Exploration of Physics Concepts of Jatim Park: From Classical Physics to Digital Technology

N Suprapto1,*, A S Adam1, Sulianyah1, T Sunarti1, and H Mubarok1

1 Physics Department, Faculty of Mathematics and Natural Sciences, Universitas Negeri Surabaya, Jl. Ketintang, Surabaya 60231, Indonesia

*E-mail: nadisuprapto@unesa.ac.id

Abstract. As the common understanding, physics extend well in every part of life, include in many holiday destinations in Indonesia. In the east of Java, Jatim Park group has established by the combination of education and entertainment, produce the concept of learning while playing. However, most of the props didn’t contain the farther information about the cause or the process of certain phenomena. This particular study is part of the combination of the observation, literature study from relevant sources and authors’ knowledge in physics concept analysing. Accordingly, this paper describes the physics concept in two different locations of Jatim Park group, Jatim Park 1 and Jatim Park 3 (Infinite World). Moreover, the physics exploration captures the modernity of that destination, from classical physics to digital technology. In addition, the authors represent the standardization of the physics props on both of that park.

1. Introduction

As a part of Natural Science, Physics is very common in real life [1]. Particular natural phenomena explained well on it and as the learning objectives of the observation-based learning. Observation process needs real media for gaining more information in physics concept. According to the cone of experience from Edgar Dale, Direct and purposeful experience is the most concrete media [2]. The direct observation supports the detail information for students due to real-time variable relation to others. It is possible when students directly involved using as much as possible senses they have. Somehow, media as the observational object must be “eye-catching” or visual interesting to gain the attention as the first condition to make sure that students want to study more about the other knowledge on that media.

A study from observation typically uses in many learning methods as an inquiry to make student-centre instruction [3]. An inquiry is a person thinking to find out the information due to knowledge and understanding certain phenomenon. Therefore, the concept of inquiry appropriate to apply in physics learning, use in many existing methods or combine with another approach [4]. The most important thing in inquiry concept starts with the interesting occurrence, even use the viral phenomena relate to the concept as the objection. Then provide that observed media as the experiment setting to gain personal thinking process from direct experience complete with various activities, train particular skill in the same way. From that activity, students have the purposeful experience as the most concrete media and the concept gaining from this activity stay longer.

Common physics instruction didn’t combine with experiment design or the students’ concept as the study result didn’t achieve from purposeful experience through experiment, make students learn
physics once or twice a week and leaving various misconception [5-7]. That misconception not only occurs on the students but also future teachers and in-service teachers [8]. For gaining more interest in study physics, media as the first aspect for attention-grabbing in inquiry can be achieved from the direct observation in a holiday destination. As the lifelong learning concept, travelling is the cause to increase the generic skill development for some students [9]. Likewise, travelling is an alternative to the common education style from the government with determined time and place. The special and personal experience of stay in direct place makes an unforgettable experience with all personal sense of students. That concept is a whole new concept compared with classroom instruction [10]. However, it doesn’t mean that the national curriculum from the government can’t be combined with learning from travelling; it collaborates and develops to an interactive method as place-based learning.

As the travel destination, Jatim Park Group is the biggest tourist attraction network in the east of Java, Indonesia. Mostly, Jatim Park Group state in Batu city, the theme park icon of East Java on latitude 7°52′S 112°31′E. As the theme park, Jatim Park consists of a different topic in each place and combines education with entertainment. Jatim Park 1 with a tagline of ‘Study Park and Recreation’ has many top attractions like the Science Centre, Gyroscope and Indonesia Heritage Museum. All the physics props in the science centre here typically same, under the scope of classical physics. Contrast to this condition Jatim Park 3 has a modern tool to demonstrate some physics concept. All the props have digital technology to show the simple concept to something never seen before in common. It brings the attention level to the max, amazes the visitor frequently and supports the concept of study while playing.

Based on the timeline, physics is distinguished to two main areas, classical physics and modern physics. In classical physics, most of the motion phenomena describe on Newtonian mechanics and optics explained in geometric or physic form. However, classical physics never been boring in the demonstration depend on the idea and other compliments to make it interesting. When the digital technology uses to demonstrate classical physics, the common vision of everyday phenomena become unique and interesting media. For this objection, this particular research explores the physics concept on the Jatim Park Group to describe the suitability in the instructional process.

2. Method
This study combines observation, literature study from related sources and authors’ knowledge in physics concept analysing as the main method. Observation made on the predetermined spot based on the recent researchers’ information and many websites of nominee theme parks and open the science or technology park. In that holiday destination, the researchers observe relating props in physics concept and capture it on picture and video. Furthermore, all the data didn’t impose or predetermined by the researcher. It means, the topic of some physics prop is uncontrolled. Accordingly, two different locations of Jatim Park Group, Jatim Park 1 and Jatim Park 3 (Infinite World) chosen to be research object. The observation phase produces the picture and video to be analysing to relating concept and compared to literature study and authors’ knowledge. Besides, the observation finds many inappropriate conditions and describes the sample standardization of the physics props in classical physics.

3. Results
This section describes the findings as to the data of the observation activity in Jatim Park 1 and Infinite World in Jatim Park 3.

3.1. Initial study: Physics props findings
In Jatim park 3, there is not only an Infinite World but also the Fun Tech Plaza. Infinite World determined to compare with the Science Centre in Jatim Park 1 as the same part of classical physics but in a different demonstration from the digital technology on it. All the part both on Jatim Park 1 and Jatim Park 3 didn’t provide an education-entertainment concept in a whole place, Science Centre and
Infinite World is a part of education concept beside the pure entertainment concept. Extreme attraction established to complete the ‘all in’ holiday destination.

3.1.1. Jatim Park 1: Science Centre. In this Theme Park, physics concept in props follows the part of classical physics. Besides, the demonstration uses the classic method, show the prop and complete with the explanation. Generally, all the props exist in two main areas, outdoor area and indoor area. The characteristic of many tools has been adapted to the station characteristic. All the physics tools in Science Centre show in Table 1.

**Table 1. Physics props in Science Centre.**

| Title               | Physics Concept      | Description                                                                 |
|---------------------|----------------------|-----------------------------------------------------------------------------|
| Gravitram           | Mechanical Energy    | Metal ball moves from the high place to lower side, transform the potential energy into kinetic energy when it moves in a track motion. |
| Bike on a wire      | Newton’s Law         | Bike state on a wire and move in horizontal direction, fulfil the First Newton’s Law on vertical direction. |
| Gong                | Sound Wave           | A traditional music instrument of Indonesia, flat form with circular metal disk and hit with a mallet to produce a typical sound. |
| Lever               | Newton’s Law         | Show three types of lever, first class, second class and third class with each characteristic. |
| Facet Eye           | Reflection           | 19 reflective metal balls arrange to honey comb form, if the middle ball touch with our finger, the other ball reflect. It is the model of the flies’ eye. |
| Echo dome           | Sound Wave           | A dome with echo effect.                                                    |
| Illusion Mirror     | Reflection and Refraction | Two parallel glasses complete with adjustable bulb brightness. Cause reflection or refraction depends on the brightness on two glasses. |
| Vortex Tornado      | Dynamic Fluids       | Water in a tube, complete with hole in the bottom to move the water, generate the water vortex tornado inside the tube. |
| Pulley              | Newton’s Law         | Feel the different force based on the number and design of the pulley.       |
| Wave of Ball        | Mechanics Wave       | Wave effect from 11 pendulums with different length of thin rope when displaced sideways from its resting in a same time. |
| Magnetic Pendulum   | Magnetism            | 13 magnetic pendulum state side by side. When one of that pendula displaced sideways, the other displaced because of the magnetic force. |
| Self-Excluding Mirror | Reflection        | 17 mirrors install side to side with a same angle and unparalleled and getting back position. In some position, our reflection seen clearly but in shift position, our reflection disappeared. It because of our angle to the mirrors. |
| Tesla Coil          | Electricity          | The Tesla Coil is an oscillator at radio frequency and drives a double resonant transformer to produce low current with high voltage. Visitors hold the Fluorescent Long Lamp Tube and the light on in frequent time. |
Based on Table 1, the physics props dominate with mechanics concept. It is a common situation, many mechanics tools easy to build with low design cost. In Science Park, all the props complete with simple but meaningful information, explain the relating physics concept with instruction for use and the Jatim Park Group mascot. Unfortunately, the explanation didn’t complete with English, so international tourism can’t understand easily. The explanation design is shown in Figure 1.

Figure 1. The instruction banner of Pulley Efficiency.

Based on figure 1, the information of the pulley efficiency use explained clearly, the visitor just pulls the rope with the load attachment and different pulley design. This prop is easy to operate and the visitors feel the force directly. However, the concept explanation writes in inappropriate information. The information above shows that the number of pulleys proportional to the mechanical advantages, but the biggest effect of the mechanical advantages is the pulley arrangement. In the same amount of pulley generate different mechanical advantages, one pulley is moving greater than the fixed.

3.1.2. Jatim Park 3: Infinite World. As Jatim Park 1, this holiday destination uses the classic physics. However, it completes with digital collaboration. Some support technology used to modify the usual presentation of optics concept. All physics concepts applied in Infinite World is a reflection of the facing off mirrors, produce the infinity reflection of a particular object. That’s why this holiday destination titled with Infinite World. The good angle of the lighting to some interesting object makes the awesome visual experience. Many objects placed to build some thematic situation. Besides, a part
of this place uses picture projection and audio complement to construct a similar situation as a particular place.

![Figure 2. Beach Infinite.](image)

Beach Infinite and Galaxy Garden are two themes in Infinite World. Beach Infinite consists of the water picture projection and supported with relating sound as Figure 2. Being here makes the illusion to the wide beach, as the effect of the face-off mirror in the wall. In reality, this place isn’t too wide, approximate to 3 meters in width. Furthermore, Galaxy Garden has a similar concept to Beach Infinite, two faces off mirror behind the glowing artificial flower, makes the illusion like in light flower on a super-wide area as Figure 3. Likewise, all the thematic spot didn’t contain concept information, visitors should be analysing many settings in this place. For learning objection, needs more effort to encourage students to analyse the concept applied besides the just interesting media.

3.2. Discussion
Physics concept observed in both of the Science Centre in Jatim Park 1 and Infinite World in Jatim Park 3. Overall, Science Centre commonly displays the physics concept. Many props are used to explain a particular physics concept available to try and observe the effect directly. Besides, those tools completed with information banner with title, instruction and simple explanation about relating concept. This facility helps visitors to understand more about the utility of the props and the process of demonstrating tools about the cause of something else. However, there is something wrong about the condition in this area; many demonstrate tools can’t work properly because of the old tools or bad
maintenance. There is the operator to fix the stuck tools in many props like Gravitran but the other broken tools stay located in the visitors seeing, make the bad impression about the visiting experience. These broken tools should be located in an unseen place to make sure that visitors get a good image in visiting experience. Moreover, the misconception finds in a part of the information banner. It means, needs standardization in many parts. The information banner should be reviewed from experts in university and it should be designed in collaboration on it. Then, it should be complete with English, so international visitors can understand easily. The modernity of this area can be manifested by the interactive digital media; information about particular props can be visualized in detail.

Infinite World shows the reflection effect differently. The face-off mirror makes the infinite reflection with many glowing objects in a dark place install to build many themes. Besides, there is a special object with a combination of a one-way mirror, give the effect of extreme deep well. As an interesting aspect, this place makes more attention than the Science Centre. But this place didn’t contain any explanation of the phenomena, establish to fully entertaining park. For education contribution, it should be complete with short information.

Jatim Park has a complete theme park in physics concept application props. The classical physics, the classic concept of physics with classic show available in the Science Centre in Jatim Park 1. This park has a complete scope of physics concept as mechanics, optics, magnetic and electricity. All concepts observed helps with information banner relating to the props. While Infinite World in Jatim Park 3 shows the digital technology combination to show the physics concept. All concepts in this area state in the scope of optics as reflection and refraction. Different from Jatim Park 1, Infinite World established for a fully entertaining place with no explanation about tools. For education use, the learning facilitator should make students focus on the cause of visual effect in every part on Infinite World to prevent students do other activity with no relating of the learning process.

4. Conclusion
Jatim Park Group has various ways to demonstrate many physics concepts. Jatim Park 1 has the Science Centre to show physics classically. Many props install and complete with information banner which contains instruction and a short explanation about the cause of some phenomena. Besides, this area consists of the various scope of physics concept as mechanics, optics, magnetism and electricity. Based on the observation of this park, many inappropriate findings should be fixed as review the physics concept in information banner, repair the broken props or place it on the visitors’ unseen area and complete the explanation with English for international tourism access. Furthermore, Jatim Park 3 has Infinite World with a different thematic part in a different room. Mostly, this area consists of Reflection of face-off mirror; make the infinite room effect or infinite reflection of the particular glowing object. However, this area didn’t contain any explanation on how the visual observed happen. So, Educational Facilitator should be designing the appropriate strategy to use this area as the media of observation.

Acknowledgment
Thank you for Directorate of Research and Community Service, Directorate General of Research and Development, Ministry of Research, Technology and Higher Education that have funded this research through the scheme of Penelitian Unggulan Perguruan Tinggi (PUPT) with Grant Number B/21851/UN38.9/LK.04.00/2019.

References
[1] Adam A S, Suprapto N, Kholiq A and Mubarok H 2019 J. Phys.: Conf. Ser. 1171 012039
[2] Edgar D 1969 Audio-Visual Methods in Teaching (third edition) (New York: Dryden Press) p 108
[3] Wenning C J 2012 J. Phys. Teach. Online. 6 9
[4] Windschitl M J, Luft R L B and Gess-Newsome J 2007 Science as Inquiry in The Secondary Setting (Arlington: NSTA Press) p 1-20
[5] Imeldaand R B and Subramaniam R 2010 The Phys. Teach. 48 55
[6] Apisit T, Manjula D S, Ian D J, Kwan A and Chernchok S 2011 Phys. Rev. ST Phys. Educ. Res. 7 020101
[7] Erin M K and de Bruyn R J 2011 Can. J. Phys. 89 1155
[8] Suprapto N, Suliyanah, Prahani B K, Jauhariyah M N R and Admoko S 2018 J. Phys.: Conf. Ser. 997 012011
[9] Kuh G D 1995 J. of High. Educ. 66 123
[10] Werry M 2008 Pedag. & Cult. Stud. 30 29.
[11] Creswell J W and Plano Clark V 2011 Designing and conducting mixed methods research (2nd ed.) (Thousand Oaks, CA: Sage)
[12] Suprapto N, Deta U A, Lestari N A, Kholiq A, Adam A S, Mubarok H and Jauhariyah M N R 2018 J. Phys.: Conf. Ser. 1108 012097
[13] Creswell J W 2012 Educational research: Planning, conducting, and evaluating quantitative and qualitative research (4th ed.) (Boston, MA: Pearson)
[14] Suprapto N and Pai Y F 2015 Man In India 95 1005