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Physics Learning Based on Wetlands and Banjar Culture

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Abstract: Kalimantan Selatan is related with wetlands and Banjar culture. Both wetlands and Banjar culture can be included in physics learning because physics learning is inductive learning. It means that daily activity and every environment can be used to understand concepts, principles, laws, and theories of physics. Physics learning based on wetland and Banjarnese culture can attract students' attention. It also can increase students' interest to join in physics study. There are so many physics applications on Banjarnese culture, for example, Kuin's and Lok Baintan's floating market. Kuin's and Lok Baintan's floating market can be integrated into fluids. Physics learning based on wetland and Banjarnese culture affects student achievement and fosters students' love for the Banjarnese culture and their environment.

Keywords: *Floating market, physics learning, fluids static, banjar culture, wetlands*

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I. INTRODUCTION

South Kalimantan is related with wetlands. South Kalimantan's wetlands are 32,272 ha from its region [1]. According to [2], wetlands are swampy areas, brackish, peatland or water covered with water, whether natural or artificial. The covered water are puddles and running permanently or temporarily by fresh water, brackish, and salt water. Wetlands also include sea areas where the depth is not more than six meters at low tide [3]. There are so many Banjar cultures which are related with wetlands. One of them is floating market in the Kuin River (Banjarmasin) and Lok Baintan river (Martapura).

Floating market is famous local wisdom in South Kalimantan. Floating market crowded with visitors. The visitors are local people, national tourists and international tourists. Floating market takes place in the early morning and starts before dawn. Floating market is a traditional market held on the surface of the river. Floating market uses traditional boats called jukung and klotok. Buyers and merchants use their jukung/kelotok in carrying out trading activity. Atmosphere of floating market is unique and distinctive. Its uniqueness is jostling between large and small boats seeking another buyer. Merchants are always hanging around and fro. They are always shaky mocked by river waves [4].

Floating market has also become a good tour for local tourists, domestic tourists, or international tourists. Floating market is unique because in addition to transactions carried out on a jukung/kelotok, merchants and buyers also are not stuck somewhere, but it continues to move with the flow of the river. This uniqueness makes this floating market called Pasar Balarut [4], [5].

Floating market can be integrated in learning at school either in middle school or high school. One of the subjects that could integrate the floating market is physics. These conditions provide a great opportunity for teachers and ed-

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ucators to create learning tools that suit the environment around the floating market in South Kalimantan. Thus, students can learn the physics and Banjarnese culture of South Kalimantan simultaneously.

Physics is an experimental science. In Physics, students will observe and learn about various natural phenomena. Students will try to find patterns and principles that connect these phenomena [6]. For questions about why large ships can float, but how small stone can sink, the answer can be found by using the foundations of physics.

Based on the nature, physics learning is very encouraging for students to analyze various phenomena in the environment in their daily lives. The greater the number of teachers associate it with real world, there is more interest in physics learning. The students' interest will decrease or even disappear if the lessons delivered by teachers do not have a 'contact' with the field situation as if the lesson delivered is something that happens in a fantasy world. This is one of the causes the students lose their interest in learning process [7].

Therefore, the atmosphere of learning in physics subject must be made as creative as possible in order to be attractive and easy to understand for the student. Physics learning will be more interesting and easy to understand if the object is located close to the students. To improve the learning's interest atmosphere, necessary environment-based learning that is according to the environment in South Kalimantan should be promoted. Environment, where students can learn, can be natural conditions, objects, animals, plants, humans, and also objects that exist in the environment. Environtment-based learning is an education that aims at allowing students to have the knowledge, skills, values and motivation to solve problems about environtments towards sustainable development [2]. So, learning approach that closely matches students' cultural and environmental conditions are expected to change the paradigm of the real against the subjects of physics.

Not only based on environtment, floating market can also create the Banjar culture-based learning. Banjar culture refers to a variety of cultural richness that grows and develops in a society. Banjar culture is known, trusted and recognized as important element that is capable of reinforcing social cohesion among community residents [8]. It is therefore important to encourage students to learn the banjarnese culture.

One of the subjects on the physics is fluids concept. The fluid includes liquid, which flows under the influence of gravity to occupy the lowest area that may contain it. The fluid consists of static fluids and dynamic fluids. Fluids static is about the fluids that dwell in the equilibrium state. Fluids dynamic is a lesson about fluid motion, which is a branch of mechanics that is more complex [6]. Fluids play an important role in every aspect of life. We breathe, drink, swim, and also in our own bodies are fluids.

Fluids Static concept is related with everything in the river. Not only on surface but also inside the river, can be related to fluids static. Fluids static concept can explain things of physics in the floating market and its environtmen. Sub-material on the concept of a fluid static, is the pressure, hydrostatic pressure, Pascal's law, Archimedes force, surface tension and viscosity of the fluid liquid. In a static fluid, it is also learned how something can float, sink and float.

South Kalimantan's students are not necessarily familiar with the floating market. This is very good because we can take advantage of the floating market, to integrate in physics learning.

II. FLUIDS STATIC CONCEPT IN FLOATING MARKET

Kelotok and Jukung are above the river surface. There is the force exerted by the water on the boat. One of the forces that affect jukung and kelotok is the force of gravity. The force of gravity causes jukung and kelotok to always turn down.

The gravitational force will also affect the river water. The higher the depth of the river, then the heavier the river water, so that the greater the pressure of liquid at the bottom. Hydrostatic pressure is the pressure caused by the weight of the river water itself. The amount of pressure that occurs depends on the density of the liquid, the acceleration of gravity, and the depth. This means that when there is an object that is plunged into the river to be at a certain depth, the object will undergo hydrostatic pressure.

$$p_h = \rho g h \tag{1}$$

p_h = Hydrostatic pressure (Pascal or Pa)
ρ = Density of the liquid (kg/m^3)
g = Gravity (m/s^2)
h = Depth below the surface of the fluid (m) [6].

The river surface remains flat, but we do not know whether or not there is a flat river bottom. The river is also flat although many poles are stuck and some buildings blocking the water. It can be in the analogy as a fluid which is inside a communicating vessel. We see that the height of the fluid surface in the fourth jukung/kelotok is the same, which indicates that the pressure is only depen-

dent on the depth and not on the shape of the container. This phenomenon is expressed in the fundamental law of hydrostatics, which reads: all points that are located on a flat plane in the similar liquid have the same pressure.

If a piece of wood is sunk in the water then the wood released will be pushed to the top and then floating. Jukung dissolved into the river also will be floating as long as not leaked. From these cases, it is indicated that the object in the water (the fluid) is generally a force upward. This force is called the force of Archimedes. Objects submerged in fluids, either partly or entirely undergo force upward by weight of the fluid displaced by the object.

An object is said to be sunk if the object moves down to the bottom of the water. It can happen because the weight of the object is greater than the compressive force to the top, or it can be written:

$$w_{\text{benda}} > F_a$$
$$\rho_b V_b g > \rho_f V_b f g \quad (2)$$

When

$$\rho_{\text{benda}} > \rho_{\text{fluida}} \text{ [9]}$$

Based on the above equation, the object also will sink when the density of the object is smaller than the density of water.

An object is said to float away if the object is not located at the bottom of the jukung/kelotok and no part of which appears on the surface of the fluid. In this state the weight of the object is equal to a compressive force to the top and volume of the submerged object is equal to the volume of liquid displaced.

$$w_{\text{benda}} = F_a$$
$$\rho_b V_b g = \rho_f V_b f g \quad (3)$$

When

$$\rho_{\text{benda}} = \rho_{\text{fluida}} \text{ [9]}$$

Based on the above equation, the object also will sink when the density of the object is smaller than the density of water.

An object, like jukung and kelotok is said to float if there are parts of objects that appear on the surface of the fluid. In this state the weight of the object is immersed in a fluid equal to the upward force.

$$w_{\text{benda tercelup}} < F_a$$
$$\rho_b V_b g < \rho_f V_f b g \text{ [9]} \quad (4)$$

Based on these results we can connect the mass of the object with the mass of fluid in the form of the equation:

$$\rho_b = (\rho_f V_b f)/V_b \quad (5)$$

obtained:

$$\rho_{\text{benda}} < \text{ fluida}$$

Based on the above equation, the object also will sink when the density of the object is greater than the density of water.

Jukung and kelotok is made from wood. Deck of jukung and kelotok are hollow. Deck made of wood is hollow and filled with air. The air has a density less than water. Cavity causes jukung and kelotok to move large volumes of river water. Because the upward force is proportional to the water's volume of the rivers removed, the cavity causing an upward force becomes very large. Even though the boat is charged either with human or cargo, it will not sink as long as density of boat and the cargo is not greater than the density of water of the river, thus still allowing the boat to float above the surface of the river in spite of its load increasing. Because the density of jukung/kelotok is smaller than river water also affects the weight of the jukung/kelotok force. The weight of the jukung/kelotok will be smaller than the upward force of the water.

Once a boat is leaking, the water will get into the boat. This will cause water to replace the air in the cavity of the jukung/kelotok. As a result, the density of jukung/kelotok will slowly increase. In the end, the boat will sink because the role of the air density has been lost. Even then jukung/kelotok will wreck. Some people get used to throw garbage into the river. Examples: a woman is buying a banana in the floating market. Bananas are eaten immediately and discharged. After finishing eating all that remains is the banana peel. A woman throws banana peels into rivers. The banana peel's density is 3.11-6.12 g/cm^3 [10], while the density of river water is 1 g/cm^3. Thus, the density of the banana skin is greater than the density of water of the river. This will result in sinking a banana skin.

This is bad. If the density of the water of the river is greater than density of garbage bins, they will float and will soon gather with other garbage deltaic. If the density of garbage is greater than the water of the river, then the waste will be at the bottom of the river. The bigger amount of garbage being dumped will make more piles of garbage in the river. This of course would destroy nature. It also can disrupt the ecosystem of the river. The garbage that keeps piling up can cause bad odor. If this happens, then the floating market will be no longer having a lot of visitors.

Surface tension of the liquid is the propensity of liquids to stretch so that its surface is covered by an elastic layer. The molecules in liquid water stream to exert its members of molecules to attract each other [11]. A molecule in the liquid is surrounded by a number of neighboring molecules that are the same in all directions. Therefore, the style of intermolecular resultant net on the inside of the molecule is zero. The situation is different when near the surface of the liquid. Because there are no molecules on the surface, the molecules tend to be drawn to one direction, to the surface. This causes the surface of the liquid to behave like a membrane that is stretched. This tendency results in surface tension that maintains and enhances the freedom of the liquid surface.

When the liquid is navigable for jukung/kelotok, surface molecules of water around the walls will be attracted to the wall. This attractive force is called adhesion. At the same time, however, the surface of the water molecule is also subject to the liquid cohesive forces that are interesting molecules in the opposite direction. If the force of adhesion is greater than the cohesive strength, the surface of the fluid near the wall is curved upward. If the opposite happens, the liquid surface is curved downward.

Water molecules on the river surface do not have the gravitational attraction to molecules present on it. The influence of attractive force on air molecules existing on the surface of the liquid is considered small so that it can be ignored. As a result, the molecules, those that are in the top layer (surface), experience a gravitational attraction with its neighbors such as the one on the bottom and sides. The attractive force in the downward direction on the surface of the molecule causes the surface of the liquid to shrink down, then the resulting force to resist the downward force so as to produce a resultant force stretched along the surface and cause surface tension.

The surface tension in the liquid is defined as the force per unit length. In the case of small objects that are on the surface of the liquid, the weight of the object, which is directed to the bottom will be resisted by the surface tension multiplied by the length berkontakan surfaces directly with the liquid.

Mathematically written:

$$\gamma = F/d \tag{6}$$

Information: γ = Surface tension (N/m)

F = Force of surface tension (N)

d = length berkontakan surfaces directly with the liquid (m) [11]

This case indicates that the motion in liquids is determined by the viscosity of the liquid. The more viscous liquid makes more difficult for an object to move. Thus, it can be said more the viscosity of the liquid, the greater the force of friction in the liquid. Viscosity is also called friction that occurs in the fluid. The greater the viscosity of a fluid, the greater the friction. Fluid viscous as oil has a large viscosity coefficient ($\eta = 110x10^{-3} Pa\ s$). Fluid viscous as water has a small viscosity coefficient ($\eta = 1,00x10^{-3} Pa\ s$).

Unit for viscosity is Poise, to honor the French scientist, Poiseuille, who made a study of this phenomenon. Large frictional force provided by viscous fluid is expressed by the following equation:

$$F_f = k\eta v\ [12] \tag{7}$$

Capillarity is the event of fluctuation in the surface of the liquid inside a narrow tube (capillary). Capillarity is affected by the force of cohesion and adhesion between the liquid with the walls of the capillary.

The adhesion force is the force of attraction between particles that are not similar. Water that is within the capillary tube will rise as water and glass adhesion force is greater than the cohesive forces between the particles of water. Thus, it composes a cavity. Surface water on the curved glass wall is called the meniscus concave.

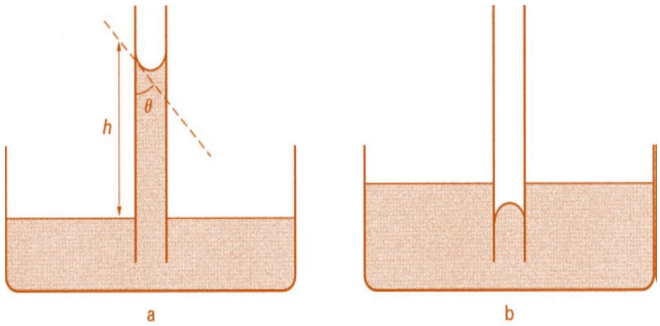

Fig. 1. The rise and fall of the liquid in the tube Source [11]

Cohesive force is the force of attraction between the particles that are similar. Mercury, which is within the capillary tube, will tend to fall. This is because the cohesive forces between mercury are greater than the adhesion force between mercury and glass. Thus it is forming a convex. The surface of the mercury which is convex is called meniscus convex.

If greater adhesion than cohesion is there, the liquid in the narrow tube will be rising to a height, h. If the adhesion is smaller than cohesion, where the angle is greater than 90^o, the liquid level in the tube will decrease.

$$h = \frac{(2T cos)}{r\rho g} \tag{8}$$

Information: y = Fluctuation of the surface of the

liquid

T = Surface tension (N/m)

= Contact angle

ρ = Density of the liquid (kg/m^3)

g = Acceleration due to gravity (m/s^2)

r = The radius of the capillary tube (m) [11]

The contact angle in the equation indicates the angle formed by the walls of the vessel with the liquid surface tangents. If the contact angle is less than or equal to $90^o(0 \leq 90^o)$ the surface of the liquid in the capillary tube will be higher than the water level in the vessel. In other words, the liquid level in the capillary tube will rise. Whereas if the contact angle is greater than $90^o(0 > 90^o)$ the water level in the capillary tube will drop.

It does not only bring benefits alone. Applications of capillarity are also providing a problem in everyday life. The resulting problems include:

a) Leakage of rain water on the outside wall of boats or raft through the pore walls of the vessel that serves as a capillary tube

b) Rising water from the bottom wall rowboat or raft through a wooden board or the gap toward the top and wet walls so the boat becomes watery (moist)

The viscosity of the viscous fluid flow is equal to the friction in the movement of solid objects. For ideal fluid, the viscosity is equal to zero ($\eta = 0$), so it is said that a moving object in the ideal fluid does not encounter friction caused by fluid. However, if an object is moving at a certain speed in a viscous fluid, the object will be inhibited from motion by frictional force of fluid on it. If the object has a geometric shape like a sphere of radius r, then the laboratory calculations indicated that:

$$k = 6\pi r \tag{9}$$

Thus, the frictional force can be searched using the equation. This equation was first stated by Sir George Stokes in 1845, known as Stokes' law stated as follows:

$$F_f = k\eta v$$

$$F_f = 6\pi r\eta v \tag{10}$$

Keterangan:

F_f = Stokes friction force (N)

r = radius (m)

η = Coefficient of viscosity (Pa s)

v = Velocity (m/s) [12]

III. HOW TO INTEGRATE FLOATING MARKET IN PHYSICS LEARNING?

[13] mentions that the various results of research related to the study indicate:

(1) Learning is supposed to have a meaningful purpose, here learning resources need to be utilized as much as possible. The active involvement of learning resources to students is expected to improve the students' attention to the meaning of the study.

(2) Basic learning process should be based on exploration and discovery, instead of memorizing / repetition routine.

(3) Learning outcomes must bring understanding/comprehension or cause a reaction/answer that can be understood. Learning outcomes should not be bound by the conditions, time, and place, and should be implemented on the situation and the time of others.

The description above shows that the learning process is not just a transfer of knowledge from the teacher to the student, but rather a process of activities. The process is the interaction between teachers and students and between students and students. That is the reason why during the learning, students do not interact with the teacher as a source of learning, but interact with the overall learning resources that may be used to achieve the learning objectives. Learning emphasizes more on the way to membelajarkan students, not on what students are learning.

One way to learn students is integrated environment and culture that exist around the students during learning process. Environment and culture that can be attributed to the fluid material is a floating market. It's because physics learning is an inductive learning. It means that daily activity and every environment can be used to learn concepts, principles, laws, and theories of physics. The floating market in learning physics can be integrated in the learning of physics through teaching materials, either in the form of modules, worksheets, and instructional media.

Modules are printed teaching materials designed to be studied independently by students. Using the module, students can determine the speed and intensity of learning itself [14]. Modules are developed based on the principle of structuring information. The structure of writing a module [15] is often divided into three parts as follows: (a) the opening part: the title, contents, map information, and objective competence. (b) The main part: Introduction/overview of matter, relations with other materials, description of matter, Assignments, and Summary. (c) The concluding part: glossary, bibliography, and index.

[16] explains that the development of the module must consider the characteristics required as a module. (a) Self instructions, is an important characteristic of a module, as these characters allow a person to learn in-

dependently and not rely on others. (b) Self contained, i.e., when all the learning materials needed are contained in the module. (c) Stand alone, is the characteristic of the module that does not rely on teaching materials or other media, or should not be used together with teaching materials or other media. (d) Adaptive, the module can adjust the development of science and technology, as well as is flexible/adaptable. (e) Friendly (user-friendly), each instruction and exposure information shown to be helpful and friendly to the wearer, including ease of access to users in response and liking.

Module based on Floating market may be starting as info about the culture in South Kalimantan. Then the static fluid material is integrated on anything related to the floating market. Examples of questions and tests that exist on the module can also be integrated with what is in the floating market. It's better if given a map concept that explains the link between what is floating market with the concept of physics that apply there. Thus, students not only master the concepts of physics, but know and learn about the culture banjo which has become a tourist attraction. Modules such as these are also based on environmental wetlands, because the river itself is part of the wetlands in Southern Kalimantan.

Worksheet is a series of tasks to be performed by students to support the learning process of teachers to achieve the goals set. Worksheet is one of the teaching materials that are essential to the achievement of success in learning physics. Student worksheet is teaching material that has been packaged in such a way that students are expected to learn the teaching material autonomously [17]. Worksheets developed should attract the attention of students to read and can lead students to finding the lesson concept [18].

Worksheets that integrated floating market can be observed Worksheets, Worksheets experiment, or Worksheets problem solving. At Worksheets observation, students may be given projects to observe the floating market. Observation can be direct observation of the floating market. Moreover, it can also be via video of floating market. Students will explain the concepts, principles and laws of physics about what the floating market is. It will be the ability to train high-level students. Students will analyze what they found about floating market.

At Worksheets problem solving, students can be given a case relating to the floating market. The case could be a mathematical or conceptual one. So that students will remember about the floating market. Thus, students can learn about the environment and local culture during the learning of physics. Learning to use the environment as a learning medium is a learning process that gives hands-on experience to students, so that students are motivated to learn [19]. Media serve the purpose of instruction in which the information contained in these media should involve students in both the mind and in real activity [20]. The materials must be designed in a systematic and psychological view on the principle of learning. Media of learning physics are now developing very rapidly. There are media in the form of slide presentations like power point and prezy, virtual laboratories (Phet), games, macromedia flash animation, and video. In fact we can use video footage of the news as a learning resource. Newspaper clippings can be used as a medium of learning. The amount of media available today must be balanced with the media creatively. Integration of the floating market into learning media is very precise. Because it will show directly the local culture of students. Cultural diversity is characteristic of each region, as the basis for developing media-based learning of local culture [21].

Integrating environmental floating market into the study of physics is very helpful. Students are right to master the concepts of physics inductively. Because physics is taught on examples from daily life, then it is generalized in accordance with the concept of physics. Physics is the study of the nature of matter, energy and the symptoms experienced by objects in nature, as well as the basis for the development of science and technology in everyday life. Learning physics is not just memorizing formulas and solving problems alone but students are expected to understand, observe, analyze, solve problems, implement, and style it in everyday life.

With this learning students also will do the learning environment. Students will get to know their own environment. Students can analyze what's in the surrounding environment. Environment-Based learning is a learning environment that uses learning objects as a real experience, observes it directly, obtains data accurately and is able to learn independently or in groups [22].

Environment-based learning is the result of the positive impact of the activities of utilization of the environment for use with the goal of developing science process skills and student learning outcomes as it can create an atmosphere of learning more interesting, more fun, more interactive, not boring, as well as effective and efficient [23].

Students also will learn banjar culture of learning physics. Floating market is banjar culture that has been renowned. Even floating market has become part of an ad from a television station in Indonesia. It will make students more interested in following the lesson. In addition, students also will be rich with knowledge about reviews of their local wisdom, education serves to preserve the

cultural values positively, on the other hand education can serve to create change towards a life more innovative [24]. [25] emphasized the importance of early and institutionalized to maintain and develop culture locally as an integral part of national education, so that students are not deprived of its cultural roots.

IV. CONCLUSION

Floating Market which is South Kalimantan local culture can be integrated into learning physics. The concept of physics, particularly the fluid can explain many phenomena that occur in the floating market. Thus, students do not only learn about physics. Students also will learn about the culture of Banjar (local culture-based learning). And the students also will learn what is in the environment (environment-based learning).

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