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Linkage Analysis of Physics Concepts in the Bom-bom Car Game at Lamongan Marine Tourism

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ABSTRACT

The implementation of Physics learning must be contextual where during the learning process it is made by exploring the knowledge possessed and associated with its application in real life in the community environment of students. In learning physics students are required to be able to understand concepts, theories, principles, laws, and models and it is expected that through scientific processes they are able to have skills in developing knowledge during the learning process carried out. However, there are still many students who do not understand the linkages of contextual learning and only focus on understanding concepts according to the specified textbooks. The purpose of this research is to increase students' learning motivation by analyzing the relationship between physics concepts and the bom bom car game at Wisata Bahari Lamongan. The research method used is descriptive-qualitative. Through observation, interviews, literature review and documentation is done as a data collection technique. It can be concluded that the bom–bom car game at Lamongan Marine Tourism has a connection with the concept of physics, namely the concept of Newton's Third Law, momentum, impulse, and collision.

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INTRODUCTION

The application of the learning process in schools must be contextual. Where during the learning process it is made by exploring the knowledge possessed and associated with its application in real life in the community environment of students according to Permendikbud Number 103 (2014). Contextual-based learning is considered to make students better understand and master learning material, specifically the concept of physics (Satriawan, 2016). However, the reality is that education in schools still separates formal text-based knowledge only. Thus, many students still find it difficult to understand the lessons being taught.

In learning physics students are required to be able to understand concepts, theories, principles, laws, and models and it is expected that through scientific processes they are able to have skills in developing knowledge during the learning process carried out. In addition, the learning process does not only train science products (concepts, theories, principles, laws, and models) but also needs to train the learning process in carrying out scientific processes through observing a problem, formulating problems, making hypotheses, testing hypotheses with existing experiments. and draw conclusions to relate it to existing theories and concepts (Tilaar, 2006).

According to Karim et al, (2016) students find it difficult to understand physics material, one of which is the law of conservation of momentum. The law of conservation of momentum is usually used to solve collision problems of two or more objects. The meeting of two moving objects is the meaning of the collision. The phenomenon of the collision process can be found in

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everyday life (Makhmudah et al., 2019). The essential concept of the Law of Conservation of Momentum is "The total momentum before the collision will always equal the total momentum after the collision". However, it is difficult to prove in experiments on classroom learning, due to the lack of support for the available learning media (Prima et al., 2016; Ansumarwaty & Busyairi, 2021). In addition, students are not accustomed to being confronted with an event/phenomenon concretely in understanding learning material, especially Collision material. Thus, there are still many who find it difficult to understand existing physics concepts (Defrianti et al, 2021; Fadholi et al., 2018).

To influence students' learning motivation, namely the teacher needs to link the learning process with games that are often encountered by their students so that students continue to be enthusiastic in carrying out fun learning. The game of car bombs is a game that can be related to the concept of physics. To avoid collisions that occur in the game, car bombs are formed in such a way as not to endanger the driver, which is equipped with a rubber bumper to reduce the shock experienced when a collision between players' cars occurs. The attraction of this game is when the incidents between cars collide. Therefore, based on the existing problems, the purpose of this study was to analyze the relationship between the concept of physics and the bom bom car game at Wisata Bahari Lamongan.

RESEARCH METHOD

Based on the objectives that have been set, the research method used is descriptive-qualitative. Qualitative methods are used to describe the variables contained in the research based on data collection, analyzing data, verifying and reviewing from the point of view of scientific concepts, especially learning physics.The descriptive method is used to provide an applicable description by analyzing the concept of physics in car bomb games at tourist attractions as a learning medium for students.

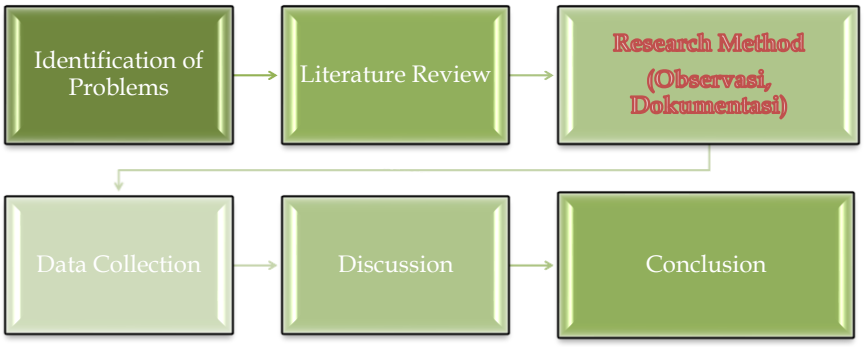

Figure 1. Research design chart

This research was conducted at Lamongan Marine Tourism. The discussion will explain the main parts, namely : Identifying physics concepts in the designated places, and the potential of WBL in the learning process as an innovative learning method. The main data sources are obtained from observations (direct observation) and documentation. The second data source was obtained from a literature study regarding the theory used from books and journals related to previous studies.

RESULTS AND DISCUSSION

Identification of Physics Concepts

Newton's Third Law

Bom-bom car is the best game to learn and can be connecting to the physics concepts. Bom-bom car move with the presence of electricity because one of the poles is located at the back of the car and is connected to the iron nets on the ceiling of the rides. Some of the electrical energy will be converted to move the car and some will be converted into heat. Electric sparks that occur due to

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electric voltage from nets that are interconnected with car bombs so that the car moves. The energy obtained by each car is the same, but cars with light passengers have the potential to move faster.

In addition, when the car is driven and hits another car, we will experience a jolt. This happens based on the physics concept of Newton's Third Law which states that " When bom bom car A exerts a force on bom bom car B, bom bom car B will exert the same force on bom bom car A. The resulting direction is opposite."

$$F_{action} = - F_{reaction} \quad \text{(Eq. 1)}$$

From the equation above, it can be seen that "This equation is the law of action-reaction, where F is called the action and -F is the reaction. The action and reaction forces of the two objects have the same shape, are in the opposite direction, and are in line. When the bom bom car A exerts a force of F on the bom bom car B, the bom bom car B will exert a force equal to -F on the bom bom car A. F and -F have the same magnitude but different directions."

Figure 2. Bom-bom car game in Lamongan marine tourism

When a car crash occurs because it is given rubber at the bottom of the car, the car will immediately stop or change direction. The rider will also feel a change in the direction of motion and will be pushed in the direction it was before the collision. During a collision, it is assumed that the mass of each car is the same. Because the mass of the rider also affects the effect of the collision itself. A rider with a greater mass will experience a smaller jolt compared to a rider who has a smaller mass will also experience a harder jolt. Therefore it is recommended, when playing this game the driver must always wear a seat belt so that when the riders collide with each other they will remain safe.

Momentum

The game bom bom car can be said to have momentum if it has mass and speed. The rate of change of momentum in the bom bom car game is equal to the net force acting on the bom bom car. The amount of momentum in the bom bom car game that collides with each other is constant.

Linear momentum (p) is defined as "*a measure of the difficulty to stop the motion of an object*". The momentum of a moving object is the product of the object's mass and its velocity. So, every moving object has momentum. The direction of the momentum will always be in the same direction as the direction of the velocity when viewed from the magnitude.

Mathematically it can be written:

$$p = m.v \quad \text{(Eq. 2)}$$

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Information :
p = Momentum (kg.m/s)
m = Mass (kg)
v = Velocity (m/s)

Impuls

Impulse in the game bom bom car serves as an addition, subtraction, and change the direction of momentum in units of time. According to the equation:

$$\mathbf{I = F.\Delta t} \qquad \text{(Eq. 3)}$$

Impulse occurs when the force involved is large enough for a short time (close to zero).

$$\mathbf{F = m.a} \qquad \text{(Eq. 4)}$$
$$\mathbf{= m\ \frac{(v_2 - v_{1)}}{\Delta t}}$$
$$\mathbf{F.\Delta t = mv_2 - mv_1}$$
$$\mathbf{I = p_2 - p_1}$$
$$\mathbf{I = \Delta t}$$

Collision

DeIn addition to the concept of Newton's third law, there is also the concept of collision in the bom bom car game. The collision or collision is the meeting of two car bombs that move relative to each other. Car bomb bombs have mass and speed or you can say car bomb bombs have momentum. When the car bombs collide with each other, the car bombs experience a collision. In any type of collision the law of conservation of momentum will apply, but the law of the conservation of mechanical energy does not always apply. Because, some of the energy in this bom bom car game can be converted into heat due to collision or deformation.

Figure 3. Game bom bom car crashes

The collisions that occur in the bom bom car game are perfectly elastic collisions, partially elastic collisions, and perfectly elastic collisions. A perfectly elastic collision occurs when two car bombs collide and both are able to separate in different directions but the energy value remains the same. In the case of a partially elastic collision, after the collision one of the car bombs is thrown and the value of its kinetic energy becomes smaller. In the condition of a perfectly inelastic collision, after the collision the two car bombs merge with each other with additional energy values.

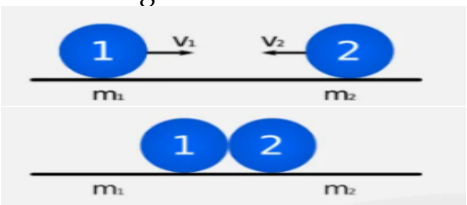

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Figure 4. *Perfectly elastic collision*

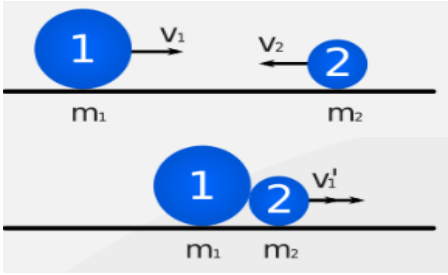

Figure 5. Partially elastic collision

Figure 6. Perfectly inelastic collision

CONCLUSION

From the results of the analysis and discussion that has been carried out, it can be concluded that the game bom – bom car at Wisata Bahari Lamongan has a connection with the concept of physics, namely the concept of Newton's Third Law, momentum, impulse, and collision. This can be seen when the car bombs are played at a certain speed, then collide with other car bombs.

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