pattolo is designed to be inserted into the pillars and Arateng flanking the pillars of the house. As in the figure below.

Figure 7. *Arateng* dan Pattolo

If it is 12 cm more than the width and the distance between the posts is 2.5 m then

$$\sum \tau = r_1 F_A - r_2 mg = 0$$
$$\sum \tau = 2{,}5F_A - 0{,}12mg = 0$$

The total moment of force acting on Pattolo and Arateng is zero.

Addengeng

An example of a rigid body equilibrium related to Addengeng is as follows:

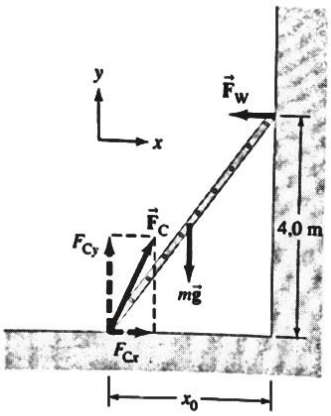


Figure 8 A ladder is placed against a wall assuming the wall is smooth without friction (Giancoli, 2014)

Figure 8 is an example of a ladder in equilibrium and shows the forces acting on the ladder. The wall is smooth without friction so it only provides a force that is directed perpendicular to itself or Fw. The floor provides a force Fc which has horizontal and vertical components, namely Fcy (frictional force) and Fcx (normal force) and the gravity of the ladder is:

$$\sum F_x = F_{cx} - F_w = 0,$$
$$\sum F_y = F_{cy} - mg = 0\,, \text{dan}$$
$$\sum \tau = yF_w - xmg = 0.$$

From equation (4.16) it can be seen that the forces and moments acting on the ladder balance each other so that there is no displacement and rotation of the object.

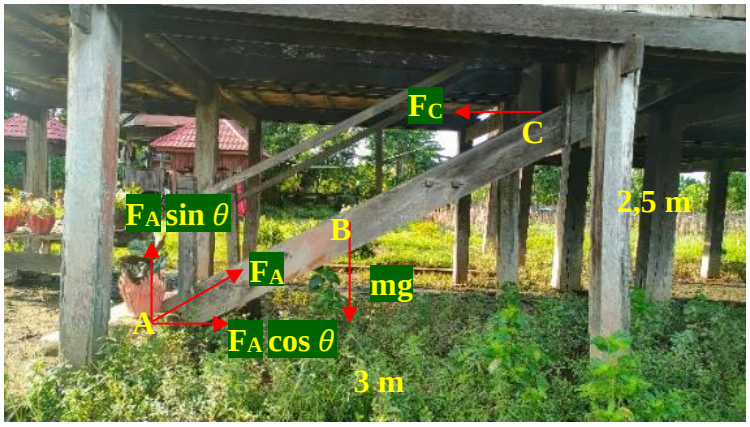


Figure 9. Equilibrium on the ladder

When the high of ladder is 2.5 m and wide is 3 m, the slope of the ladder is

$$\tan\theta = \frac{x}{y}$$
$$\theta = 39{,}69°$$
$$\theta = 40°$$

If the fulcrum is at point C and the gravitational force is 9.8 m/s2 then,

$$\sum\tau = \text{y}\, F_A \cos\theta + \text{x}\, mg + \text{x}\, F_A \sin\theta = 0$$
$$\sum\tau = 2{,}5\, F_A \cos 40 + 3\, mg - 3\, F_A \sin 40 = 0$$
$$\sum\tau = 3\, mg - 0{,}2\, F_A = 0$$

The actual angle is 40° the total moment of force is equal to zero or the ladder is in a state of equilibrium and has an equilibrium equation $\sum\tau = 3\, mg - 0{,}2\, F_A = 0$

▪ CONCLUSION

The results of the analysis of the components of the Saoraja Lapinceng traditional house found concepts that can be used as physics lessons on rigid body equilibrium material, (1) Poles (Aliri') which can be used as center of gravity material, the center of gravity of the house is called the ball position which has the meaning of the center of everything according to the results. the calculation of the weight of the house is located at G=(11,75m);(5,5 m);(2,5 m). (2) The foundation (Pallangga) is used as material for the moment of inertia which is a rigid body with a rectangular shape following the philosophy of Sulapa Appa, the moment of inertia of the pallangga is I = 416.67 M. (3) Pattolo' and Arateng can be used as examples of rigid body equilibrium because it is an example of the application of a cantilever beam, the results of the analysis show that pattolo' and arateng have the following equilibrium equations $\sum\tau = 2{,}5F_A - 0{,}12mg = 0$, (4) Addengeng can be used as an example of rigid body equilibrium because it is an example of applying equilibrium to a ladder, the ladder has an angle of 40° which is an ideal angle for a ladder and has the following equilibrium equation $\sum\tau = 3\, mg - 0{,}2\, F_A = 0$ Timpa' Lajja can be used as an example to understand the concept of moment of force which has a slope angle of 30̊ and signifies a sign of balusu power, namely tellu boccoe, moment of force of τ =0,5 F.

▪ REFERENCES

Arsyi, N., Rappun, I. I., Vausia, V., & Hasyim, M. (2021). The concept of equilibrium of tough objects in saoraja lapinceng traditional house in barru regency. *Journal of Physics: Conference Series*, *1899*(1), 012123. https://doi.org/10.1088/1742-6596/1899/1/012123

Ardianti, S. D., Wanabuliandari, S., Saptono, S., & Alimah, S. (2019). A needs assessment of edutainment module with ethnoscience approach oriented to the love of the country. *Jurnal Pendidikan IPA Indonesia*, *8*(2), 153–161. https://doi.org/10.15294/jpii.v8i2.13285

Aykaç, N. Ö. (2021). An overview on globalization discussions through the concept of

culture. *Culture and Civilization*, *1*(1), 7–17.

Beddu, S., dan Ishak, Muh. T. 2009. Arsitek arsitektur tradisional bugis [*Laporan Penelitian*].Universitas Hasanuddin.

Budiarti, R. A., & Wardani, S. (2022). Analysis teacher understanding on based ethnoscience basic learning. *TA'BID Jurnal,* 25(2), 1–6.

Close, H. G., Gomez, L. S., & Heron, P. R. (2013). Stu- dent understanding of the application of New- ton's second law to rotating rigid bodies. *American Journal of Physics*, 81(6), 458-470.

Diegues, A. C. (2014). The role of ethnoscience in the build-up of ethnoconservation as a new approach to nature conservation in the tropics. *Revue d'ethnoécologie*, *6*, 0–15. https://doi.org/10.4000/ethnoecologie.1956.

Fananta, M. R., Widjiasih, A. E., Setiawan, R., Hanifah, N., Miftahussururi, Nento, M. N., Akbari, Q. S., & Ayomi, J. M. (2017). *Literasi Sains*. Kementerian Pendidikan dan Kebudayaan.

Fatmawati, E. (2021). Strategies to grow a proud attitude towards Indonesian cultural diversity. *Linguistics and Culture Review*, *5*(S1), 810–820. https://doi.org/10.21744/lingcure.v5ns1.1465

Ghufron, A. (2011). *Desain kurikulum yang relevan untuk pendidikan karakter* [Relevant curriculum design for character education]. *Jurnal Universitas Negeri Yogyakarta*, (Edisi Khusus Dies Natalis UNY), 52–63.

Jannah, R., & Putra, S. (2022). Ethnoscience in Learning Science : A Systematic Literature Review. Scientiae educatia: jurnal pendidikan sains. *11*(2), 175–184.

Kencanawati, I., & Angela, L. (2022). Reconstruction of community knowledge in the process of making potato dodol kerinci on the criteria of product halalness using ethnoscience approach ethnoscience helps unite local science with formal science in a more balanced process and the. *11*(2), 107–118.

Khasanah, N., Wartono, W., & Yuliati, L. (2016). Analysis of mental model of students using isomorphic problems in dynamics of rotational motion topic. *Jurnal Pendidikan IPA Indonesia*, 5(2).

López, M. L. (2003). Angular and linear acceleration in a rigid rolling body: students' misconceptions. *European journal of physics*, 24(6), 553.

Mashood, K. K., & Singh, V. A. (2012). An inventory on rotational kinematics of a particle: unravelling misconceptions and pitfalls in reasoning. *European Journal of Physics*, 33(5), 1301.

Maylasari, I., Agustina, R., Ramadhani, K. D., Nugroho, S. W., & Annisa, L. (2018). Statistik Sosial Budaya 2018. In I. E. Harahap, R. Sinang, & D. Susilo (Ed.), *Badan Pusat Statistik*. Badan Pusat Statistik.

Nawawi, N. 2020. *Teknologi membangun rumah bugis menurut panrita bola ugi* [Technology for Building Bugis Houses According to Panrita Bola Ugi]. *Teknosains: Media Informasi Sains Dan Teknologi*, *14*(1). https://doi.org/10.24252/teknosains.v14i1.12943

Oktarina, R. (2018). *Implementasi kurikulum 2013 dan pendidikan karakter* [2013 Curriculum Implementation and Character Education] . *JMKSP (Jurnal Manajemen, Kepemimpinan, dan Supervisi Pendidikan)*, *3*(2). https://doi.org/10.31851/jmksp.v3i2.1867

Ortiz, L. G., Heron, P. R., & Shaffer, P. S. (2005). Student understanding of static equilibrium: Pre- dicting and accounting for balancing. *American Journal of Physics*, 73(6), 545-553.

Phommarach, S., Wattanakasiwich, P., & Johnston, I. (2012). Video analysis of rolling cylinders. *Physics Education*, 47(2), 189

Putra, H. S. A. (2021). Ethnoscience A Bridge to Back to Nature. *E3S Web of Conferences*, *249*, 1–9. https://doi.org/10.1051/e3sconf/202124901002

Rahmawati, I., Sutopo, & Zulaikah, S. 2016. *Identifikasi kesulitan mahasiswa pada materi dinamika rotasi* [Identification of Student Difficulties in Rotation Dynamics Material]. *Prosiding Seminar Nasional Pendidi- kan IPA Pascasarjana UM dengan tema Inovasi Pembelajaran IPA yang Bermakna dan Mencerdaskan. Malang*, (pp. 284-293).

Rahmawati, I., Sutopo, S., & Zulaikah, S. (2017). Analysis of students' difficulties about rotational dynamics based on resource theory. *Jurnal Pendidikan IPA Indonesia*, *6*(1), 95–102. https://doi.org/10.15294/jpii.v6i1.9514

Rimoldini, L. G., & Singh, C. (2005). Student understanding of rotational and rolling motion concepts . *Physical Review Special Topics Physics Education Research*, 1(1), 010102.

Solheri, S., Azhar, M., & Yohandri, Y. (2022). Analysis of ethnoscience integrated environmental literacy for junior high school. *JPBI (Jurnal Pendidikan Biologi Indonesia)*, *8*(2), 178–188. https://doi.org/10.22219/jpbi.v8i2.17657.

Sudarmin, S., Zahro, L., Pujiastuti, S. E., Asyhar, R., Zaenuri, Z., & Rosita, A. (2019). The development of PBL-based worksheets integrated with green chemistry and ethnoscience to improve students' thinking skills. *Jurnal Pendidikan IPA Indonesia*, *8*(4), 492–499. https://doi.org/10.15294/jpii.v8i4.17546

Sulistri, E., Sunarsih, E., Utama, E. G., & Moseki, U. R. (2020). The development of digital pocketbook based on the ethnoscience of the singkawang city to increase students' scientific literacy on heat matter and its transfer. *JETL (Journal of Education, Teaching and Learning)*, *5*(2), 263. https://doi.org/10.26737/jetl.v5i2.2042

Triono, E., Suwandi, S., & Andayani, A. (2020). Objectives, function, and teaching material of indonesian literature in curriculum ktsp and k13 at sma level. *Jurnal Pendidikan Bahasa dan Sastra*, *19*(2), 186–197. https://doi.org/10.17509/bs_jpbsp.v19i2.24784

Ünsal, Y. (2011). A simple piece of apparatus to aid the understanding of the relationship between angular velocity and linear velocity. *Physics Education*, 46(3), 265.

Wasilah, dan Hildayanti, A. 2016. *Filosofi penataan ruang spasial vertikal pada rumah tradisional saoraja lapinceng kabupaten barru* [Philosophy of Vertical Spatial Planning in Traditional Houses of Saoraja Lapinceng, Barru Regency]. *Review of Urbanism and Architectural Studies*, *14*(2), 70–79. https://doi.org/10.21776/ub.ruas.2016.014.02.7

Wijaya, B. N., Kumala, K., & Pandin, M. G. R. (2022). The efectivity of building lokal cultural knowledge for generation z of indonesia in the digital era through instagram. *NUSANTARA : Jurnal Ilmu Pengetahuan Sosial*, *9*(1), 189–197. https://doi.org/10.31604/jips.v9i1.2022.189-197

Yunianto, T., Suyadi, S., & Suherman, S. (2020). *Pembelajaran abad 21: Pengaruhnya terhadap pembentukan karakter akhlak melalui pembelajaran STAD dan PBL dalam kurikulum 2013* [21st century learning: Its influence on the formation of moral character through STAD and PBL learning in the 2013 curriculum]. *Premiere Educandum : Jurnal Pendidikan Dasar dan Pembelajaran*, *10*(2), 203. https://doi.org/10.25273/pe.v10i2.6339

Zaenab, S., Chamisijatin, L., & Wahyuni, S. (2020). Strengthening character education through literacy movement at Muhammadiyah junior high schol. *Journal of Community Service and Empowerment*, *1*(1), 54–63. https://doi.org/10.22219/jcse.v1i1.11516

Zulkarnain, dan Hildayanti, A. 2018. *Integrasi konsep arsitektur islam pada rumah adat saoraja lapinceng kabupaten barru* [Integration of Islamic Architecture Concepts in the Saoraja Lapinceng Traditional House, Barru Regency]. *Nature : National Academic Journal of Architecture*, *5*(1), 1–12. https://doi.org/10.24252/nature.v5i1a1