

Visitors Experience and Non-Formal Science Learning (NFSL) Approaches in Malaysia

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Abstract

This paper explores two issues, one, Non-Formal Science Learning (NFSL) approaches offered at the National Science Centre (NSC) through visitors' service experience and its influences on services; and two, the various theories on non-formal learning and its applicability for conceptualizing the NFSL. The pre-interview was intended to clarify on the variables for conceptualizing the effectiveness of NFSL at the science centre. Fifteen (15) visitors were interviewed to examine the learning approaches that visitors appreciate (physical servicescape, social servicescape and service delivery) and how these lead to the effectiveness of the main services offered by the science centre. The preliminary survey reveals that 90% of the respondents felt that the physical servicescape of the premise affect mood during the visit and highlighted specific issues on the cleanliness, temperature, odours and functionality of a few equipment/ exhibits in the galleries that may turn off their mood during the visit. 80% of the respondents highlighted social servicescape was missing. The staff at the centre was hardly seen on the ground, and respondents added that the lack of help from the staff might influence their decision to revisit the science centre in the future. Service delivery was assessed on two factors, namely the parking facility and service speed. Though the respondents complained about the location of the parking area, the majority of them agreed that the service speed level was acceptable. 95% of the respondents admit learning at least one new thing about science, technology, and innovation (STI) during the visit. Overall, 70% of the respondents enjoyed their visit to the NSC. The Environmental Psychology Theory, Social Learning Theory and Experiential Learning Theory are potential theories in conceptualizing and understanding the visitor's services experience to overcome issues on decreasing interest of the public in STI awareness programs and increase the STI popularization in the society.

Keywords: visitor's service experience; servicescape; non-formal science learning (NFSL); science centre

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I. INTRODUCTION

In today's innovation-led and knowledge-intensive economy, the Science, Technology, and Innovation (STI) are critically essential for society's socio-economic development, especially for a developing country like Malaysia. According to the Academy of Science Malaysia (2015), the country will need at least one million science and technology (S&T) workers by 2020 based on 6% projected annual economic growth, national key economic areas (NKEAs), and the emergence of new technology-driven sectors. Out of those one million S&T workforces required, half million of them are expected from the graduates of at least degree or diploma levels in various STI fields. Whereas the remaining half million are the skilled workers that completed technical or vocational training needed for the support services in the emerging STI industries. However, this targeted skilled STI workers would only make up 3% of expected 15 million required workforces in 2020, compared to other most advanced countries where their skilled STI workers build up almost 30% of the total workforce needed (Academy of Science Malaysia, 2015). With that, continuous efforts are essential to attract Malaysians interest (especially the younger generation) towards the STI fields through various STI enculturation activities or programs with Non-Formal Science Learning (NFSL) approaches.

The Malaysian government realize on the importance of STI enculturation in the society and accelerate the initiatives through the establishment of a few public NFSL institutions under the Ministry of Science, Technology and Innovation (MOSTI) including the National Science Centre, NSC (MOSTI, 2016). The NSC is a public science centre with the vision to be a leader in non-formal STI learning and drive Malaysian towards creative and innovative thinking (NSC, 2011b). Their mission is to promote lifelong learning of STI and inculcate the spirit of innovation in society, especially amongst the younger generation (NSC, 2011a). Such efforts are essential to nurturing the interest of young talent and helping the government maintaining the demand for skilled workers or STI experts needed for future development as well as the economic stability within the race of IR 4.0.

NFSL: MALAYSIAN EXPERIENCES

The non-formal learning (especially in science), offers multiple perspectives on learning since not everybody learns the same way where some people may do best by trying out practical exercises or simple hands-on activities (Chik, Ismail, & Azman, 2010). The non-formal learning is intentional, usually structured with pre-planned activities, but does not necessarily lead to certification and without any specific syllabus to be followed or completed (Ainsworth & Eaton, 2010; Donitsa-Schmidt & Zuzovsky, 2018; Moldovan & Bocoş-Bințișan, 2015; Tudor, 2013; Werquin, 2010). The NFL approaches have been mentioned by the Ministry of Education Malaysia (MOE) as early as 1960's when they started the adult education initiative through 'adult school program' with the main objective to defeat the illiterate problem in the society, especially in the rural area (Mohd Azhar, Muhammed Fauzi, & Othman, 2003). Then, the non-formal learning approaches evolved accordingly to cater to many forms of learning objectives primarily related to the skilled and semi-skilled talent needed by the country. Places like community learning centre were

established to encourage learning to happen through a non-formal education as a platform to meet local needs (Norqvist & Leffler, 2017). In Malaysia, the community learning centre such as GIATMARA offers short courses and training (as well as full-time courses) related to skilled and semi-skilled industries such as automotive, construction, bakeries, beauty, and many others (Chik et al., 2010).

The Malaysian Education Blueprint for 2013-2025 has highlighted how the learning of Science, Technology, Engineering and Mathematics (STEM) can be enhanced through the integration of formal, non-formal and informal approaches (MOE, 2018). The form of formal learning here refers to formal education based on a national curriculum where the science learning style will be shifted from the routine 'chalk and talk' or memorising towards hands-on learning approaches with a lot of science experiments and activities. The non-formal learning refers to a carnival, festival, a school trip to non-formal learning institutions (including the science centre), science camping, science workshop, and many other extra-curricular activities (MOE, 2013, 2018). Whereas the informal learning usually happens accidentally within a day to day routine places such as chatting with students during break time in school, catching up some educational information while listening on the radio or getting new information from several organized events in school even as a passive audience (Eshach, 2007).

The non-formal learning setting becomes one of the reliable educational sources, especially in science learning and teaching (Çil, Maccario & Yanmaz, 2016; Falk & Dierking, 1997; Rennie & Mcclafferty, 1995). The National Science Teaching Association, USA, recommends the science teaching promotion using learning experiences within non-formal settings for all level of students (Çil et al., 2016; NSTA, 2012). Therefore, visiting Non-Formal Science Learning (NFSL) institutions like a science centre can potentially help both students and teachers visualized the science phenomenon better through the exploration of interactive exhibitions and hands-on science programs. The Ministry of Education Malaysia have raised their concern to reduce the examination routine as the primary evaluation method in assessing student performance and started in 2014, the psychometric and school assessments methods were introduced (Wan Mustapha, 2017). The focus for student's assessments are not solely based on formal learning with exam-oriented only but also involved their knowledge, potential and talent gained from other sources of learning, including from the NFSL approaches.

Even though there are many high potentials offered by the NFSL institutions like the National Science Centre (NSC) and full supports given by the government, these public institutions face enormous challenges including the visitor's complaints related to service experience and low participation in its national STI programs and policies. Public Awareness of Science, Technology, and Innovation Malaysia's Report⁴ by MASTIC (2014) showed that less than 1.9% of Malaysians visited the National Science Centre (NSC) yearly. Likewise, less than 4.5% of Malaysian visited the well-known NFSL institutions annually, including the NSC, the National Planetarium and the Petrosains (Academy of Science Malaysia, 2015; MASTIC, 2014). Compared to other higher developing countries like Singapore and China, they perform far better with at least 15-20% of its citizen visited their national science centre or science museum yearly (Hunter, 2017; Qi, 2017; Science Centre Singapore, 2013). Thus, the objectives of this paper are two-

⁴ Public Awareness of Science, Technology and Innovation Malaysia report by MASTIC was released once in 5 years and to date the report in 2014 is consider as the latest one.

fold; one, to examine the non-formal science learning (NFSL) approach offered at National Science Centre (NSC) through visitors' service experience and its influences on services; and two, to analyse various theories on non-formal learning and its applicability for conceptualizing NFSL approaches at the science centre.

II. RESEARCH METHOD

A preliminary interview was carried to gauge insights on the role of the science centre and Non-Formal Science Learning (NFSL). The interview is a first step in identifying how visitors service experience (VSE) can lead to effective non-formal learning with the objective of developing a conceptual framework on VSE and effectiveness of NFSL. Interview with 15 walk-in respondents at the National Science Centre (NSC), Kuala Lumpur, Malaysia was implemented at the end of their visit to clarify further important factors of VSE and effectiveness of NFSL. This number of participants were considered sufficient as the same numbers were also used by Yiu, Kong, Fong and Chan (2010) in their preliminary study on clinical observation of laryngoscopes patients. The preliminary interview was done with convenient approaches as it allowed faster recruitment for a small sampling size (Inthiran, Alhashmi, & Ahmed, 2015). A set of interview questions was prepared as a guide to get insight from the actual visitors about their experience at the science centre that potentially influence the effectiveness of NFSL approaches. Among the questions asked were whether they enjoy the visit; was the visit considered as educational; what their learning was from the visit; their opinion on the facilities, the equipment/ exhibits in the galleries; the ambient and physical aspect of the premise and how they were served (entertained) during the visit.

III. RESULTS AND DISCUSSION

The survey was carried out in a day during a weekend. Most of the visitors were families with young kids. The findings revealed that there are several factors related to the visitor's service experience that potentially affect the NFSL at the science centre, especially from the servicescapes and employee's service perspective. The demographic profile of the respondents consisted of 60% female and 40% male. Most of the respondents, 47% were between 13-17 years old, 40% above 18 years old, and 13.3% were less than 12 years old. 54% of the respondents were secondary school students or have entered the secondary school level. Meanwhile, 13% of them were primary school students, and the balance of 33% were either college students or have entered university level.

The first part of the interview was on physical servicescape or physical environment. The preliminary survey reveals that 90% of the respondents feel that the physical servicescape of the premise affect the visitor's mood. Respondents highlighted specific issues on the cleanliness, temperature, odours, and functionality of a few equipment/ exhibits in the galleries that turned off their mood during the visit. The second part of the interview concentrated on social servicescape. Almost 80% of the respondents mentioned that the staff were hardly seen on the ground. They added that the lack of help from the staff might influence their decision to revisit the centre. The third part of the interview was on service delivery. 40% of the respondents complained about the parking facility as the area located is a bit far from the main building and seems unfriendly for a family with young kids or elderly. However, the majority

of them agreed that the service speed level was acceptable, and some improvements can be made on the queuing system and the information counter service. The effectiveness of the non-formal learning was assessed on three areas, the learning obtained, the service experience and the importance of VSE. 95% of the respondents admit that they did learn at least one new thing about STI during the visit. 70% of them enjoyed the visit to the NSC despite a few issues on their service experience. However, some of them did mention that an excellent visitor's service experience will make their non-formal science learning (NFSL) more enjoyable at the science centre. Findings from a preliminary survey done at the NSC with the actual walk-in visitors reveal that there were indications of visitor's service experience that potentially influence the effectiveness of NFSL approaches at the NSC. The findings of the preliminary survey in this study are summarised, as in Figure 1.

Visitor's service experience is crucial, especially within the public services like the science centre where the service delivery and servicescapes (physical and social) style in the institutions influence the approach-avoidance behaviour of the visitors. The service experience is defined as the service encounter and/or service process that creates the customer's behavioural responses emotional and cognitive which result in a mental mark or a memory (Collier, Barnes, Abney, & Pelletier, 2018; Edvardsson, 2005). In the science centre, the experience started from the moment visitors enter the premise, experience the exhibitions and final finally leaving the place. Service experience takes into account the entire process of services and considered as an integrated conception that combines functional and emotional attributes (Chang & Huang, 2016; Wong, 2013).

Western literature reveals that social interactions, including museum facilitators or explainers, significantly enhancing visitors' learning by influencing their behaviour, attitudes, knowledge, content and action after the visit (Kamolpattana, Chen, Sonchaeng, Wilkinson, & Willey, 2015). The facilitation conditions were clearly explained in a study done in Thailand Science Museum by Kamolpattana et al. (2015). In this study, it was found that facilitation or helps

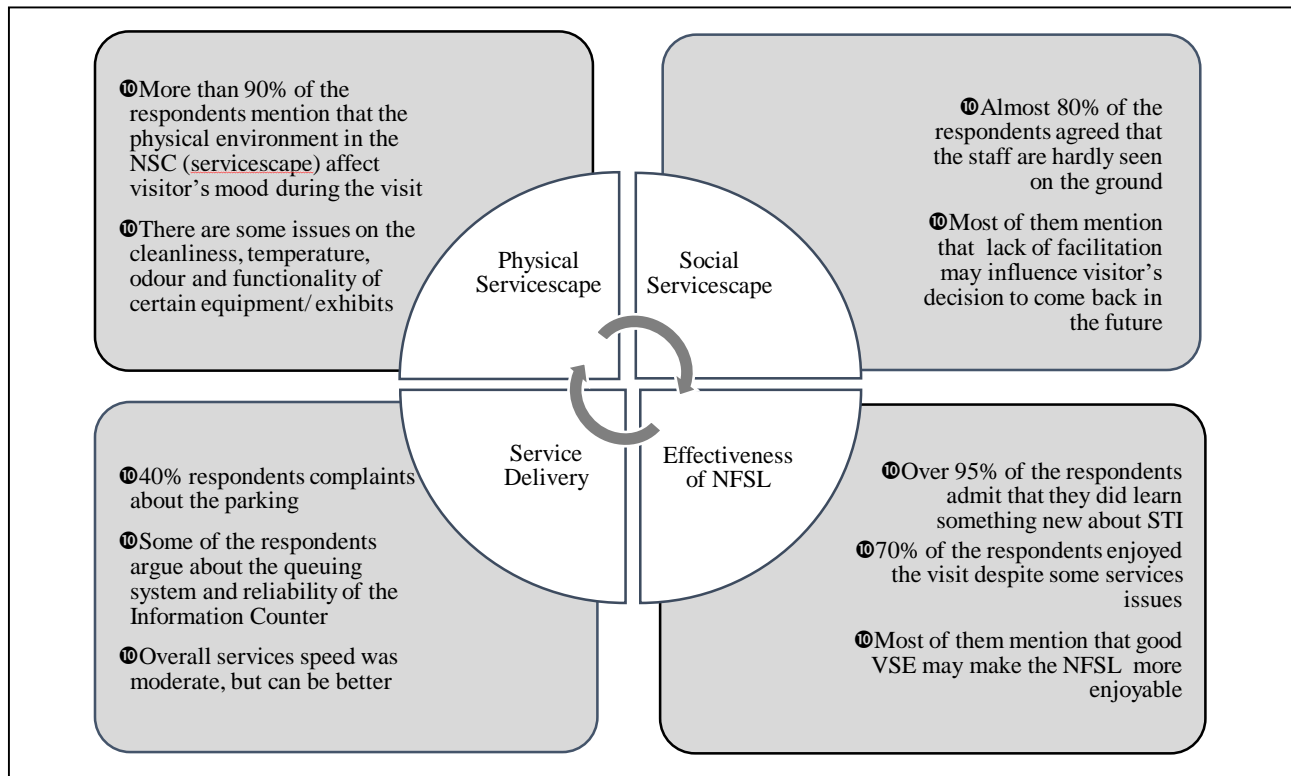


Figure 1
 Preliminary Survey Findings

from the staff is needed to provide opportunities for Thai people to interact with the science centre more expressively. It is common for students to be quiet and refrain from speaking in the class to pay attention to the teacher's instructions in most of Asia's culture. Thus, it is understandable why within the Thailand culture, guidance and facilitation from the staff or volunteers are needed to encourage them actively involved in any NFSL activities or program within a science centre setting. As one of ASEAN countries, Malaysian culture and behaviour may also highly close related to Thai people, and this may explain why our learning style a little bit different from western people. Most of the western science centres or museums practice 'self-exploration' style of learning that suit their behaviours and preferences; however, this might be less effective from the context of ASEAN culture that is very rich in politeness and shyness as Malaysians.

Moreover, the museum industries and other places with a similar setting (e.g., the science centres, science museums, and planetariums) have changed the way they operated. The museum's industries have shifted from focusing only on products, collections, displays or exhibits to another perspective where they started to emphasise on the audients (visitors) and services experience. The shifted focus has been mentioned by Su and Teng (2018) that identify the visitor experience as one of the core products in a museum setting. This experience is not limited to the surrounding setup of a museum only, but also involve the services started from its entrance, exhibitions, amenity areas (gift shop, food service and restrooms), to the micro-architecture of the building (Su & Teng, 2018). Other objects and

interpretive materials such as media, labels, and brochures are also part of the physical context that contribute to the visitor's service experience (Falk & Dierking, 2013; Su & Teng, 2018). Thus, by enhancing the visitor's service experience including the promotional materials, the science centre becomes not only the favourite spot for kids but also other groups of potential visitors, which are the youngsters and adults.

It is no doubt that the science centres are the place for everyone in society, but toddlers (aged between 3-6 years old) and kids (aged between 7-15 years old) tend to love them better and hardly reject the place. Most of the time, kids and a young family with toddlers are interested in visiting the place due to its flexible learning style, which emphasises edutainment and freedom of exploration that suits the active behaviour of these young children. In Malaysia, instilling interest in STI before the children reach 15 years old is critical since the influence of science and technology (S&T) understanding at this age may affect their consideration to pursue their study in science and technology (S&T).

The initial learning process occurs at the phase of introduction to learning. It happens right after the babies were born until they are about to enter kindergartens or playschools (0-5 years old). At this phase, babies learn spontaneously almost all the time with guidance from the parents, grandparents, sibling, and caregivers. Ainsworth and Eaton (2010), reveal that during every early childhood informal learning phase, learners will learn basic concepts such as identifying colours and shape, classifying which one is which? (e.g., is this a cow, cat, buses, ball, etc.), observing what is happening (e.g., watching a bird flying through the air and make a conclusion that the bird is flying), testing and experimenting (e.g., if I poke this, what will happen?), communicating, measuring and counting. Once the learners get to engage in organized learning, they enter the realm of either *non-formal* or *formal learning*. In most developed countries, the early non-formal learning experiences for young are operated on a fee-for-service basis (Ainsworth & Eaton, 2010). They added that if the parents can afford to pay for the fees, their children will have higher chances to participate. Otherwise, the child may remain immersed in an informal learning environment until they enter the school, the first formal learning experience. The non-formal learning places for young children include playschool, parent-baby learning program, parent-toddler learning program and learning session or programs organized by science centres, museums, zoos, or other learning organizations.

The Non-Formal Science Learning (NFSL), through institutions like science centres and science museums, has a long history in helping to promote, stimulate interest, and create awareness about STI. An international study conducted by a consortium of 17 science centres in 13 countries known as The International Science Centre Impact Study reveals that both adults and youth that were visiting a science centre was seen to significantly correlated with increased: understanding and knowledge of STI; curiosity and interest of STI; engagement and interest with science as a school subject and technology-related out-of-school activities for youth; and personal confidence and identity in STI (Falk, Needham, Dierking, & Prendergast, 2014). The science centre offers non-formal science learning (NFSL) approaches through its exhibition's galleries, education programs, and varieties of STI activities. Most science centre emphasizes the hands-on elements in which visitors are allowed to touch and use the display material or subject in the galleries to understand the science concepts behind each exhibit. By doing so, the visitors are practising individual experimenting acts as in scientific research such as trying, observation, investigating, and learning by doing to get the

desired results or answers. The ability to use the five human senses, which are the touch, smell, taste, listening, and talking, makes the learning approaches in the science centre more realistic and attracts the interest of young children that is full of curiosity about the environment surrounding them.

The National Science Centre (NSC) in Malaysia for example, offers special programs tailored to a specific group of audiences namely Little Explorer for 3-4 years kids, Budding Scientist for kids at 4-6 years old, Science Wonders for primary school students, Science Trend for secondary school students and many more. The approaches are more relaxed with many hands-on activities that encourage the free flow of learning and encourage the participant to try the exciting experiment. The learning that happens in science centres are closely related to non-formal approaches since all visits and activities occur are intentionally and pre-planned (in some circumstances). Moreover, the visits and activities in the NSC are conducted without restriction to any particular curriculum or syllabus; instead, implemented creatively intending to achieve the learning goals sets earlier.

In Malaysia, most of the parent knows that the child's learning experience happens as early as 4-6 years old, but not aware of what is non-formal learning means. Due to the great attention given to the importance of formal learning in society, children are introduced and enforced to the formal way of learning. At this early age, they enter either the private or public pre-school. The approaches that mimic almost every style of formal learning make the lesson more or less similar to formal school and engage the exam system as early as 4-6 years. The children were required to learn quick ways on how to read, write, memorize, and understand specific calculations (mathematics) in some private pre-school like Brainy Bunch, Smart Readers, Little Caliph, and few others with quite expensive fees. Other parents will send their children to government pre-school, but most of these facilities are limited and can only accept 5-6 years old kids based on available seats with priority to lower-income families. Most of the out-of-school programs were known as extra-curricular activities, and the students get the chance to join the programs during their school trip to the non-formal institutions either in pre-school, primary, or secondary schools. The NFL happens during these school trips, but they may or may not realize it even though the trip is intentionally organized.

The Malaysia Education Development Plan 2013-2025 also focused on the subject of science and technology to be strengthened in schools and encourage out-of-school activities that benefited science learning (MOE, 2013). Teachers and students are encouraged to take the opportunity to visit NFSL institutions like the National Science Centre, National Planetarium, and Petrosains to take the more considerable learning advantages at these institutions that can be fun, relevant and enriching with varieties of hands-on activities (MOE, 2013). Knowledge application is not restricted within a compounded classroom alone but can instead be achieved creatively through non-formal activities that potentially open student's mind and refreshingly inspired. Furthermore, the science centre also becomes an excellent platform for the public to gain general knowledge about Science, Technology, and Innovation (STI) due to its flexibility of delivering the understanding. The NFSL institutions (like the NSC) have their roles by providing the public with access to interactive and hands-on science learning alternatives, raising awareness, promoting interest, strengthening the trust and willingness of people to participate in STI, especially to the students and youngsters. A science centre offers visitors several experimental options and provides the scope of 'doing science' through which they target the opportunity to discover the scientific concept themselves.

A few relevant theories were explored to understand further the learning style happens in the science centre. The Environmental Psychology Theory by Mehrbean and Russell (1974) explain well about the visitor's service experience aspects (service delivery, physical servicescape and social servicescape) that predicted to influence the visitor's approach-avoidance behaviour after the visit. The other theories related are Social Learning Theory by (Bandura, 1977) which explain the learning happens through the social cognitive ways and Experiential Learning Theory by Kolb (2015) which closely related to the effectiveness of NFSL approaches at the science centre.

The learning style in the museum (and science centre) setting is considered the unique qualities of the environment or the surrounding area in the premise (Berry & Mayer, 1989). The Environmental Psychology Theory explains about how organisms respond in unison to objective stimuli that are present in the spatially restricted area where this perspective was applied in stimulus-organism-response (SOR) model by exploring how people react to actual stimuli in spatially bounded consumption setting (Barker, 1968; Rosenbaum & Massiah, 2011). The environment's setting (physical and social appearance of the premise), including the service delivery elements) has a significant influence on the emotional and physiological aspects of the customers that, in return, affect the customer's behavioural response of either stay or leave. Customer approaches or avoidance decisions to certain services or places are influenced not only by physical stimuli (servicescape) but also by social, humanistic stimuli (Rosenbaum & Massiah, 2011). These conditions may explain how the NSC's staff treatment to their visitors during the preliminary survey could influence the overall mood of the visitors throughout the visit. According to Line, Hanks, and Zhang (2018), social servicescape is another crucial part of the total service encounter. It strongly influences various emotions, attitudes, and behaviours of the focal customer, such as pleasure, delight, anticipated satisfaction, place attachment, and word of mouth. The behavioural responses in the SOR model by Mehrabian and Russell's (1974) is illustrated as in Figure 2.

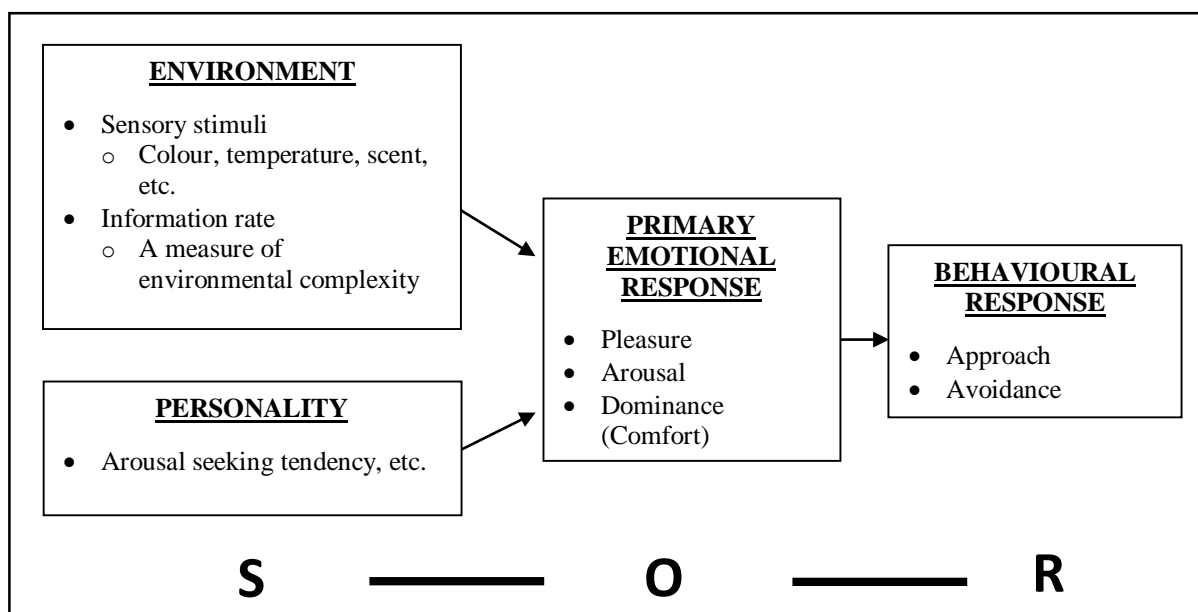


Figure 2

SOR Model by Mehrabean and Russell (1974)

The applied SOR model in Figure 2 explains how the customers and employees (represent by the organisms in the SOR Model) behave towards certain variables in the service environment that result in approach-avoidance behaviour to the services through the whole services experience from the perspective of service delivery, physical and social servicescape. Understanding the environments that best suit the behaviours of both employees and customers may help the management to provide excellent services that encourage the customer to stay longer, maximise the length for exploration and increase the intention to re-visit the place while eliminating the avoidance behaviours. An excellent physical environment setting or in this study known as the physical servicescape (e.g., the sensory stimuli such as the colour of the building or interior design, the scent of the place, temperature, etc.) that suite the preference of the customer will encourage them to stay longer and happily explore the services offered. These conditions (the environmental stimuli) have been mentioned by the respondent of the preliminary survey at the NSC can influence their decision to either stay longer or just leave the premise based on the experiences they had during the visit.

Another theory is Bandura's Social Learning Theory (1978) which explains how the NFSL approaches happen in the NSC. In Social Learning Theory, an imitation of behaviour by an observer happens when a model possesses characteristics such as talent, intelligence, power, good looks, or popularity that appears to be inspiring in observer's perception. In the case of learning behaviour at the NSC, the observer will imitate the enjoyable learning experience that they gain from the visit. This includes any learning activities happen in the science programs that they participate in, observational behaviour of the science actions done by the science facilitators, and interaction of other visitors with the hands-on exhibits in the galleries. This kind of learning best describes how humans, especially children, observe people and the environment surrounding them before later imitates or copies the desirable behaviours.

The learning environment is the key to promoting the development of children (Baniyamin & Rashid, 2016). In the NSC, some of the activities like Let's Experiment Corner and the Science Shows become one of the adorable actions that inspire the visitors to learn and explore further through their observational acts. Most of the time, the observational behaviours on how certain science exhibits works also explain the learning curve that happens through Social Learning Theory at the science centre. From the perspective of services in the science centre, Bandura Social Learning Theory shows the relation of a visitor's service experience and the effectiveness of NFSL through some process of learning and observation. The visitors will give attention to what is happening around them, especially the experience with the services at the premise. Then, the visitors will enter the *retention* phase where they will recognize the behaviour of the people (staff) who are they dealing with and remember the outcome of that interaction. If the service experience were good, the visitors would *produce* positive responses or acts accordingly. This will later *motivate* them to positively continue the mission to explore and observed many other forms of NFSL offered in the NSC. In another perspective, people's behaviours that mimic others through modelling and observation are the best facts that reflect customer's approach-avoidance behaviours. This situation portrays a very close relation to the Bandura Social Learning Theory, where the interaction between cognitive, behavioural, and environmental

surroundings the individual may influence their behaviours, thought, and actions. The Social Learning Theory Bandura 1978 is summarized as in Figure 3.

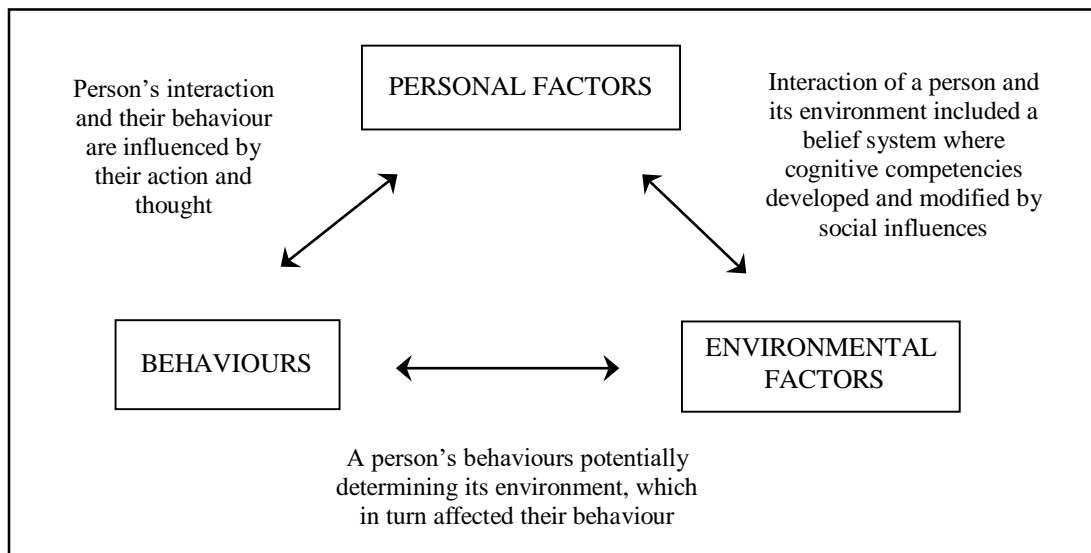


Figure 3
Summary of Bandura Social Learning Theory (1978)

Another critical theory that explains well on the NFSL approaches at the science centre is the Experiential Learning Theory by Kolb (2015). Based on this theory, the learning experiential is defined as a process whereby the knowledge is created through experience transformation and resulted from the combinations of transforming and grasping the experience itself. Baniyamin and Rashid (2016) explained that non-formal learning in the museum (and science centre) as we know today, begins with the understanding of the Experiential Learning Theory. They spark a knowledge of the museum's (and science centre's) environments and its contents that potentially influence visitor's learning effectiveness when all the four stages of the experiential learning cycle are in place. The experiential learning cycle is explained in Figure 4.

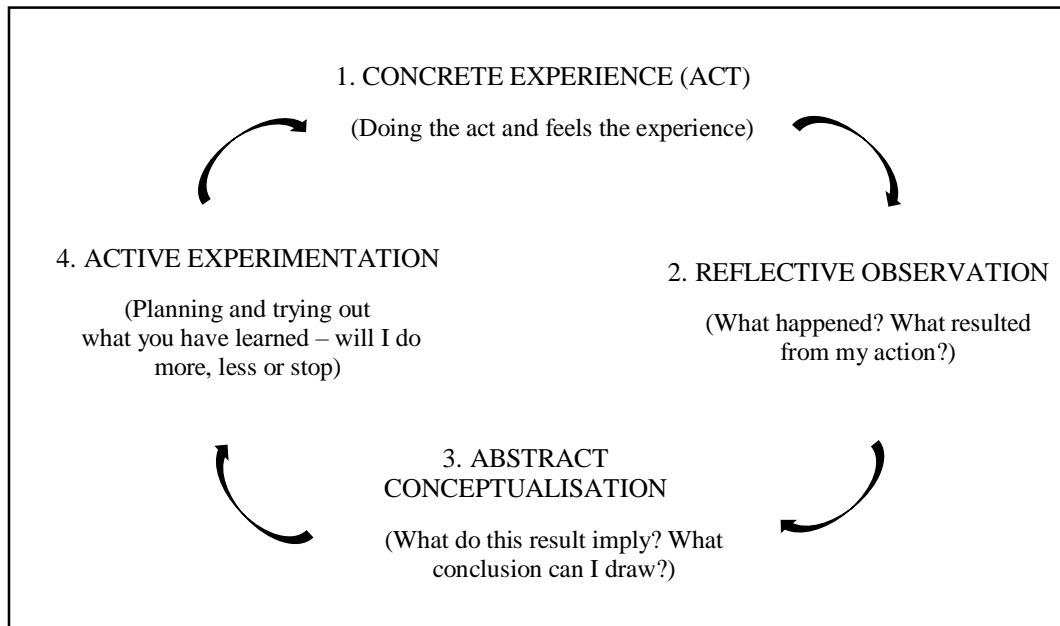


Figure 4
The Experiential Learning Cycle (Kolb, 2015)

The Experiential learning theory takes a holistic approach to how experiences, including cognition, environmental factors, and emotions, can potentially influence the learning process. As an example, almost all the exhibition galleries at the NSC adopt the concept of exploration, which requires the visitors to learning by doing or having their own self-experience with the science exhibits. This is the first stage in the Experiential Learning Theory cycle that is known as *concrete the experience* where the individual acts on their exciting subject to get the experiences. The visitors also need to interact with the exhibits in the galleries that are mostly interactive and hands-on in order to understand the learning objectives. The visitor's interaction with the exhibits will produce the results or outcomes based on the action (or experimentation) done by the visitors. This will encourage the *reflection observation* to happen where the visitors will review or reflecting the experience that he/ she just had. At this stage, the visitors were observing what is happening on their interaction with the exhibits and the result of their actions. The visitors will then make an *abstract conclusion* from the experiences they gained and assume what they had learned from those experiences. It encourages them to think of what the result implies from the series of actions, and there is any conclusion that they can make from the activities.

Lastly, based on the conclusion made, the visitors will have the tendency to try out again what they have learned from the series of trials. They will now start to plan future actions towards the subject of interest/ exhibits and decide whether to do more trial, reduce the error, or just quit the act that proven to be ineffective. At this stage, the visitors are already at the *active experimentation* stage where most of the Experiential Learning Cycle happens, and

the individuals who have done the activities getting the learning outcomes. The visitors are now will feel motivated to try out more exhibits and actively experimenting with it as they are now able to plan and trying out what they have learned before. With that, the visitor's learning experience and educational values of the visit will be increased. In summary, the theories explained earlier are reflected in Figure 5.

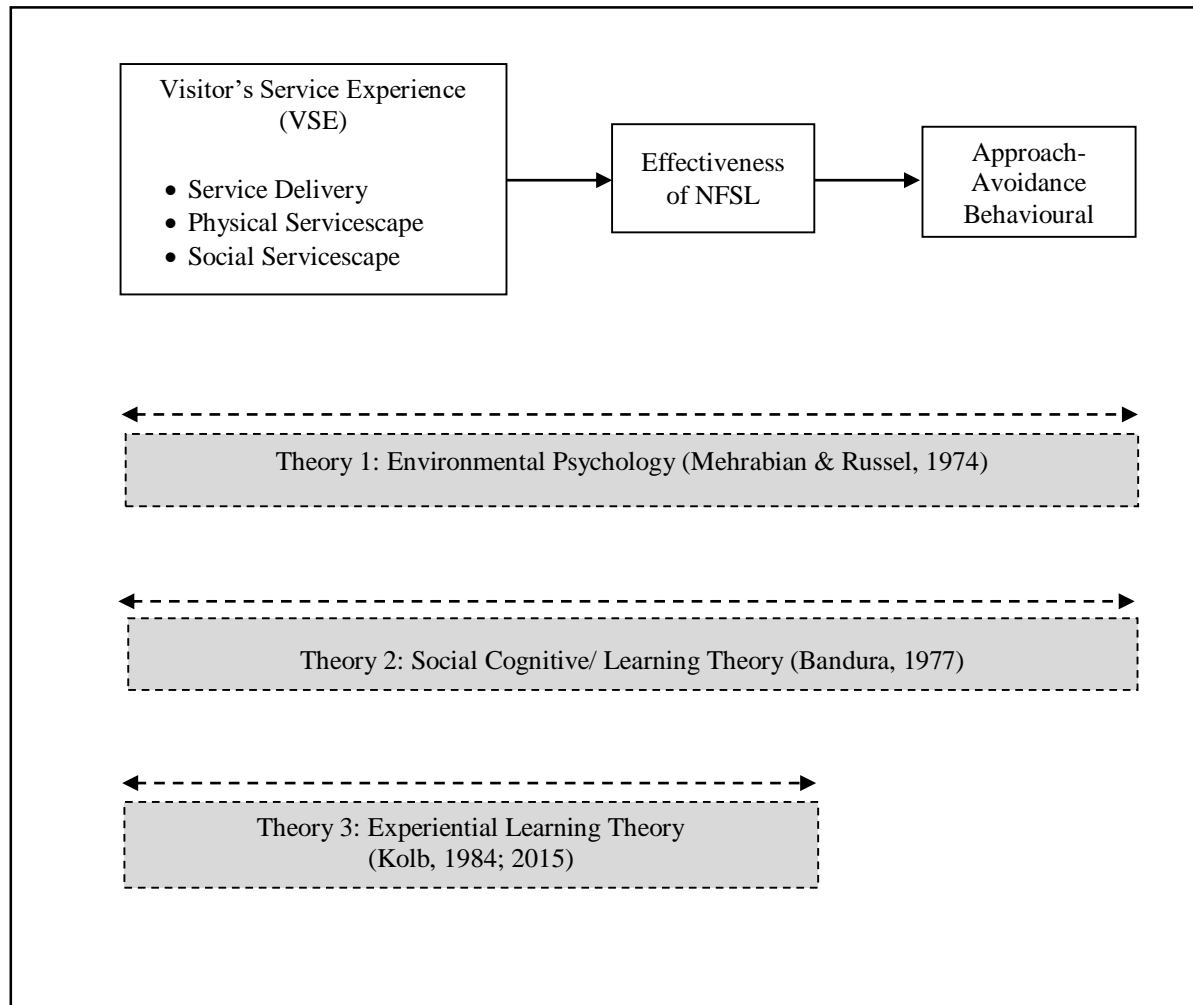


Figure 5

Theories Applied

The result of the interview and the analysis of pertinent theories related to non-formal learning paved way for the development of a conceptual framework on non-formal learning in Malaysia with the focus on the science centre. Relevant independent variables (the VSE variables), and dependent variables (the effectiveness of service and loyalty to service) are conceptualise for further studies and understanding of behaviours for non-formal learning and the achievement of for Science, Technology and Innovation (STI).

IV. CONCLUSION

Most of the time, kids and a young family with toddlers are interested in visiting science centre due to its flexible learning style, which emphasises edutainment and freedom of exploration that suits the active behaviour of these young children. In Malaysia, instilling interest in STI before the children reach 15 years old is critical since the influence of STI understanding at this age may affect their consideration to pursue their study in science and technology for the next years to come. The Social Learning Theory by Bandura (1977) and Experiential Learning Theory by Kolb (2015) explains how science learning happens in the science centre through the Non-Formal Science Learning (NFSL) approaches. The NFSL approaches in the science centre have great potential in helping the government to increase the trust, interest, and public's understanding of STI, which later contributes to the national capacity building of STI talents needed to be a developed nation.

Other than understanding the theories characteristic of NFSL that makes people (especially kids and youngsters) loves the science centre, the centre shall also provide an excellent visitor's service experience to ensure its relevant existence in the competitive environment nowadays. The Environmental Psychology Theory explains how the physical, emotional, and social environment settings at the premise potentially influence the approach-avoidance behaviour of the visitors. To make the place a popular destination, targeting wider audient, including youngsters and adults, the service perspective cannot be neglected. Visitor's service experience is crucial, especially when dealing with the way visitors are treated and servicescapes style in the service industries (including science centre), that in return have a significant influence in determining whether the customer will stay, leave or return to the place. That is why the Environmental Psychology Theory applied by Mehrabean, and Russell (1974) in their SOR Model was also studied to understand about the approach-avoidance behaviours of the visitors at the NSC and nicely explain the service delivery and servicescapes (physical and social) aspect related to visitor's service experience. By understanding the visitor's services experience in a science centre setting, the service providers within the NFSL institutions like the science centres, museums or planetariums will have a great chance to understand the holistic picture of how to serve their visitors better. In doing so, it is hoped that they are able to overcome certain issues such as the decreasing interest of the public in STI awareness programs and be able to bring in more visitors to their premise for more prominent coverage which potentially increase the STI popularization in the society.

In conclusion, understanding the theories and characteristics related to NFSL in the science centre (NSC) ease the STI learning objectives to be achieved and helps to understand the learning behaviours of the visitors, especially the young ones. In order to make the science centre as one of the most popular destinations, targeting a wider audient including the youngster and adult, the perspective of the service especially form the service delivery, physical and social servicescape aspect, cannot the neglected.

REFERENCES

1. Academy of Science Malaysia. (2015). *Science Outlook 2015: Action Towards Vision*. (Academy of Science Malaysia, Ed.). Kuala Lumpur: Academy of Science Malaysia. Retrieved from

<http://www.youblisher.com/p/1432982-Science-Outlook-2015/>

2. Ainsworth, H., & Eaton, S. (2010). *Formal, Non-formal and Informal Learning in the Sciences*. (J. Clydesdale, Ed.), *Sciences-New York* (1st. ed.). Calgary, Canada: Onate Press, Eaton International Consulting Inc.
3. Bandura, A. (1977). *Social Learning Theory*. (Stanford University, Ed.) (1st ed.). New York: General Learning Press. <https://doi.org/10.1111/j.1460-2466.1978.tb01621.x>
4. Bandura, A. (1978). Social Learning Theory of Aggression. *Journal of Communication*, 28(3), 12–29. <https://doi.org/10.1111/j.1460-2466.1978.tb01621.x>
5. Baniyamin, N., & Rashid, M. M. (2016). Understanding Science Centre Engagement in Nurturing Visitor Interest and Curiosity. *Procedia - Social and Behavioral Sciences*, 222(222), 235–243. <https://doi.org/10.1016/j.sbspro.2016.05.152>
6. Barker, R. G. (1968). *Ecological Psychology: Concepts and Methods for Studying the Environment and Human Behavior*. (Kansas University, Ed.). California: Stanford University Press.
7. Berry, N., & Mayer, S. (1989). *Museum Education: History, Theory and Practice The*. Virginia: National Art Education Association Virginia.
8. Chang, W. L., & Huang, L. Y. (2016). Measuring Service Experience: A Utility-Based Heuristic Model. *Service Business*, 10(1), 1–30. <https://doi.org/10.1007/s11628-014-0263-9>
9. Chik, W., Ismail, N., & Azman, N. (2010). Diverse Learning Styles of Non Formal Adult Learners in Community Colleges in Malaysia. *Social and Behavioral Sciences*, 7(2), 139–144. <https://doi.org/10.1016/j.sbspro.2010.10.020>
10. Çil, E., Maccario, N., & Yanmaz, D. (2016). Design, Implementation and Evaluation of Innovative Science Teaching Strategies for Non-Formal Learning in a Natural History Museum. *Research in Science & Technological Education*, 34(3), 325–341. <https://doi.org/10.1080/02635143.2016.1222360>
11. Collier, J. E., Barnes, D. C., Abney, A. K., & Pelletier, M. J. (2018). Idiosyncratic Service Experiences: When Customers Desire the Extraordinary in a Service Encounter. *Journal of Business Research*, 84(November 2017), 150–161. <https://doi.org/10.1016/j.jbusres.2017.11.016>
12. Donitsa-Schmidt, S., & Zuzovsky, R. (2018). The effect of formal, nonformal and informal learning on teachers' promotion to middle leadership roles in schools. *International Journal of Leadership in Education*, 00(00), 1–17. <https://doi.org/10.1080/13603124.2018.1508754>
13. Edvardsson, B. (2005). Service Quality: Beyond Cognitive Assessment. *Managing Service Quality: An International Journal*, 15(2), 127–131. <https://doi.org/10.1108/09604520510585316>
14. Eshach, H. (2007). In-school and Out-of-school Learning: Formal, Non-Formal, and Informal Education. *Journal of Science Education and Technology*, 16(2), 171–190. <https://doi.org/10.1007/s10956-006-9027-1>
15. Falk, J. H., & Dierking, L. D. (1997). School Field Trips: Assessing Their Long-Term Impact. *Curator: The Museum Journal*, 40(3), 211–218. <https://doi.org/10.1111/j.2151-6952.1997.tb01304.x>
16. Falk, J. H., & Dierking, L. D. (2013). *The Musuem Experience Revisited* (1st. Ed.). Walnut Creek, CA, CA: Left Coast Press, Inc.

17. Falk, J. H., Needham, M. D., Dierking, L. D., & Prendergast, L. (2014). *Final Report: International Science Centre Impact Study*. OR USA.
18. Hunter, M. (2017, June 22). The world's 20 most popular museums. Retrieved January 22, 2018, from <http://edition.cnn.com/travel/article/most-popular-museums-world-2016/index.html>
19. Inthiran, A., Alhashmi, S. M., & Ahmed, P. K. (2015). A Preliminary Study on the Usage of Search Assisting Features when Searching for a Personal Health Task. *Aslib Journal of Information Management*, 67(2), 159–181. <https://doi.org/10.1108/AJIM-09-2014-0110>
20. Kamolpattana, S., Chen, G., Sonchaeng, P., Wilkinson, C., & Willey, N. (2015). Thai Visitors' Expectations and Experiences of Explainer Interaction Within a Science Museum Context. *Public Understanding of Science*, 24(1), 69–85. <https://doi.org/10.1177/0963662514525560>
21. Kolb, D. A. (2015). *Experiential Learning: Experience as the Source of Learning and Development*. (A. Neidlinger & J. G. Levine, Eds.) (2nd Ed.). New Jersey: Pearson Education, Inc.
22. Line, N. D., Hanks, L., & Zhang, L. (2018). Birds of a Feather Donate Together: Understanding the Relationship Between the Social Servicescape and CSR Participation. *International Journal of Hospitality Management*, 71(April 2017), 102–110. <https://doi.org/10.1016/j.ijhm.2017.11.012>
23. MASTIC. (2014). *Public Awareness of Science, Technology and Innovation Malaysia 2014*. Putrajaya. Retrieved from <https://mastic.mosti.gov.my/en/sti-indicators/public-awareness-science-technology-innovation-sti-malaysia>
24. Mehrabean, A., & Russell, J. A. (1974). *An Approach to Environmental Psychology*. Cambridge, MA: US: The MIT Press.
25. MOE. (2013). *Malaysia Education Blueprint 2013 - 2025*. Ministry of Education Malaysia (1st ed., Vol. 27). Putrajaya, Malaysia: Ministry of Education, Malaysia. <https://doi.org/10.1016/j.tate.2010.08.007>
26. MOE. (2018). The Explanation of Education Policy. Retrieved August 29, 2018, from https://www.moe.gov.my/images/KPM/UKK/2018/04_Apr/Slide_Penerangan_Dasar_KPM_Tahun_2018_PDF.pdf
27. Mohd Azhar, A. H., Muhammed Fauzi, O., & Othman, A. K. (2003). *Pendidikan Bukan Formal (PBF) di Malaysia: Cabaran Dan Hala Tuju Wawasan 2020*. Seminar Kebangsaan Memperkasakan Sistem Pendidikan. Retrieved from http://eprints.utm.my/2287/1/PENDIDIKAN_BUKAN_FORMAL_DI_MALAYSIA.pdf
28. Moldovan, O., & Bocoş-Binţinţan, V. (2015). The Necessity of Reconsidering the Concept of Non-formal Education. *Procedia - Social and Behavioral Sciences*, 209(July), 337–343. <https://doi.org/10.1016/j.sbspro.2015.11.245>
29. MOSTI. (2016). *National Science & Technology Policy: Utilizing STI for Socio-Economic Transformation and Inclusive Growth*. Ministry of Science, Technology & Innovation Malaysia. Putrajaya. Retrieved from <https://www.mosti.gov.my/wp-content/uploads/2017/02/Full-DSTIN-2016.pdf>
30. Norqvist, L., & Leffler, E. (2017). Learning in non-formal education: Is it “youthful” for youth in action? *International Review of Education*, 63(2), 235–256. <https://doi.org/10.1007/s11159-017-9631-8>

31. NSC. (2011a). *Annual Report: National Science Centre 2011*. Kuala Lumpur, Malaysia. Retrieved from <http://www.psn.gov.my/wp-content/uploads/2012/09/Laporan-Tahunan-2011.pdf>
32. NSC. (2011b). *The 25 Years Journey of the National Science Centre*. (National Science Centre Malaysia, Ed.) (1st ed.). Kuala Lumpur: National Science Centre Malaysia.
33. NSTA. (2012). An NSTA Position Statement: Learning Science in Informal Environments. New York: National Science Teachers Association. Retrieved from http://static.nsta.org/pdfs/PositionStatement_Informal.pdf
34. Qi, L. (2017, June 15). China Museum No. 1 in Visit Last Year. *China Daily*, p. 20. Retrieved from http://www.chinadaily.com.cn/culture/2017-06/15/content_29754417.htm
35. Rennie, L. J., & Mcclafferty, T. P. (1995). Using Visits to Interactive Science and Technology Centers , Museums , Aquaria and Zoos to Promote Learning in Science. *Journal of Science Teacher Education*, 6(4), 175–185.
36. Rosenbaum, M. S., & Massiah, C. (2011). An Expanded Servicescape Perspective. *Journal of Service Management*, 22(4), 471–490. <https://doi.org/10.1108/09564231111155088>
37. Science Centre Singapore. (2013). *Science Centre Singapore Annual report 2012-2013*. Singapore. Retrieved from [http://www.science.edu.sg/aboutus/Documents/Science Centre Annual Report 2012-2013.pdf](http://www.science.edu.sg/aboutus/Documents/Science%20Centre%20Annual%20Report%202012-2013.pdf)
38. Su, Y., & Teng, W. (2018). Contemplating Museums' Service Failure: Extracting the Service Quality Dimensions of Museums from Negative On-Line Reviews. *Tourism Management*, 69(June), 214–222. <https://doi.org/10.1016/j.tourman.2018.06.020>
39. Tudor, S. L. (2013). Formal – Non-formal – Informal in Education. *Procedia - Social and Behavioral Sciences*, 76, 821–826. <https://doi.org/10.1016/j.sbspro.2013.04.213>
40. Wan Mustapha, W. N. (2017, December). Moving Away from Exam-Oriented Mentality. *New Straits Times*.
41. Werquin, P. (2010). *Recognising Non-Formal and Informal Learning: Outcomes, Policies and Practices*. (A. Hassan & D. Roseveare, Eds.), *OECD* (1st ed.). OECD. <https://doi.org/10.1787/9789264063853-en>
42. Wong, I. K. A. (2013). Exploring Customer Equity and the Role of Service Experience in the Casino Service Encounter. *International Journal of Hospitality Management*, 32(1), 91–101. <https://doi.org/10.1016/j.ijhm.2012.04.007>
43. Yiu, E. M. L., Kong, J., Fong, R., & Chan, K. M. K. (2010). A Preliminary Study of a Quantitative Analysis Method for High Speed Laryngoscopic Images. *International Journal of Speech-Language Pathology*, 12(6), 520–528. <https://doi.org/10.3109/17549501003759221>