Planetarium Pedagogy and Learning Experience: Exploration into Planetarium Education Program

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Abstract: This paper is an exploration of the education program conducted by National Planetarium Kuala Lumpur (PNKL), educational theories well as the inclination of education program with the Standard Based Curriculum for Secondary School (KSSM) for science subject. The methods used in this study are document analysis and participant observation. This study has found that there are two types of education programs conducted by PNKL which are on-site program and off-site program. The Educational theories applied in the education programs are constructivism and behaviourism. Some educational approaches embedded via the education programs conducted by the PNKL are object-based learning and artful learning. The study also investigated the link between the education program with the Standard Based Curriculum for Secondary School in the science subject. The topics are best taught in the planetarium because of its capacity to speed up learning and help explain unobservable phenomena. The implications of this study and recommendations for future research are discussed based on the findings of the study.

Keywords: Explotary, Planetarium

INTRODUCTION

Planetariums are the world's astronomy classrooms and theatres of public science education that have been serving people for the past century. In a time when quality science education is more important than ever, a scientifically literate public is an essential part of the progress of any country. Planetariums around the world both inspire and educate people of all ages concerning the surrounding of the Earth and as well as the place in the Universe. Due to advancement of technology, humans can now gain knowledge of space in a planetarium. A planetarium allows astronomical concepts to be demonstrated in a three dimensional environment that significantly aids spatial understanding. The planetarium setting is not only educationally effective but also awe-inspiring. As skilled educators, teachers plan for school field trips for students to learn, as a school field trip acts as an educational attraction to students. The best approach to teach astronomy at lower secondary education in Malaysia is through the utilization of outdoor learning environment.

The National Planetarium (PNKL) is an informal science institution which has a significant role in supporting the Ministry of Science, Technology and Innovation (MOSTI) to propagate and spread space science awareness and knowledge and in the development of space science resources for the nation. The mission of this planetarium is to provide infrastructure and quality service to the society pertaining astronomical activity and space science. There are four main functions of PNKL: (1) to cultivate STEM astronomy where the PNKL aims to empower the role of the national planetarium as an organization that cultivates the astronomy field and space science in Malaysia; (2) to raise awareness on the importance of space science where the PBKL is in the pursuit to cultivate and raise public awareness on the importance of the astronomy field and space science via screening, exhibition, program and social media; (3) digital screening, where PNKL provides skills in handling digital screening of optical astronomy and amateur radio; (4) Human capital development, where PNKL serves to provide recommendation, coordination and guidance on astronomy and space science in Malaysia.

A planetarium is a well established informal science education tool. A study was conducted in 2016 aimed to find out the effect of using planetarium as

an outdoor learning environment. This study used the qualitative method to elicit students' opinions towards the area of interest. The results show that the implementation of the planetarium as a source of outdoor learning in science education has a positive impact on students (Seyma and Unsal, 2017). Other research have also found that students learn new knowledge and experience with the aid of a planetarium. Pasachoff and Percy (2005) stated in their book that museums and planetariums can be informal learning environments to students, which are very different from formal education in schools. Students opined that planetariums being part of outdoor activities in science education gives a positive impact, and the results contributed to the literature on school learning environment in Turkey science education in Turkey (Seyma and Unsal, 2017).

A planetarium is generally considered to be a positive learning environment and a great tool to develop public interest - however, there is a lack of research that discuss the alingment of the planetarium educational program with the Standard Based Curriculum for Secondary School for science. Therefore, the research will focus on how education program by Planetarium Negara Kuala Lumpur align with the Standard Based Curriculum for Secondary School for science.

LITERATURE REVIEW

This chapter consists of previous study and findings towards the specified research area and theories in Planetarium education. In this context, the review mainly revolves around the model of learning and the development of astronomy education through application of planetarium in pedagogy.

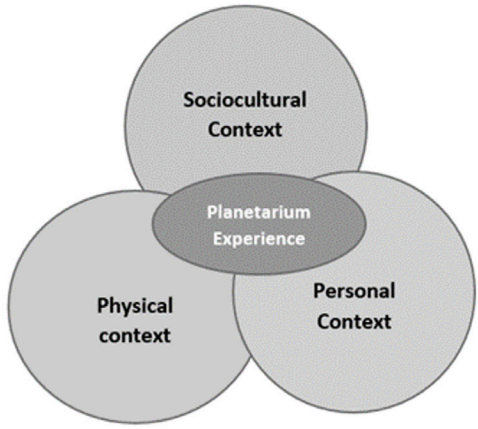
2.1.1 Contextual Model of Learning (CML)

CML is a framework outlining that learning is complex and involves a chain of contexts which are sociocultural, personal and physical. These three contexts will change with time as learners are molded by experience, what occurs in the world around them and where the learning setting takes place (Falk & Dierking, 1992; 2000). The three contexts will be discussed in detail on how individuals are influenced by each respective

context.

William (2017) suggested that although the venue of planetarium does not fit into the definitions of informal science education, the CML can still be a practical integrative framework to study how planetarium experience lies at the intersection of these three contexts and how the overlap of contexts gives rise to student learning.

Figure 1: CML in Planetarium (modified from Falk & Dierking, 1992)



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2.1.2 Sociocultural context

Sociocultural context is based on human beings as part of the world in which social and cultural aspects influence the way people think and how people learn. The incorporation of social and cultural elements are essential in order to explain the diversity of different learning styles among students (William,

2017). Therefore, it is significant for educators in formal and informal education settings to take into account the interaction among students, between students and guides/instructors/teachers. In the context of formal education settings, teachers should be supportive in creating a positive classroom atmosphere as well as promoting engagement and learning among students.

The shifting of learning approach from teacher-centered learning to student-centered learning should be put on emphasis as this allows students to speak their mind and discuss topics among peer groups which can open to powerful learning with the assistance of teachers as facilitators. The same idea applies to informal learning settings as well. Falk and Storlsdieck (2005) pointed out both within-group social mediation, and mediation by others outside the immediate social group, as vital aspects that influence learning. Hence, Informal Science Institution (ISI) for instance, the planetarium should create an environment where individuals are given a chance to have both types of interaction for optimal learning possibilities.

2.1.3 Physical context

Physical context refers to the actual physical environment where learning takes place such as classroom, at the zoo, in a museum or within a planetarium. Past research show how learning is affected by the physical space and the ability of visitors to orient themselves within an ISI (e.g Evans, 1995; Falk & Balling, 1982, Kubota & Olstad, 1991). Besides that, the details within the space and architecture influence the total experience and what is learnt. Research has found that lighting, crowding, color, sound and space have subtle effects on learning (e.g. Coe, 1985; Evans, 1995; Hedge, 1995; Falk & Storksdieck, 2005).

Apart from that, factors like exhibits, labels and educational signage as well as time spent by visitors at exhibits are important influences on learning (Bitgood, Serrel & Thompson, 1994; Bitgood and Patterson, 1995; Falk 1994; Serrel, 1996, 1998). Falk and Storksdieck (2005) posed five important factors within

the physical context which are influential in optimizing what an informal institution offers visitors: "advance organizers, orientation to the physical space, architecture and large-scale environment, design and exposure to exhibits and programs, and subsequent reinforcing events and experiences outside the museum" (p.747).

2.1.4 Personal context

Personal contexts refer to individual characteristics in which a visitor or student brings into the learning environment both in a formal and informal settings. Prior knowledge and personal experiences through informal learning have been broadly studied (e.g Dierking & Pollock, 1998; Falk & Adelman, Falk & James, 2003; Hein, 1998) together with personal interest of visitors (e.g Adelman et al, 2001; Adelman, Falk & James,2000 ; Falk & Adelman,2003), while other research have identified the motivation of visitor to attend a museum or other ISI as influential to learning (e.g Falk, 1983; Falk, Moussouri & Coulson, 1998).

ISIs and other informal settings have no power over the personal context yet can provide learners with control over their choices and activities while visiting. This will contribute to personal interests towards learning thus letting visitors to engage in activities attached to prior knowledge and interests. Learners tend to experience and learn new things on their own accord as students are given free choice and self-control. Falk and Storksdieck (2005) described these important personal context aspects which affect learning: "visitor motivation and expectation, prior knowledge, prior experiences, prior interests and choice and control" (p.747).

2.2 Object-based Learning

Object-based learning is a student centered learning approach. Objects can take various kinds, small or large, but the technique usually involves students engaging with, and inquiring physical objects or working in close surroundings. Objects can be utilized in several

forms. In all scenarios, in making learning real, the tangible design of the object, the connection made with it and the understandings that arrive from it can be significant in making learning real. The items are utilized to stimulate the imagination of the learner and to assist them in applying their comprehension to other situations and issues. Student-centered learning brings student skills and curiosity into the course of learning, making the experience more individualized, and engaging the student in his or her own future. The active learning encourages and provides meaningful interactions within learners and provides a welcoming space in which learners feel supported, accepted, valued and approved. PNKL is full with objects and monuments that can be cosider as part of Object-based learning.

2.3 Artful Learning

Most of the monuments in PNKL consist of artistict element. Brothman (2013) explains the artful learning is the idea that the arts provide a basic learning model. Planetarium Negara Kuala Lumpur in its Space Art Series exhibit that the learning activities designed for each episode mainly consist of drawing and making projects such as diorama. The integration of the arts component into science learning has contributed greatly in aiding learners to better understand the subject matter. This is supported with research by Brothman (2013) who described the connection between the arts and the enhancement of critical thinking skills. Booth and Jenson (2001) believe that a race in the brain increases cognitive capacity.

METHODOLOGY

This study is a type of qualitative research as the study opted to answer research questions which require exploratory methods and seek to unearth the opinion, thoughts and feelings of a research subject. Qualitative study is used to help with the understanding of theories and concepts applied in the subject of interest. In this context, the research objectives are to investigate in depth the education program conducted by PNKL linking to the Curriculum Standard for Secondary School. The objectives require formal, objective and systematic process for obtaining information towards the subject matter.

Qualitative data method include participant observation and document analysis. Both these methods help the researchers in answering the research questions. The utilization of multiple methods is significant in contributing the major strength of case study research.

Table 1. Method of data analysis

Section	Method
RO 1: To investigate the types of education programs carried out by Planetarium Negara Kuala Lumpur.	Participant Observation
RO 2: To analyze how the education programs by Planetarium Negara Kuala Lumpur align with the Standard Based Curriculum for Secondary School for science.	Field notes and Content/Document analysis

3.1.1 Participant Observation

Participant observation is a method of data collection in which the researcher becomes one of the participants in the research or participate indirectly in the event under study (Chua, 2016). Participant observation is helpful in obtaining and understanding the physical, cultural, physical and economic contexts in which the study participants live. Researchers can also discover key elements for an in-depth interpretation of the research problem but that were unknown when the study was planned. Data collected by participant observation acts as a check against the biased reporting of what they think of, and is done by the participants. Participant observation is also helpful to understand the physical, social, cultural and economic environments in which study participants live; the associations with and between persons, contexts, concepts, norms and events; and the actions and activities of individuals-what they do, how often, and with whom. Moreover, the methodology helps researchers to establish a knowledge of the cultural environment that will prove invaluable during the project. It provides the researcher with a nuanced understanding of the meaning that personal experience can offer. There is no replacement for the phenomenon of human interaction-interaction with other individuals, with locations, to observe or participate. Observing and engaging are important to understanding the breadth and complexity of human experience-an overarching research initiative for any project in development. Researchers may also discover factors critical for

a comprehensive understanding of the research problem through participant observation, but which were unknown when the study was planned. This is the great benefit of the methodology because researchers do not always ask the correct questions, but they may get true answers to the research questions being asked. Therefore, what is learned from participant observation will not only aid in understanding data gathered by other techniques, but also to design questions for those techniques that will offer the best understanding of the phenomenon being studied. In this study, the researchers paid visits to the planetarium, both physically, and virtually (via its official website). This is considered as primary data where the researcher jotted down field notes which are referred to as textual notes.

3.1.2 Document analysis

Apart from primary data collection, secondary data is also necessary to provide important information in linking the school curriculum with the education program. The utilization of document analysis benefits to the study as data collection from a document study can give background and additional information about the organization being studied (Pershing, 2002). This method of data collection saves time and expenses as the documents are already in written form. Documents can easily be retrieved by the researchers according to their own time. The drawback of using this method is that the possibility of some of the documents being confidential and not accessible.

Documents related to the National Planetarium Kuala Lumpur (PNKL) and Curriculum Standard for Secondary School (KSSM) were selected to be analyzed. The documents were analyzed thematically pertaining to the themes in the curriculum specification for lower secondary school in science subject linking to education activities in PNKL.

DATA ANALYSIS

This chapter provides findings of the research and data analysis. The findings are in two forms which are primary and secondary data. The researcher's field notes from participant observation are the primary data while documents from Planetarium Negara Kuala Lumpur and Standard Based Curriculum for Secondary School (KSSM) for science subject serve as the secondary data. Documents from PNKL and KSSM were analyzed through content analysis.

4.1 Types of education program carried out by Planetarium Negara Kuala Lumpur

The methods used in this study are document analysis and participant observation. This study has found that there are two types of education programs conducted by PNKL which are on-site program and off-site program. On-site refers to the education program within the PNKL and off-site programs refers to programs done by PNKL, but outside the physical building.

Table 2. Onsite Program

Section	Method
Balai Cerap Guo Shou Jing	The observatory is a source used in ancient times to assess the emperor's date for events. Balai Cerap Guo Shou Jing was founded in Gao Cheng, China, by an astronomer. This observatory is important as a calendar source as well as astronomy field for China civilization.
Sculpture	Sculpture is an effort of the Arabs to provide a profound view of the cosmos. From the past, the society in question expanded the field of astronomy to understand the existence of God. In numbers, the Arabic symbol means seven days a week and has to do with space and time.
Balai Cerap Purba	The presence of observatories in a country is seen as the development of civilization. The value of time is gold in which calendars, date and time are significant matters in a nation.
Jam Matahari/ Sundial	A sundial is an instrument that shows the time of day when the approximate location of the Sun in the sky provides sunlight. It consists of a flat plate (the dial) and a gnomon, in the narrowest sense of the term, which casts a shadow on the dial. The shadow conforms various time-lines, which are indicated on the dial to signify the time of day, when the Sun continues to travel through the sky. The Sundial was used before the GMT was set. Local authorities from the past were in charge of time determination. Sundials can be used to determine the date and month at a particular time. There is also a sundial named Jam Matahari Merdeka which functions according to the latitude and longitude in the planetarium.
Batuan Buruj	The Sculpture of the Constellation was placed to give an aesthetic view and refreshing atmosphere which is suitable for visitors' photography moments. The sculpture also contained information explaining the constellation displayed.
Lobby of the planetarium	This area is upgraded in accordance to the exhibition theme which is 'Unstability in Space'. The finishing of the ceiling and the arch with Light Emitting Diode (LED)was made based on the stipulated theme.

Table 3. Off-Site Program

Program	Explaination	
Kejohanan Roket Kebangsaan	Kejohanan Roket Kebangsaan is a yearly program organized by The National Planetarium Kuala Lumpur (PNKL) in collaboration with The Ministry of Energy, Science, Technology, Environment and Climate Change (formerly known as MESTECC), Ministry of Education, Universiti Teknologi MARA and Majlis Amanah Rakyat. This program supports science space education across the secondary school curriculum. Participants involved are students who come from government school and Maktab Rendah Sains MARA selected all over the nation from 13 to 16 year old.	
AstroCon National Space Week	Held in conjunction with World Space Week Malaysia in 2018, where PNKL worked closely with the Ministry of Energy, Science, Technology, Environment and Climate Change (formerly known as MESTECC). The details of the activities are as follows:	
	ISS Contact: Communication with astronauts	This activity is an opportunity for school children to interact with astronauts at the International Space Station (ISS) using the equipment and facilities of the Microsatellite Station National Planetarium.
	Origami Rocket:Co-Organizer of Utusan Karya Sdn Bhd.	Utusan Karya Sdn Bhd jointly organized the origami rocket event. Besides developing origami rockets, participants were also provided with an overview of the types of rockets and paper.
	Saturn in Heaven	Saturn planet observation took place with the installation of several portable telescopes in the stairwell of the PNKL. The presence of many local astronomical groups were included in this operation. In addition to the planet Saturn, knowledge about constellation, stars and other celestial objects found in the universe were also shown to the public.
	MiSI SpaceUp Unconference	Inclusive forum which was conducted to allow open discussion about the Malaysian space industry among activists, experts, academics, industry and space enthusiasts. The Malaysia Space Initiative is jointly organizing this operation (MISSION).
	National Astronomical Convention (ASTROCon)	This activity was a scholarly debate on the subject of Flat Earth or "Flat Earth" by several panels of local experts. The activity was aimed at attracting as many as possible astronomical activists around the country in general and around the Klang Valley in especially.
	Sun observation	During World Space Week, observation of the Sun using a handheld telescope was open to the public.
	The Little Space	The "Space Unites the World" hands-on activity of Si Cilik Angkasa was available to students from kindergarten to primary school.
	Science Technology Education Festival (SCITECH) 2018	The national event known as the Science Technology Education Festival (SCITECH 2018) was organized by the Science Education Department, Faculty of Education UiTM with the association of the Ministry of Education Malaysia (MOE) and the Ministry of Energy, Science, Technology, Environment & Climate Change (MESTECC). SCITECH 2018's partners include the City of Kuala Lumpur, National Planetarium Kuala Lumpur (PNKL), Institut Fizik Malaysia (IFM) and STEM@UiTM. The Faculty of Education, Universiti Teknologi MARA (UiTM) organized the SCITECH 2018 program to achieve the goal of reinforcing science components for school students across Malaysia. With the patronage of the PNKL, SCITECH 2018 was organized under the World Space Week

4.2 Alignment of Standard Based Curriculum for Secondary School for science theme with the Planetarium educational program.

Oriented on the four subject areas of biology, chemistry, physics and earth science, the content for the Science Curriculum Standard Form 1 to Form 5 is built. All four topics are grouped into five themes that are Scientific Methodology, Maintenance and Continuity of Life, Exploration of Elements in Nature, Energy and Sustainability of Life and Exploration of Earth and Outer Space. Nevertheless, it does not consist of all five themes for each learning year. Every theme is segmented into a few learning areas in the Content Standard and Learning Standard. The learning area is detailed in both themes.

Based on the learning field, the Content Standard can have one or more learning standards that have been conceptualized. In the cognitive and affective fields, the Content Standard is written based on the hierarchy. The general statement consisting

of knowledge components, scientific abilities, is the Content Standard statement. In accordance with the expected learning level, thinking skills, scientific attitudes and noble worth. The Learning Standard is the objective of learning, written in the form of measurable conduct. The learning standard included the scope of learning and scientific skills as well as thinking skills that require the need for pupils to do science to acquire the intended scientific concept. Essentially, the learning standard is planned from simple to complex through the hierarchy, but the Learning Standard sequence could be configured to meet the need for learning. The Content Standard for the affective domain is usually presented at the end of that specific Content Standard's cognitive domain, but not all cognitive domains of the Content Standard will be done with the affective domain. The growth of the pupil is prescribed by a term or phrase with one or more specifications that indicate a standard in the context of a learning outcome. Teaching and learning should be holistically designed and incorporated to assist a few learning standards to be achieved depending on the adequacy and standards of learning. In the content standard, teachers should evaluate both the learning expectations and success criteria prior to preparing the teaching and learning activities. When the content standard for the cognitive domain is executed, the content standard for the affective domain is implicitly inserted. To meet the needs for learning to suit the student's skill and style of learning, activities can be diverse to achieve one content quality. In addition to using technology as a medium to efficiently achieve the content quality, teachers are encouraged to schedule activities that require the pupils to generate and be actively engaged in analytical, objective, innovative and creative thinking.

Table 4. Theme Organization of Science Curriculum Standard

Program	Explaination
Themes in Science Lower Secondary School	In the national standard-based curriculum, earth and space exploration and the scientific method are part of the themes. It is intended that learners understand about Earth's motion patterns, phenomena such as stars that can be seen in the night sky.
Science Form 1 Theme 5: Exploration of Earth and Space	The purpose of this theme is to provide an idea of the Earth's structure and how geohazards occur. With the advancement of science and technology, the effects of geohazards can be minimized on humans and the environment. This theme also offers a deeper understanding of fossil fuel formation, renewable energy options and their uses.
Science Form 2 Theme 4: Earth and Space Exploration	This theme is designed to provide insights into the universe, the stars and the solar system. Focus is placed to the nature of different galaxy forms and how the stars are categorized. In the Solar System, the planets are examined to build knowledge that existence and continuity of life can only be sustained by planet Earth. Other phenomena in the Solar System and how they affect life on Earth are also given the main emphasis. Hypothetical problems or anomalies are implemented to promote the analytical and imaginative thinking of pupils.
Science Form 3 Theme 5: Earth and Space Exploration	This theme provides an insight into the impact of the activities of the Sun on the weather in outer space, which also significantly influence life on Earth. This theme also explores technological growth in the exploration and astronomy of outer space.

Findings are in two forms which are primary and secondary data. The researcher's field notes from participant observation are the primary data while documents from Planetarium Negara Kuala Lumpur and Standard Based Curriculum for Secondary School (KSSM) for science subject serve as secondary data. Documents from PNKL and KSSM were analyzed through content analysis

Research Objective	Findings	Summary
RO 1: To investigate the type of education program conducted by Planetarium Negara Kuala Lumpur and target audiences.	Type of education program On-site program Off-site program	There are two types of education programs conducted by Planetarium Negara Kuala Lumpur which are on-site program and off-site program. The target audiences are broad ranging from children to adult.
RO 2: To analyze how education programs by Planetarium Negara Kuala Lumpur align with the Standard Based Curriculum for Secondary School for science.	Themes in science curriculum syllabus Theme 5 Form 1: Exploration of Earth and Space Theme 4 Form 2: Earth and Space Exploration Theme 5 Form 3: Earth and Space Exploration	The themes in Standard Based Curriculum which can be linked to education program and content knowledge in themed exhibition are Exploration of Earth and Space in science subject for lower secondary students.

CONCLUSION

The first research question investigated the type of education program carried out by PNKL and their target audiences. Education program is referred to as an education curriculum developed by an institution or education ministry that considers the subject's learning progress in formal education. The curriculum may be institution-led programs that increase awareness and interest in specific subjects. In this context, PNKL is an informal science institution that serves and provides education programs that dictate the learning progress of science subjects in formal education. Based on the findings previously mentioned, there are three types of education program conducted by PNKL; on-site program, off-site program and online program. On-site programs are programs that take place at the national planetarium. PNKL has held numerous exhibitions and a number of programs that take place on-site. With good facilities that could accommodate huge numbers of visitors at a time, the national planetarium is a perfect fit when it comes to learning settings in education.

Off-site programs are programs that take place outside of the planetarium. Programs such as Kejohanan Roket Kebangsaan which was conducted at Universiti Teknologi MARA shows that informal science institutions like The Planetarium Negara Kuala Lumpur has been working together with The Ministry of Education and The Ministry of Science and Technology, Climate and Change (MESTECC) to inculcate Science, Technology, Engineering and Mathematics (or known as STEM) education throughout the nation. PNKL does not only serve as a main tourist attraction with a huge target audience and visitors - the institution also has the advantage of various stake holders to work with. Planetariums are not just for learners who are young but the target audiences is wide-ranging. In order to attend public events, they invite everyone from the country. The planetarium is visited by several community groups and specialist organizations for lifelong learning opportunities. The world today is plagued by many STEM-related matters. In order to make good decisions and foster strong, global effects, it is the public who have the capacity to understand these issues. In these matters, planetariums educate the public.

5.1 The inclination of themes in the Standard Based Curriculum for Secondary School for science subject towards education programs conducted by PNKL

In the national standard-based curriculum, earth and space exploration and the scientific method are part of the themes, it is anticipated that students are taught about Earth's motion patterns, and phenomena such as stars that can be seen in the night sky. The inclination of themes in the Standard Based Curriculum for science subject for Lower Secondary School is through the content of exhibition in the planetarium. The zones mentioned in the findings are Zone A which comprise exhibition on Universe content and Zone B with Space Exploration content. These two zones show subject matter that can be linked to the school curriculum. The Planetarium exhibition as part of the on-site programs conducted by PNKL which applies a variety of methods in presenting the information of space science, can provide learners with a different learning experience outside from the classroom.

With facilities and fun activities, learners not only gain knowledge but they can also appreciate and incorporate values such as patriotism and the advancement of science and technology. Offsite programs such as Kejohanan Roket Kebangsaan is a competition where participants ranging from 13 year old to 16 year old are expected to design a water rocket to be launched in the air. Through this program, participants may, while designing the water rocket, incorporate 21st century skills such as creative thinking skill, critical thinking skills and collaborative skills as suggested in the Standard Based Curriculum for Secondary School (KSSM). These are the attributes stated in KSSM and the education program organized by PNKL has met the criteria to incorporate the scientific attitude and noble values in the learning activities. Apart from that, Space Art Series is an example of an online program conducted by PNKL. Each episode contains a 10 to 12 minute video which highlights different topics such as Knowing Space, Moon, Moon Phases, Solar System, Man on Moon, Galaxy, Spacecraft, Constellation and Alien Planet. This

series is very useful as learning materials for students from lower secondary school to learn about space science under the theme of Earth and Space Exploration in the science subject within the context of learning standards. Additionally, the series has suggested learning activities suitable for each topic discussed in each episode. Teachers, parents, instructors and others can make use of this video as a learning activity while teaching space science to the learners. The activity is fun and can help students to learn more about astronomy.

CONCLUSION

In conclusion, planetarium pedagogy from an instructional perspective is beyond mere surface visits and the use of external sources. Learning space science will be more efficient, fun and meaningful through visits to informal science institutions or science centers. Learning should be optimized and be made truly enriching by visits made through careful planning where visitors have to perform activities during the visit. In this context, instructors play an important role where discussion should be conducted after the visit to deduce the activities performed so that the anticipated learning outcomes or the success criteria could be achieved by the learners. Instructors should make use of planetarium pedagogy as part of learning theories, approaches and strategies as this informal science institution can serve and provide the best services and practices to meet the needs in learning space science. In this study, it has been discovered that the inclination of themes in science subject for lower secondary school which is Earth and Space Exploration could be a huge help in assisting students to understand better, thus drawing students' interest and attention to learn science, with the hopes that it will eventually lead to the students developing a deep interest towards STEM-related careers in future. Planetarium pedagogy is comprehensive and the target audiences for the education program is not just for young learners but also the general public to best experience and appreciate space science and astronomy that has contributed so much to the development of the nation.

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