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Analysis of Physics Concepts in Several Rides at Batu Night Spectacular (BNS) Indonesia

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ABSTRACT

Edutainment can simply be defined as a learning designed by combining educational content with entertainment. This study was conducted with the aim of analyzing the physics concepts contained in several rides at the Batu Night Spectacular (BNS) amusement park. This research uses a qualitative approach and is a case study. The data collection technique used is documentation in the form of images or articles on online media. There are three rides analyzed, namely Flying Swinger, Megamix, and Gravitron. From the data and the results of the analysis that has been done, it can be concluded that, Flying Swinger, Megamix, and Gravitron work based on the concept of force or having the concept of force on them. The forces that were analyzed on the three rides were centripetal force, centrifugal force, gravitational force, frictional force, and string tension force.

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INTRODUCTION

Nowadays, the development of science, especially in the field of science, is very rapid. One of the triggers is education. The Indonesian government in the 2013 curriculum stipulates that the Minister of Education and Culture Regulation no. 22 of 2016 concerning Standards for Primary and Secondary Education, which means that the learning process in education units is carried out interactively, inspiring, fun, challenging, motivating educators to actively participate and providing sufficient space for initiative, creativity, and independence according to their talents, interests, and abilities. physical and psychological development of students. Learning resources can be in the form of books, print and electronic media, the environment around the environment or other relevant learning resources (Permendikbud, 2016).

In terms of education, one of the sciences that affect human civilization is science. According to Yusuf (2017), science is systematic knowledge about nature and the physical world, including it, and physics is one of them. Physics itself according to Wiese (2016), is one of the sciences that studies the relationship between matter and energy. For most students, physics is one of the subjects that are considered very difficult to understand. Too abstract physics material for students causes students to have difficulty in studying physics. This is what causes physics to tend to be less attractive, even becoming a frightening specter for students.

One effort to change this view is by linking the application of physics in everyday life to learning. One example is linking physics with recreational amusement parks. This of course can reduce student boredom in studying physics while increasing student motivation (Löfstrand & Pendrill, 2016). In addition, according to Emafri & Rifai (2019), the physics learning process is very possible to be carried out in an environment outside of school. Learning done in nature can give birth to inspiration because there is free space to increase creativity.

The term edutainment consists of two words, namely education which means education and entertainment which means entertainment. In terms of language, edutainment can be interpreted

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as a fun education or learning process designed to combine educational and entertainment content in a harmonious way, so that learning activities take place in a pleasant manner (Hamruni, 2009). According to Hamid, edutainment comes from the word education which means education and entertainment which means entertainment. Edutainment is a learning process designed to harmoniously combine educational and entertainment content to make learning fun.

Referring to the definition of edutainment, it can be said that the purpose of the edutainment approach in learning is none other than to make learning fun, so that students feel comfortable, safe, and relaxed and the classroom atmosphere does not feel tense, scary, threatened, or depressed. Edutainment as a learning process is designed by combining educational and entertainment content in a harmonious way, so that learning activities take place in a fun way.

One of the amusement parks that can be used to realize edutainment-based physics learning is Batu Night Spectacular which is located on Jl. Hayam Wuruk no 1, Oro-oro Ombo - Batu Tourism City, East Java. The rides on BNS not only offer entertainment for visitors but can also be used as learning media where the rides on BNS work based on certain principles, one of which is physics. This way of working can then be analyzed and taught to students, in addition to making the class atmosphere fun, students can also learn new things about the physics concepts used in the vehicle. Based on this background, this research was conducted with the aim of analyzing the physics concepts contained in several amusement rides located at Batu Night Spectacular (BNS).

RESEARCH METHODS

This study uses a type of qualitative research. Qualitative descriptive research aims to describe, describe, explain, explain and answer in more detail the problems to be studied by studying as much as possible an individual, a group or an event. The focus of this research is the rides found in the Batu Night Spectacular (BNS) tourist park which works by utilizing the concept of physics. The location of the research subjects is at BNS Tourism (Batu Night Spectacular) Batu, Malang which is located on Jl. Hayam Wuruk no 1, Oro-oro Ombo - Batu Tourism City, East Java.

The stages of this research, namely: (1) Collecting information related to the rides contained in the Batu Night Spectacular, (2) Identifying the physics concepts contained/used by the previously identified rides, (3) Selecting the rides which will be analyzed further, (4) Analyzing the physics concepts contained in the selected rides, and (5) Formulating the results of the analytical study.

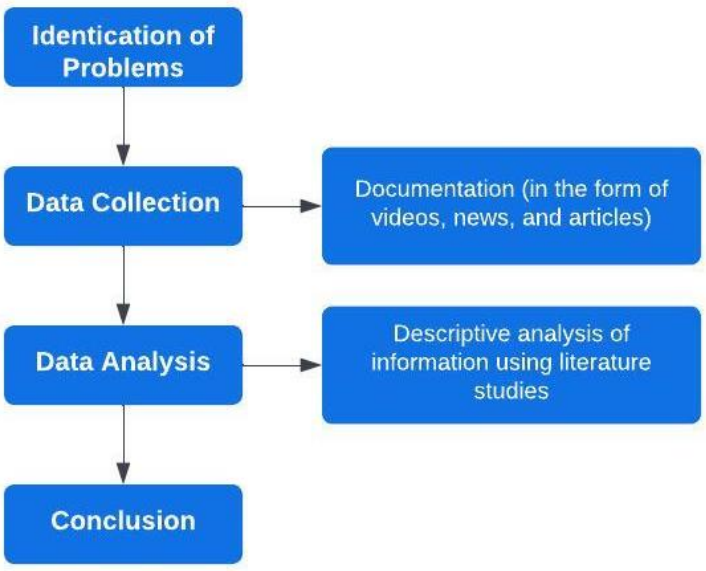


Figure 1. Research stages

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This study uses the documentation method as a method of data collection. Documentation in the form of media photos, videos, and articles obtained from certain sites. The analysis used is the method of analyzing information from the study of literature.

RESULTS AND DISCUSSION

Batu Night Spectacular (BNS)

Batu Tourism City has the aim of reviving the night atmosphere of Batu city so that the city government presents the Batu Night Spectacular as a night tourism object with the concept of an integrated family entertainment atmosphere that combines the concepts of malls, markets, games, sports and entertainment in one new place and space in the Oro area. -Oro Ombo. This tourist attraction provides a variety of rides that can be enjoyed by all family members. There are many choices of various rides such as a ghost gallery, test slalom, tallest aerial bike, garden lantern, and trampoline. There are also many rides specifically provided for children, such as the kids zone which consists of 25 kinds of rides. In addition, at the end of the trip out of the BNS tour, a night market is available. At the end of the night market, there are hundreds of rows of chairs provided for visitors in the food court area.

List of Analyzed Rides

1. **Flying Swinger**

   Flying Swinger is one of the rides at BNS which is classified as extreme because it can refer to adrenaline. Reporting from the Aneka Wisata website, this ride is almost similar to the 'Ontang-anting' ride found at Jawa Timur Park 1. This ride looks like a swing in general but what makes it different is the height of the swing. The swing bench on the Flying Swinger is located at a high enough height and then rotated to float in the air at a certain speed.



Figure 2. Flying Swinger
(Source: Bromo Malang Tour, 2015)

2. **Megamix**

   Megamix is round like a giant bowl where visitors who will ride this ride are positioned on the inner edge of the disc. Megamix works by rotating the vehicle in three different directions, namely rotating, tilting, and then inverting. This causes the visitors' heads to one day be down and their feet up.

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Figure 3. Megamix
(Source: Dzofar, 2019)

3. Gravitron

The Gravitron is shaped like a UFO flying saucer. These rides can make visitors unable to stand as usual. This is because this vehicle will rotate horizontally at a very high speed. On the Graviton ride, visitors are invited to fight gravity.

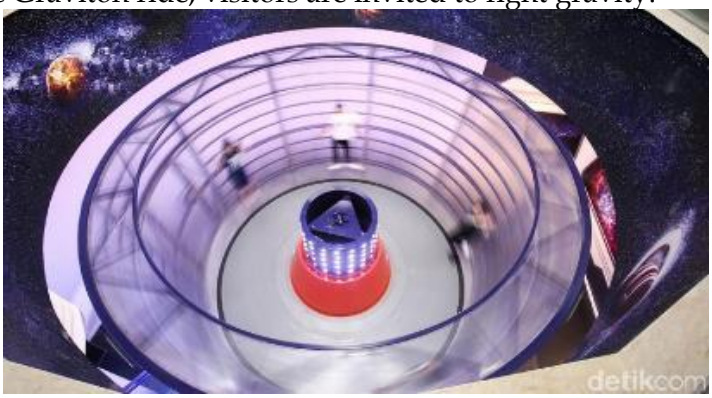
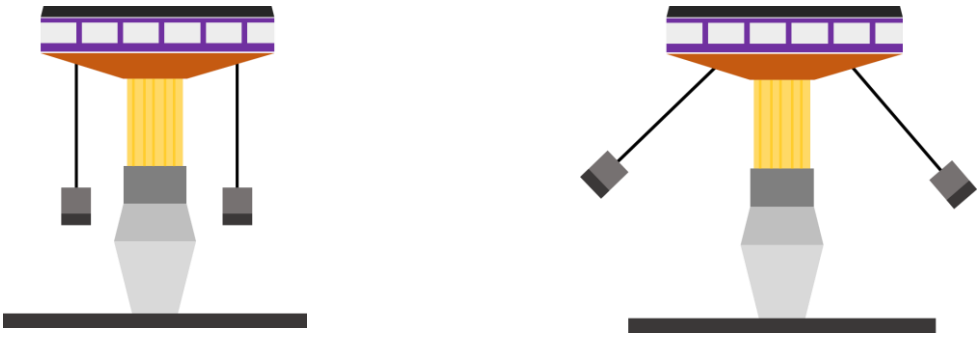


Figure 4. Gravitron rides at Trans Studio Cibubur
(Source: Ramadhanny, 2019)

Concept Analysis of the Rides

1. Flying Swinger

From a side view, the Flying Swinger vehicle looks like Figure 3. The Flying Swinger has two states, the first state is at rest and the second state is when it starts to spin.

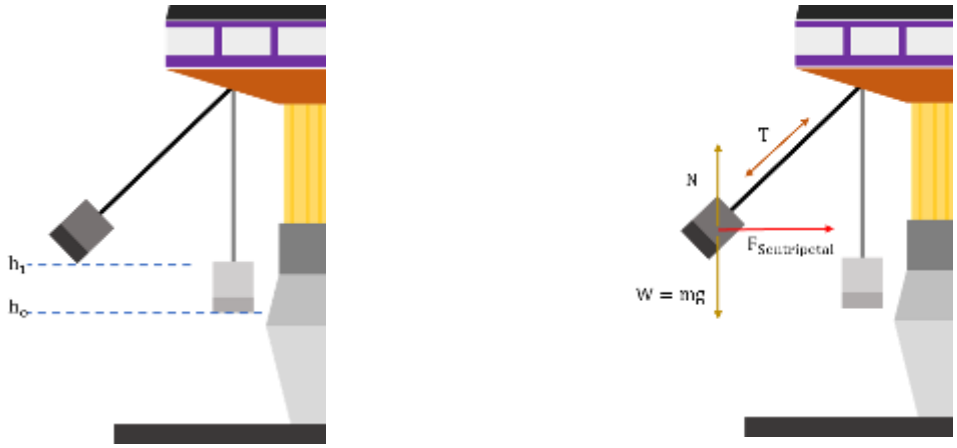


5a. 5b.

Figure 5. Flying swinger at (a) rest condition, and (b) starts moving

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When the Flying Swinger starts to rotate, the seat which was originally at a certain height (h_o) becomes higher (h_1). This change in height is caused by the role of the centripetal force. The definition of centripetal force is a force whose direction is towards the center of the circle (Suwarma, Without Years). The centripetal force on the Flying Swinger is a radial pull inward (the center of the Flying Swinger) on the seat by the rope as depicted in Figure 4b (Halliday, et al, 2012). The seat on the Flying Swinger will continue to rise due to the influence of the centripetal force that tries to continue to pull the seat towards the center point of the Flying Swinger until it reaches a certain height. The seat of the Flying Swinger cannot be completely parallel to the center (always at a certain angle to the plane) due to the adjustment of the rotational speed (radial speed) of the Flying Swinger so that the influence of the centripetal force can be controlled.



6a. 6b.

Figure 6. (a) Change in seat height when the Flying Swinger starts to rotate, (b) The component of forces applied to the Flying Swinger

Without the centripetal force, the seat will slide in a straight line and not move in a circle anymore. The force that balances the centripetal force on the Flying Swinger is the centrifugal force. The centrifugal force has a direction outward from the center of the Flying Swinger. Literature says that in fact, centrifugal force is not a force, but only a pseudo force that is generated when an object moves in a circle. Mathematically, the centripetal force and the centrifugal force are formulated as follows

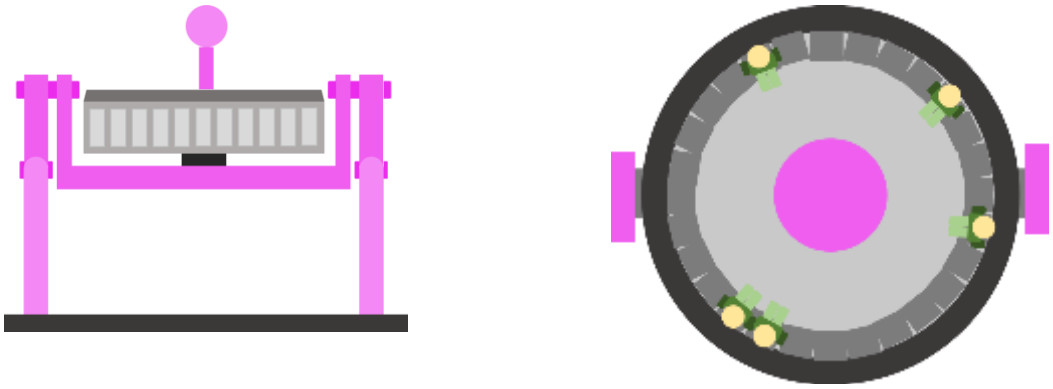
$$F = m\frac{v^2}{R}$$

Centripetal force is generally in the form of friction, rope tension, or gravitational force. In the Flying Swinger, the centripetal force is in the form of gravity and the tension in the rope (T) which supports the load on the seat.

2. Megamix

This ride consists of a tube containing a seat for visitors and two arms on the right and left to support the tube. When the Megamix is started to operate, the tube will rotate clockwise, followed by the rotation of the tube support arm. The explanation for the parts on this vehicle is illustrated by the following illustration,

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7a. 7b.

Figure 7. Megamix rides illustration (a) Side view, and (b) Top view

When the ride starts operating, the Megamix tube will start rotating in a clockwise direction. The rotation of this tube will cause visitors who are inside the Megamix to be pushed out. This push out is caused by the role of the centripetal force. The centripetal force on this vehicle is in the form of friction and gravity. The effect of friction occurs when the visitor sits on a chair where at this time, the visitor cannot move easily as if being pushed by the Megamix rotation. The force of gravity also gives the same effect to the visitors who are inside Megamix.

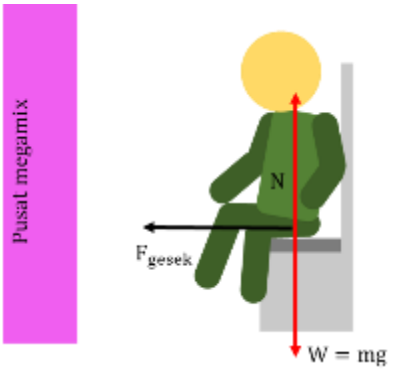


Figure 8. The direction of the force acting when the Megamix starts to spin (side view)

Although in Megamix it seems that there is a role for centrifugal force, centrifugal force in the Megamix case is only needed when analyzing the movement of visitors from the point of view of the observer who is also inside the Megamix. In another sense, the visitor who is inside the Megamix must add centrifugal force when he observes other visitors who are also inside the Megamix. This is because the centrifugal force is an apparent force that can change a non-inertial frame of reference into an inertial frame of reference.

3. Gravitron

In simple terms, Gravitron also has the same way of working as Megamix, namely that visitors will be made as if they will be pushed out by the rotation of the Gravitron.

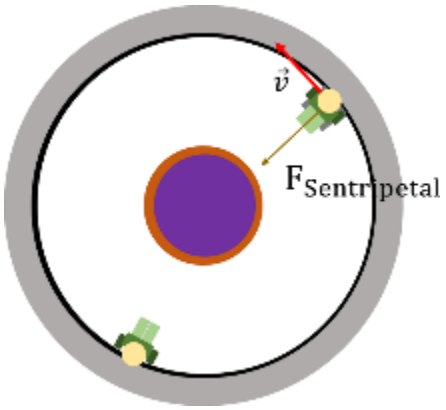


Figure 9. Forces and components of quantities acting on the gravitron

When the ride starts operating, the Gravitron will rotate in a clockwise direction. This rotation will give the effect of "floating" for anyone in the Gravitron. This effect is due to the outward thrust caused by the role of the centripetal force. Just like on the Megamix ride, The centripetal force on the gravitron is in the form of friction and gravity. The effect of friction occurs when the visitor sits on a chair where at this time, the visitor cannot move easily as if being pushed by the rotation of the Gravitron. The force of gravity also has the same effect on the visitors who are inside the Gravitron.

CONCLUSION

Based on the results of the analysis that has been done, three of the rides, Flying Swinger, Megamix, and Gravitron work based on the concept of force. The forces that were successfully analyzed on the three vehicles were centripetal force, centrifugal force, gravitational force, frictional force, and string tension force. In addition to these concepts, the three of them also have other physics concepts that can be analyzed, one example is motion. Physics learning in schools does not always have to be fixed on books, a variation that can be done is to integrate learning with rides or amusement parks, which can be referred to as Edutainment. There are so many amusement rides out there that how they work can be analyzed using physics concepts. It is hoped that with Edutainment-based learning, it can increase the effectiveness of students in learning physics concepts and create an active and fun learning atmosphere.

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