Advances in Engineering Research, volume 209
International Joint Conference on Science and Engineering 2021 (IJCSE 2021)

Learning from Technopark: Exploring of Physics Concept Through Advanced Technology

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ABSTRACT
This particular narrative study describes two science centres in the east of Java-Indonesia, popular as Infinite World and Fun Tech Zone as Technopark. The study utilises the document analysis, literature study from relating references, observation results and the authors' view. This paper also explains the Technopark concept and the physics concept exploration in the previously mentioned park. Besides, the Technopark potential for learning is also explained. The findings indicated many demonstrations of particular physics concepts in elementary, junior high and senior high levels based on the national curriculum. Infinite World shows the props to observe the nature of light, the formation of reflection on a flat mirror, and their application to particular optical phenomena. One of the props show as 'magic', looks at the distant hallway from the short mirror configuration. While in Fun Tech Zone, show the props which possible to observe motion concept in the digital and digital application in factual information and communication technology in real life.

Keywords: *Technopark, Physics concept, Advance technology.*

1. INTRODUCTION

Learning strategy need to succeed in some goals for gaining precise information. In physics, many ways of research serve interesting methods or media. As a natural-based subject, physics is observed in daily activity or natural phenomena. Based on these characteristics, activity-based learning is the appropriate method due to gain more information. In experiment settings, as part of activity-based learning, it explores the probable relationship between the observable variables [1]. A prevalent problem in physics problem used to construct the concept classification of observed situations. This classification determines the right reason from recent physics information of the particular case, facilitates students to train the observation skill, and develops the current scientific theory. Besides, this process is a well-known problem-solving method or decomposes the standard engineering system into the minor component or more straightforward design implementation [2].

Recent research suggests that observation-based learning develops into innovative learning with unique characteristics as the advantage of its method. One of these methods is conceptual clustering introduced by Michalski [3]. This method supports the learning process with observation and completes it with constructing process on post-observation to define a collection of objects with the symbol, mark the particular concept as classification and link the relation between them. Besides, learning by observation succeeds the procedural knowledge achievement effectively than the common knowledge obtaining [4]. As the observation object, the media state the vital aspect. It is a printed or electronic form to transfer some information. Based on the characteristic, Edgar Dale classified the media as Figure 1.

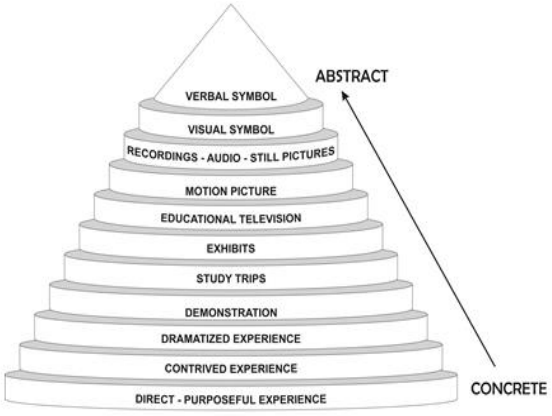

Figure 1 Cone of Experience of Edgar Dale [5].

As the source of learning media, the purposeful experience is gained from direct interaction, use more than two senses to get more information (touch, observe, hear, smell or even taste). In physics, some natural phenomena show many concepts directly, use natural sense as many as possible. However, most natural phenomena are unavailable for a long time, such as rainbows, light mirages and rain. That is, physics occasions can be presented with the support of technology. The apparatus for demonstrating particular phenomena with physics applying has been developed and transformed for a larger purpose. Education purpose of physics concept events with entertainment supplementary exists in Technopark concept.

Generally, Technopark is the collaboration between the university-industry-government, the university takes the knowledge development through research, the practical use of the knowledge as the function of industry and government plays the regulation between or financial support on it. Technopark transforms globally into a concept complete with three paramount collaborations: innovation, R&D, Advance Technology, entrepreneurship, and competition. Based on these complementary concepts, Technopark has a different name in different countries such as Teknopolis/Teknopol, Research Park, Science Park, Technology Development Centre, Technology Development Zone, Innovation Centre, and Technology Corridor [6].

As the International Association of Science Parks (IASP) defines, Technopark is a system managed by an expert in a particular field to introduce innovation and competitive culture to increase the profit of this society. For this objection, Technopark manages and supports the technology development between the three main aspects above, facilitates innovation, and produces excellent service in skill training, venue, and entertainment. As technology development needs, many Technopark has established around the world. In Korea, Technopark establishment took the final stage to integrate high technology industry with local development strategy [7]. Furthermore, the Government of South Korea has identified and has established 18 Technopark since 1997 and facilitate the economic player (supplier and its users) to incentives and tax subsidy for valuable research result in firms. This policy has a particular mission to “take back” the Korean people abroad to come back and work in Korea [8]. In Korea, a national firm takes the critical role to develop the Research and Design (R & R&D) concept in Technopark. A chaebol is a national firm, initiate to use of R&D results in South Korea. Two other firms success to use R&D results, Daewoo and Hyundai concert, in the automotive product. Both of these firms develop rapidly because of the proximity, R&D user and great complicity on technology from relating the research on Technopark [9].

In other countries, Spain combines technology transfer in regional development. Generally, Technopark development in Spain is divided into three stages. In the first stage, the Technopark concept begins in the 1980s, recognized from the effort to attract multinational companies in high-tech applications to support the dynamic local economy. The second stage occurred in the 1990s with the objection of the regional firm development in an urban location and focused on the new firm creation. In the 2000s, the Technopark development in Spain evolves to the third generation with national support. Each Technopark transforms into the specific knowledge for each park [10]. In Russia, the first concept of Technopark was known in 1988 as the effect of the Russian scientific journal publication. The first Technopark was established in 1990 by the university collaboration with scientific organizations and industry. Mostly, the Technopark in Russia follows the programme “Technology Parks and Innovations” to apply the scientific result of the university [11].

In Indonesia, the government define the Technopark as the location to produce the innovation to improve the competitive aspect of the firm and managed by professional. As the common purpose of the Technopark in other countries, it is aimed to collaborate the potential scientific result in firms from universities, research centres and firms in the group of Technopark. It can be succeeding through business incubation and supporting facilities for technology-based firms' establishment [12].

In Indonesia, a theme park with a science centre was established many years ago. Jatim Park 1 is one of the Jatim Park (JP) Group's concerns about learning while playing concepts. Although this is not the Technopark concept explained, this park is one of the histories of Technopark development in Indonesia as the first step to this concept. The visitors are expected to understand that science use is unlimited to answer the question in the examination and valuable for many things in life, including entertainment. JP 3 has 'Infinite World' and 'Fun Tech Zone', applying physics and technology. Therefore, identify the physics and technology support the instructional purpose with combine with the particular learning method.

As one of the parts of nature-based science, physics exist in almost all activities of our lives. As an example, the reflection concept is easy to find around. However, most of the students in Indonesia did not understand it. The textual and equational focus learning process is likely the reason for this mindset. Furthermore, observational-based learning reaches the most concrete thinking process with purposeful experience. Due to this objection, that study environment has to fulfil the actual

concept. This particular study describes the physics concept exploration in Technopark located in the east of java.

2. METHODS

This study uses a narrative research design focusing on physics exploration after the observation process in JP 3 location, Infinite World and Fun Tech Zone [13]. Based on the physics concept identification, these places are selected as the appropriate park for the learning scheme. Furthermore, this paper undertakes the document analysis on the related topic, literature study from relating references, observation result, and the authors' view. The physics identification process comprises linking well-known physics law and technology used to determine the potential integration to the curriculum in Indonesia. Then, the discussion describes three main parts: physics concept identification in a determined place, curriculum identification on physics concept identification result and the Technopark potential on the instructional process as the innovative learning method. Finally, all the findings elaborate on the authors' view to write the final result.

3. RESULTS AND DISCUSSION

3.1. Physics concept identification

Infinite World. This theme park shows an attractive installation complete with digital technology. As the observation objects, particular glowing objects, made from various LED in a dark room. The reason for the Infinite World brand comes from the reflection of the facing off the mirror. It makes the situation of the wide-area in limited space. Generally, this park consists of many themes in every room with condiment technology installation. Many themes in every room are time tunnel, stretch maze, *electonase*, sky walker, beach infinity, Jungle Bridge, wobbly, crazy shout, 1000 mirrors, plasma magic, kaleidoscope, and galaxy garden. One of the rooms, beach infinity, is the mirrors set in facing off position, digital projection of wave and music background. The physics concept is gained from analysing the nature of light and reflection in a flat mirror from this area. This concept is corresponding to the National Curriculum in Indonesia on the Junior High level. The projector's location can be predicted from the shadow formation when the visitor stands in the centre of the room. Mainly, the actual situation of this room shows in Figure 2.

Figure 2 Beach infinity room.

Based on Figure 2, the wave projection frequently animates as a typical wave on the beach. This room is likely as a hallway and connected to another place in a route. But with the particular installation, the cramped room change into an infinity illusion. The upside part of this room set in a dark condition generates the projection part reflection by face-off mirrors and highlight the bottom part. Besides, other details are complete with beach birds as the air conditioner's background sound and temperature setting. From the observation, the configuration of beach infinity (mirrors and projector location) illustrates in Figure 3. In addition to the thematic room, this park contains an optical installation. No different from the theme room, this object is established from the reflection of the face-off mirror. The unusual part comes from the semi-transparent mirror. This mirror is reflective on one side and transparent on the other hand, caused by the different brightness on every side; one side is brightly lit and dark on another side. The dark side is usually coated by aluminium in a thin layer. A one-way mirror is commonly used for security observation in the market, interrogation chamber, or producing the infinity effect, as Figure 4.

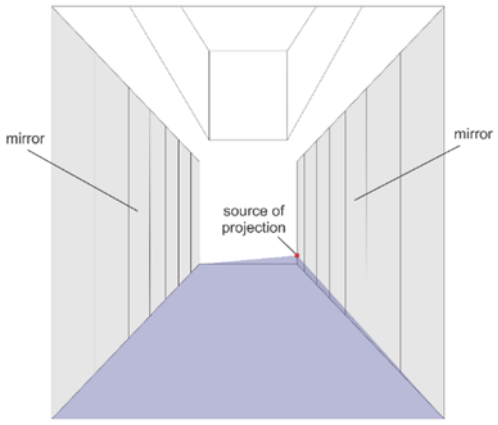

Figure 3 Beach infinity mirror and source of projection setting.

Based on Figure 4a, the installation is built in irregular hexagon form, similar to the letter "D", established from metal as the frame, one side mirror in the front area and ordinary mirrors in another six sides.

As a result, it produces the infinity slit depending on the lamp brightness; the first reflection is brighter than the second reflection and terminates to the darkest reflection as the end of the effect. The illustration of this object shows in Figure 4b. Besides, similar installation at this park establishes in vertical, make infinity well effect. These two analyses are the curriculum purpose informal instruction set by the government of Indonesia. It means the learning process can be combining with Technopark support with some adaptation.

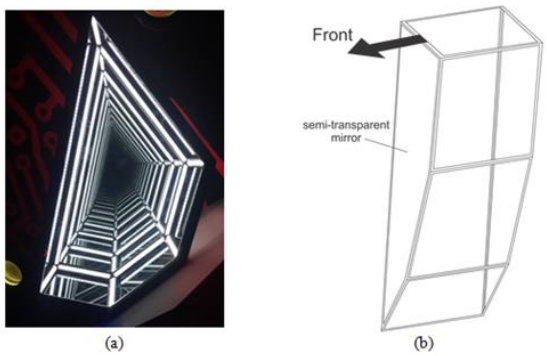

Figure 4 Infinity effect from semi-transparent mirror (a) real situation (b) illustration setting.

Fun Tech Zone. Jatim Park Group show the different and modern concept for Jatim Park 3, include Fun Tech Zone and Infinite World. As a theme park, visitors can demonstrate particular modern technology for fun purposes. Besides, it is possible to use the observation source for many physics concepts. In General, this park demonstrates digital technology, LED configuration, 3D Animation in the scope of virtual reality or augmented reality. The projection comes from the upside, and the visitor can interact with the object. The prop has also demonstrated digital learning in sport [23,24]. As the typical football playing, the visitor should make a kick move on a virtual ball; the ball moves in the direction of the kick bounce on the edge of the yard. When the ball inserts the virtual goal post, the "goal" information appears in front of the goal gate. The penalty goal demonstration shows in Figure 5.

Figure 5 Penalty goal projection on virtual small yard, ball and goal post.

Based on Figure 5, the most physics concepts applied are mechanics, observing the ball's direction after kick. A mechanic is the study of the particular objects motion and the force ac on it. Mainly, this demonstration did not define the force clearly, the further appropriate study called kinematics [14]. Besides the bounce of the ball, observe clearly, apply the concept of momentum and collision. The term collision refers to when two objects move to come closer to each other (in this demonstration: the ball and the edge of the yard) interact by force [15]. The angle of the ball produces a different direction after a bounce, as the term of the billiard playing. Based on the national curriculum, this demonstration shows the motion analysing in living things and the motion system in humans aside from the other physics concept described before.

On the other demonstration, the magic ball shows the big screen of the snow area with bear animation. The visitor interacts with the screen and throws many plastic balls, shot at the bear to gain score. Generally, this prop packs in a game setting and achieves more scores with the shot bear on the screen. That virtual ball moves in a curved line depend on the initial velocity and the gravitational acceleration. As the ball moving in the screen, this fulfils two assumptions: (1) the gravitational acceleration is constant in the downward direction and (2) the air resistance is ignored [15]. The screen of the magic ball is shown in Figure 6.

Figure 6 Magic ball screen.

Based on Figure 6, the actual ball thrown away by visitors hit the wall, project the snow area with the bear as the target. When the ball hit the wall, the virtual ball appears on the screen and smash the bear in parabolic. The bear appears on the screen at a different distance from the visitor, known from the size in the screen. It means the parabolic track different in every angle on the screen. Gaining maximum horizontal distance should increase the initial velocity at the angle of 45 degrees. To determine the ball throwing angle, there are no particular tools to make sure the exact number of the angle. Besides, the body position will affect the angle. In general, the demonstration in this park uses digital technology as the use of projection some thematic visuals for a particular

purpose. In the national curriculum, this digitalisation uses object analysing data storage and the analogue-digital transmission and its application in factual information and communication technology in real life. In future, the technology uses mainly in coding and technology applications critical as 21st-century learning [16-17]. This skill can train at this park by observing the response to our motion.

3.2. Discussions

As the previous descriptions, both Infinite World and Fun Tech Zone possibly integrate with the learning process, as the observation object for some physics concept, follow the tourism as the science that the information gained from tourism benefits to the scientific process [18]. That benefits are the strong evidence contributes to science skills, interests in relating concepts and behaviours on learning process [19]. The exciting objects in travelling, complete with 'eye-catching' objects, are the first aspect to grabbing more attention due to the students' motivation to observe the activity. This activity involves the analysing process, and students use their previous knowledge relating to phenomena as a part of scientific process skills [20]. Besides, students directly observe the cause and the process of physics phenomena, analyse the variable correlation and conclude it as the result of physics concept construction [1]. This objection will succeed gain if the students have science process skills, especially in observation and analysing ability, as the fact of this park did not complete with information about relating physics concept.

However, another strategy that should be used as the alternative is the appropriate design use. Students have to analyse the process of the phenomena, follow the question on 'why could this happen?' and 'what is the application in real-life?'. The university level will guide students to produce the new product relating to the existing props in this park. After it, the university and science park cooperation to establish the real Technopark in Indonesia. Technopark in Indonesia should be established in a fundamental concept with a precise regulation [21,22]. Based on the science park or Technopark visiting, the genuine Technopark concept (the collaboration between industry, government representation and university to apply the valuable product from university and complete the skill training) should start from the pure science on science centre. The step of the Technopark establishment is shown in Figure 7.

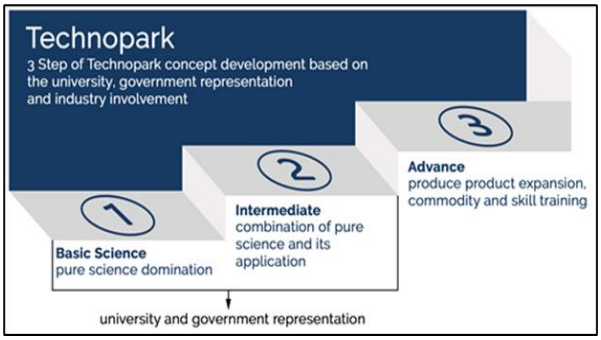

Figure 7 Three steps of Technopark establishment.

Based on Figure 7, the Technopark development consists of three steps, depending on the university, government representation and industry involvement. In phase one, the Technopark concept shows the basic science with the demonstration in pure science. In Indonesia, many theme parks have this concept, contain the domination of pure science. Science shows in the common application or demonstrates to real life as in the textbook. For example, the mirror reflection concept in any angle produces many reflections based on the angle. The second step is the intermediate level, which combines pure science and its application. In Indonesia, this stage exists with the characteristic of the application of physics concepts in real life. All Technopark in this paper state in this stage. For example, using the reflection concept of two mirrors, combined with the appropriate lighting, produces an interesting observational object for educational purposes. The first and second stage role players are university and government representation, indicated by the university demonstration props in observed Technopark.

The third stage, as the genuine Technopark concept based on the government and existing Technopark in another country, is called as Advance level. This stage is marked by product expansion, commodity and skill training. In the first generation of the Technopark establishment, this place built from the existing skill training centre did not appropriate to the real concept of Technopark. It should be developing from the first stage due to the existence of Technopark in Indonesia. However, the existing Technopark are the first attempt in this country.

4. CONCLUSION

Infinite World and *Fun Tech Zone* is two of the first attempt Technopark in Indonesia. Technopark demonstrates particular physics concepts in elementary, junior high and senior high levels based on the national curriculum. Infinite World shows the props to observe the nature of light, the formation of reflection on a flat mirror, and their application to particular optical phenomena. One of the props show as 'magic', looks at

the distant hallway from the short mirror configuration. While in Fun Tech Zone, show the props which possible to observe motion concept in the digital and digital application in factual information and communication technology in real life. In general, both parks use digital technology to show the physics concept in a different way. However, to combine, the learning process in this Technopark should use a particular strategy due to none of the applied physics concept information.

AUTHORS' CONTRIBUTIONS

All authors conceived and designed this study. All authors contributed to the process of revising the manuscript, and at the end all authors have approved the final version of this manuscript.

ACKNOWLEDGMENTS

Thanks to SIMLITABMAS, "Directorate of Research and Community Service, Directorate General of Research and Development, Ministry of Research, Technology and Higher Education", that have funded this research with Grant Number B/21851/UN38.9/LK.04.00/2019.

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