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## Understanding Science Centre Engagement in Nurturing Visitor Interest and Curiosity

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### Abstract

Reaching and engaging visitors within exhibitions and throughout the museum environment, recurred as an area of design concern. Using the recent experience of Science Centre Singapore, The Mind Museum Philippines and The Experimentarium Denmark, the responses of the centre managements provided initial findings towards quality visitor experience and informal learning intentions. The biggest challenge is to provide an opportunity for cognitive and affective learning while collectively facilitating enjoyment and fun. Learning and educational theory are explored with implications for the exhibition development process. Nurturing visitor interest and curiosity theme reveal the centre's approach to offer a rich and cohesive experience.

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## 1. Introduction

The term Quality-of-life (QOL) renowned as ‘goodness of life’ refers to the physical, psychological and sociological state of being. It entails factors such as enjoyment, achievement, aspiration and recollection (Mohit, 2014). QOL in informal learning environment has examined various factors that can influence learning such as engaging visitors' emotions or connecting with visitors' prior knowledge and interests. Likewise, learning environment is the key in promoting the development of children. Sahimi (2010) posit that understanding children's perspectives about their environment is an important factor to offer a more meaningful learning experience. For example, participatory process involving children in designing and renovating a learning space has contributed positively in promoting children's active use of the space as well as their positive attitude and sense of belonging toward the space (Atmodiwirjo & Andri Yatmo, 2011). Nonetheless, the children's place preferences and play behaviours in the environments are influenced by their developmental needs, individual, physical and social factors (Aziz & Said, 2011). Physical environment which are creative, comfortable, safe and user-friendly can increase the level of involvement in an overall free time physical activities (Abd-Latif et. al, 2011). Children have the opportunities to build their self-confidence and independence in surroundings which stimulate imagination and challenge them to face and overcome risks (Soltani, S.H.K., et. al., 2012). Various design environments can attract and stimulate their interest when they participate in skill enhancing activities (Noiprawa & Sahachaisaeree, 2011).

In museum learning environment such as the science centre, varieties of exhibits spanning various disciplines are incubators of scientific knowledge and emphasises hands-on exploratory learning. The style of the exhibit presentation deeply affects the kinds of thinking engaged in by visitors. The dynamic interpretation techniques do give more positive's outcome in attracting visitors (Hashim, 2014). Despite this, the study of interior elements and its effect on social behaviour is still immature. (Wardono et. al, 2011). The decrease of student interest in learning science is an environmental challenge towards the future communities (Yunus & Ali, 2013). Yet, science centre persists to accommodate science interest and lifelong learning. The primary objective of museum management can be achieved by a communication of meaning through quality displays of exhibitions and interactive apparatus of science (Ahmad, et. al., 2014). Using the recent experience of Science Centre Singapore and The Mind Museum, Philippines as case-studies and The Experimentarium, Denmark as valuable mention, this paper examines the managerial responses in order to explore the extent to which the design opportunities occurs. The research explained in this study is experience-oriented design research that focuses on understanding and enhancing visitor experiences. The theme nurturing visitor interest and curiosity represent one of the design criteria for science centre exhibition's success.

## 2. Relevant literature

The museum field is rich with literature that addresses the concept of informal learning or “free-choice” learning in museums (Falk & Dierking, 2000). Hein (1998) suggested that museums typically do not have set formal curriculum; rather they provide visitors with informal education opportunities. Visitors largely come by their own choice and are thus intrinsically motivated. They engage in activities in a self-directed manner and their methods of learning are varied (Greenhill, 1999). In describing the integration of intrinsic motivation into a theory of learning, Rice (2001) highlighted the task of museum educators is to move people from a recreational agenda to a learning-centered agenda through a powerful aesthetic experience. A theory of learning that integrates the function of motivation is ultimately one that can reconcile affective experiences with the construction of meaning. According to Perry (1992), requirements for an intrinsically motivating museum experience include the ability to instil curiosity, challenge, control, confidence, play and communication in the visitor's experience. To achieve intrinsic motivation, the learning theories underpinning how visitors learn and how these theories impact a museum's exhibition design efforts is briefly discussed.

Behaviorism models are drawn from traditional classroom practices and have been used to design museum exhibits in the nineteenth and early twentieth century (Greenhill, 1999). This led to authoritative, didactic displays, frequently arranged to illustrate conventional epistemological hierarchies and classifications (Hein, 1998). Indeed, behaviour-based objectives are not always the most efficient approach to facilitate learning, especially in unstructured or informal learning environments. Along with the change in theories, an altered definition of learning

itself has come into play. “Learning is now seen as an active participation of the learner with the environment... museums become central to any educational effort when the focus shifts from the written word to learners’ active participation in interaction with objects” (Hein, 1998, pp. 6).

### *2.1. Experiential learning theory*

The underpinnings of museum exhibitions, as we know them today, began with the Experiential Learning theories of John Dewey. In *Experience and Education* (1938), he advocated the use of a learner’s personal experience as a basis for teaching and learning rather than the behaviorism view of a static learner. In a museum setting, the implication is that visitor will take individual meaning from exhibitions based on their own previous experiences and their present experience in the museum. Dewey acknowledged the continuity of personal experience; that one experience builds upon the previous. He also recognized the relationship between a learner’s context and the way in which they learn. In a museum setting, this means that the museum environment influences a visitor’s learning.

### *2.2. Constructivism*

Constructivist theory is focused on activity and builds upon some of the fundamental premises of Experiential Learning theory. George Hein (1999) argue that learners construct knowledge as they learn. In addition, visitors ‘construct’ their knowledge from the meaning in the exhibit. This leads to a different focus when considering exhibit planning. “Constructivist educational theory argues that in any discussion of teaching and learning the focus needs to be on the learner, not on the subject. For museums, this translates that we need to focus on the visitor, not on the content of the museum” (Hein, 1999, pp. 78). The design of museum exhibitions calls for a more adaptable, audience-focused, constructivist approach to providing learning experiences.

### *2.3. Contextual model of learning*

John Falk and Lynn Dierking, museum educators and experts on free-choice learning, proposed a model of learning specifically for use in free-choice learning environments. There are numerous factors which influence learning within a museum. They contend the Contextual Model involves three overlapping contexts: the personal, the sociocultural, and the physical. Learning is the process/product of the interactions between these three contexts (Falk & Dierking, 2000). This theory of learning accounts for far more contexts than any of the previous methods and is specifically aimed at museum type of learning.

### *2.4. Multiple intelligences theory*

Howard Gardner’s Multiple Intelligences theory recognizes the different learning styles within visitors to museum exhibits. He posits that museums, when considering educational opportunities, should cater to people of various different intelligences, thus making exhibits widely accessible to all types of learners (Ahmad, S., et. al., 2015). The seven different intelligences includes linguistic, logical-mathematical, musical, spatial, bodily-kinesthetic, interpersonal and intrapersonal (Davis & Gardner, 1999).

## **3. Conceptual framework**

An earlier discussion of learning and educational theory is examined with implications for the exhibition development process. The paper next discusses the methods used to encourage visitor into having a response and the effect this has on the visitor participation and immersion. The findings to the theme, creating interest/curiosity, focuses on science centres’ need to establish an enjoyable image, as well as offer a rich and cohesive experience. This theme also relates to reflecting the overall goals of the science centres and the nature of how and what the centre conveys to those who walk through its doors.

#### 4. Research method

The research question that guided the investigation was - 'What are the design opportunities that will enhance visitor experiences in science centre?'

The method of inquiry used was educational criticism, an arts-based qualitative method of inquiry initiated by Elliot Eisner (1998). Educational criticism requires that the researchers describe, interpret, evaluate, and discern themes. Although the researcher's act of selecting what to include and what to leave out of a vignette are considered interpretive acts, interpretation also includes connecting the events to relevant literature and to ask what the situation means to those involved. Given the diversity among visitors and variation in their expectations upon entering an exhibition, it proves difficult to follow a completely goal-driven approach to all exhibitions relative to all visitors. As the study progressed and data were collected, it became evident that design could not be addressed exclusively, separate from the rest of the components and factors which comprise the exhibition design. Thus, this research resulted in focusing on the design opportunities, due to the unique combination of elements contributing to and ultimately impacting the visitor/learner experience. The preliminary data collection process began with interviewing the Exhibition Director of Science Centre Singapore and the Curator of The Mind Museum, Philippines. Another significant meeting was conducted with The Executive Director of Experimentarium, Denmark. The author observed and recorded in photographs the scenography, exhibitions and activities in the galleries. The data collection process come to a concluding interview during which time the author asked the respective participants to reflect upon the ways in which design opportunities can enhance visitor experiences. Next, following Eisner's ideas about "selecting a focus" and "building a plot" (see Eisner, 1998, pp.189-192), the researcher analyzed the data with pragmatic intent. That is, examined the data with an eye towards building a story. The researcher provides several vignettes that illustrate portions of design ideas from the case studies. It will lead the researcher to interpret how this effect visitor participation and immersion in understanding level of engagement of the experiential settings.

#### 5. The theme of creating interest/curiosity

As the Exhibition Director of Science Centre Singapore (SCS), Daniel Tan led SCS from 1999 as the nations' world-class science centre. Science Centre Singapore was established to showcase exhibits illustrating the physical sciences, life sciences, applied sciences, technology and industry. SCS vision is 'Where science befriends and transforms the minds of millions'. SCS recognized the need for an environment where the audience can indulge in participatory learning. Exhibitions are a key means of the science centre to reach its visitors, as noted in this statement from Daniel Tan, describing the Science Centre Singapore exhibitions department:

*The first goal of our exhibitions is to inspire a love of science and lifelong learning through cognitive pathways. To achieve this we offer exhibits on a broad range of topics, employ a variety of media and use the science show to demo the natural wonders that appeal to audiences with diverse backgrounds, interests, and learning styles.*

As Tan's statement suggests, exhibitions are important to forming the identity of the science centre. However, many other aspects of the centre also contribute to the essence and the identity it projects both externally and internally. Each new exhibition design idea made a significant contribution to the centre to transform the institution and tell new themes.

##### 5.1. Creating an identity for the science centre

As is true with all science centres, the cultural institution projects an identity to the public. When people visit a science centre, see its marketing materials, or hear others talk about a science centre, those people form an idea in their minds of what the centre is, what it means and what it can offer them. Aligning the internal sense of character or identity of the centre with a corresponding external image is important as an institution. Asger Hoeg, Executive Director of Experimentarium Denmark, is the Founding Father of ECSITE in 1990. Recipient of the prestige Leading Edge Award for Experienced Leadership in the Field by Association of Science-Technology Centers

(ASTC), Hoeg highlighted Experimentarium's 140,000-square-foot renewal and expansion project. As commented by Hoeg, regarding the external building appearance:

*The criteria were first of all it should be a landmark building and actually the winning project was not a landmark building, so we had to change the exterior. It's a fact. The Foundation said to me we would not give to that project money, but also it was important that the operation of the building was intelligent.*

According to Hoeg, The New Experimentarium building should have these unique criteria as a city landmark. The design operates as an intelligent building is another important factor. It further creates science interest and curiosity towards the public. The curator of The Mind Museum, Maria Isabel Garcia led The Mind Museum as the Philippines' first world-class science museum since 2012. The museum features over 250 interactive hands-on exhibits within five major galleries. According to Themed Entertainment Association (TEA), the thematic thread and artistic treatments throughout the museum is what makes this project extraordinary. Maria Isabel Garcia discusses the idea of experience in museum:

*Experience is what museum offers. Besides, it can never replace the learning in virtual or multimedia. Museum visitors come for the same reason to learn and quest for knowledge. An individual tries to connect to an idea or concept. Every institution has its own character, and mostly we all value the same things. We share our knowledge and experiences.*

Garcia indicates that from a broad perspective science centre have many similarities, but they differentiate themselves by the way they are organized, the people who contribute to them and the focus the centre chooses to put forth.

## 5.2. Allowing for interest, curiosity and variety

In general, all Science centre strives to convey science concepts, issues and its related technology in application to human life and the environment. By examining the design of several science centre exhibitions, the differences to approach this goal rests in the variations of what aspects of science are addressed in the centres. New space and displays allow for concept flexibility. Asger Hoeg emphasized the processing fluency as a key to creating interest to convey science concepts:

*If you go to an exhibit only 5% of the visitors read the text, therefore, you need to make the design of the exhibit as explainable as possible. Processing fluency is actually saying that if you understand what you're supposed to do and then you are interested... you can be put into flow, and then you understand what is going on.*

Hoeg believed processing fluency is a design tool to benefit visitor psychological behaviour in approaching hands-on exhibits. He also stressed the need to challenge one's mind as the flow theory recommended:

*Csikszentmihalyi...said you need to challenge people, but not beyond their ability. That is what you need to do in an exhibition. You need to arouse curiosity and virtuosity so people feel challenge, but at the end of the day they are doing what they are supposed to do...and they say, yes I understood.*

As elaborated by Hoeg, the flow theory is practical in designing visitor experience to facilitate curiosity and virtuosity. Exhibits display, informative text, visuals, audio and multimedia components are utilized to help provide a more concrete experience and contribute to the lens through which visitors view the subject on display. The integration of all these elements adds to their collective impact - there is strength in the gestalt of combined elements

working together to tell the same story. Daniel Tan explained the SCS's efforts to show the science theme and make changes to keep the issue current:

*The purpose was to understand the science theme, to make the exhibition very accessible to people and also to be able to make some changes to it in the future. The previous exhibit such as the Science Time Capsule was the third openings...And, so we tried to find ways that we would be able to change over time, something up for the five years, and then, we go on and tell a new theme.*

As indicated by Tan, having exhibition spaces that allow for new stories and regular changes keep the science centre fresh and offer visitors new experiences. The flexibility to rotate exhibitions is important for making the centre feel new even if visitors have been there before. It is critical to making such changes in order to encourage people to return. The Mind Museum curator, Maria Isabel highlighted the importance of controlling variety of feeling in communicating science exhibitions:

*Showing all the relation and things that make an atom what it is - the substance, relation, composition, from atom to earth, to the universe, etc. - all fuel interest and excitement about the theory for visitors. The more variety in the aspects of connections that are represented in the museum, the wider the range of impact on visitors.*

Garcia believes there must be a variety on a broad level throughout the museum space, as well as on a personal level, like using big scale and beautiful objects that attract special kinds of interest.

### 5.3. Reframing content with a different lens

Caring and connections have a reciprocal relationship, both drawing visitors into the subject matter. Adapting visitors as participants in an interactive experience is more likely to result in a positive museums experience (Ahmad, 2015). The floor plan layout could be fostered in making connections - intellectual, social, emotional, and sensory with the visitors. Pine and Gilmore (1999) suggested the buildup of a transformation in the visitor as the most progressive offering. A successful experience needs to involve all four realms: Educational, entertaining, aesthetic and escapist experiences. Asger Hoeg also believes the centre should endeavour for transformative visitor experience:

*So for sure we assure that both entertaining and educational activities are taking place, but aesthetic experience, there are not that many in Experimentarium...therefore I say OK, we want a dark room, a beautiful piece of art when you come in, it's very quiet and look at the piece of art, when you go out then you have had an aesthetic experience as part of the total experience and also escapist where you really get in flow.*

Hoeg's quote emphasizes the importance of aesthetic and escapist experience in balance with entertaining and learning experience in a science centre. Maria Isabel Garcia discusses on the idea of connecting science through art and science:

*In communicating science, it has to be correct, follow by making it easy to understand and beautifully expressed - through artistic way. Art and science should be constructive in exhibition making. I talked to the designers and scientists about all the different ways that they might connect to design through storytelling.*

As a science writer herself, communicating exhibition design with aesthetic experiences seemed natural for Garcia. It is a narrative space. Artifacts do more than just convey a feeling for the order of magnitude in real life; they often constitute an aesthetically attractive piece of art. The therapeutic effects of art and the arts on individual

well-being have been recognised for many centuries (Bishop, 2011). Admiration for the beauty of an object may be the starting point for future exploration, and art, for this reason, has the function of attraction.

#### 5.4. Providing wonder and surprise

Despite the variety of exhibition changes, the benefits of renovation, the redesign and efforts to put forward an identity for the science centres, the primary focus of the centres has not changed. The main emphasis of the science centres for its variety, diversity and programming remains the same as what the early science centre established in the 1960s - a focus on exploring science (Oppenheimer, 1968). The exhibitions need to tell the science phenomena. For example SCS website highlighted the centre's need to show the effects - of its exceptional wonder and unexpected intense and emphasized that those things are at the core of the centre attraction. This includes the Tesla Coil demonstration, Fire Tornado Demonstration, Waterworks Exhibition, Snow City and the IMAX dome theatre. Designers employ plot, dramatic effects, grand scale, and authenticity to make spectacular design. It is a method of producing an exhibition that is intended to transport visitors to new locations, engage them in a story being told, and have a lasting impact. (Counts, 2009).

#### 5.5. Allowing for dramatic effects

Daniel Tan believes the centre should aim to show people what an amazing place SCS is. Sharing all the stories and things that make SCS what it is, all fuel interest and excitement for visitors. As he expressed:

*What's the goal here...I think it's really...in a way to affirm science wonder for the people who've seen it live. And it's also to give them a real strong sense of dramatic effects. I think it's also to surprise them with how influential science is.*

Tan agreed the more dramatic in the aspects of science that is represented in the centre, the wider the range of impact on visitors. By using special effects (lighting, audio, video, and darkness) authentic experiences can be enhanced. Colours, lighting and décor have effects on customers' perceived social, emotional and behavioural intention on social occasions (Wardono, et. al., 2011). Dramatic effects have been used in museums to create eloquent visual environments. Light and darkness are effective methods for adding drama to exhibition design. A less common design element found in a science centre is plot. Illustrated in attractions experiences, a strong plot will engage participants' emotions and pull them into a story. It enhance a theme or incite emotion in visitors. As commented by Maria Isabel Garcia:

*Like reading a novel . . . an exhibition should have highs and lows. I tried to focus on (connections) from the biggest (universe) to the smallest (atom) and on a very basic level about how to connect with the subject, to the material, so visitors feel the story and they want to learn more about it.*

Garcia emphasized the connection with the subject as important in exhibition design to tap the visitor interest. The intellectual, emotional, sensory level of connection is cautiously applied. Much like story or a novel, a plot is a strong conceptual story with highs and lows. In the Poetics, Aristotle observes that a well-constructed plot consists of a beginning, middle and an end. Plot requires a source of "astonishment" or "surprise" to captivate audiences (Aristotle 1996). This is created by the presence of a conflict, tension, or dramatic shift in the storyline. For an exhibition, it may be a particular object that is revealed.

#### 5.6. Dealing with current issues affecting the global community

In preparing for new exhibitions, the social relevance enables a more precise question to be asked. What technological knowledge is important for the visitor as a member of a society? Social relevance refers to those



everyday decisions that are fundamental to the quality of life and the future of mankind. Asger Hoeg shared the centre new exhibition concepts:

*We are going to make a new exhibition where we should stimulate people interest in exercising, doing fitness, be healthier. And we will make exhibit that is actually based on research where we come up with hypothesis about how you could actually nudge people to exercise more and then the exhibition would be a kind of a room for stimulating the interest in your body and that way to be healthier.*

As indicated by Hoeg, in preparing for new exhibitions, the concepts are the intended message. The hands-on exhibits are a result of scientific research on how to nudge people to be more interested in the subject matter. Maria Isabel Garcia expressed her concern during early design development. The crucial question in designing a new museum involved the topics to be addressed. Science and technology have developed an immense range of subject matter. As highlighted by Maria Isabel Garcia:

*The museum's main floor has many ideas in life and physical sciences. The second floor is mainly on the theme of technology. The path will lead towards exhibits on 'who we are', followed by 'how we know', 'here to there', 'creative zone', 'how things work' and 'how we live'. We hope the practical of science unfolds naturally this way.*

As expressed by Garcia, topics that justify the expense of erecting new galleries are, for example, energy, transportation and pollution are fundamental in the global community. It is important to create an interest and spark curiosity in topics of great social relevance.

## 6. Conclusion

Through its exhibitions, science centre seek to share science by promoting the outward identity and reputation of the centre. Exhibitions at the case studies science centres are inherently tied to the overall mission and identity of the institution. Due to this strong connection it was easy to connect processes and decisions related to the exhibition designs. The content and design approaches utilized in exhibitions were part of the science centre's effort to create an environment with a fun science perspective - providing a whole, new experience. The efforts to create an identity for the institution was rooted in the hope to dispel the conception some people have of science being 'difficult and complex'. The desire was to change the perception of what visitors would find inside the centre, and hopefully draw new visitors by doing so. In order to achieve this change in outward perception, the science centre needed to deliver by cultivating interest, curiosity and variety. The cognitive understanding in delivering the message is a recurrent theme that emerged from the in-depth interview. This reflects that science centre exhibition designers and developers are always interpreting the meanings of curiosity and virtuosity, and hence reinforces the importance of meanings in experience design. The research support the importance of experience-oriented approaches in exhibition design. The importance of aesthetic and escapist experience is to be in balance with entertaining and learning experience in a science centre. Likewise, understanding the social relevance and be able to create an experience that allows the visitor to bring their knowledge, interests and curiosity together is important. Topics that justify the expense of erecting new galleries are fundamental in the global community. There is a focus on providing a variety of means to impact the visitor's overall exhibition experience. Science centres support this approach by providing visitors with opportunities to connect with the exhibition environment, to engage with technology and media, and to promote social interaction among visitors. The preliminary findings of this study could provide insights to the science centre community in mobilizing exhibition design strategies. Acknowledging science centre in terms of people, process, and products could benefit future museum experience research and practice. While this research has theoretical, methodological, and managerial implications, the limitation relates to the way the research is designed. Given the characteristics of the method used, the results remain exploratory and contingent. From this point of view, this research raises concerns about both its robustness and its transferability. To overcome these weaknesses, the



approach developed in this paper might be improved by analyzing other cultural offers based on similar strategies so as to identify points of convergence/divergence among different sites.

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