An Observational Study for Developing Digital Technology in the Museum

Nurul Fathihin Mohd Noor Shah
Faculty of Science & Technology,
Universiti Sains Islam Malaysia
(USIM),
Nilai, Malaysia
fathinshah@usim.edu.my

Masitah Ghazali, Nur Zuraifah Syazrah Othman
ViCubeLab, Faculty of Computing,
Universiti Teknologi Malaysia
Skudai, Malaysia
masitah@utm.my,
zuraifah@utm.my

ABSTRACT

This study aims to understand the behaviour of visitors of the Negeri Sembilan State Museum, Malaysia based on visitor demographic information and activity patterns. 30 volunteers were observed during their visit to investigate how they interact with tangible objects that are exhibited in the museum space. All participants were never exposed to any digital technologies in the museum before. A qualitative approach was adopted where an evaluation toolkit for museum practitioners and observation framework was used for data collection. Our findings indicated that dioramas received much more attention from the participants than the artefacts and labels display. This pointed to the inadequacy of the exhibition style where it did not capture nor attract the participants to stop, interact or obtain information from the artefacts. The gap may be filled in by the usage of digital technology in museum exhibitions as it has the potential of providing interactive features that would attract visitors and create engagement with the artefacts in the museum.

Author keywords

HCI; Digital technology; Museum; Observation.

ACM Classification Keywords

H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

INTRODUCTION

Digital technologies in museums have seen massive growth in the last few years given the big effort in producing a more comprehensible system to give visitors the best museum experience.

To improve engagement with visitors, many museums nowadays take advantage in the use of a variety of applications and technology to make the visiting experience more impactful [2].

The use of digital technologies allows the museum to create a new experience and to look for ways to create their exhibition more exciting in order to meet visitors' expectations, especially in this digital age [3, 4]. With the evolution of technologies combined with the innovative abilities of many converging media forms such as games, mobile application, virtual and mix-reality environments [5], the museum has changed from a static exhibition towards a non-linear, interactive and immersive environment [6].

This evolution occurred to fulfil the needs to attract visitors, especially the young generation. Nowadays, museum managers realised the importance of giving attention to accommodate visitor needs and expectation while touring the museums. This approach is also a part of a method to make visitors feel engaged with the exhibition and have good experience during the visit. In this technological era as well, visiting museums can also happen through a website, social media and cyberspace, especially for visitors who are not able to attend physically [7, 8]. Museum managers need to plan on technology application to interact and communicate with visitors and potential visitors. By adopting digital technology in the context of a museum exhibition physically or virtually, visitors can easily get access to the exhibition presented by the museum.

The rapid advancement in the digital world has contributed to changes in the modes of visiting the museums from something bored to something thrilling. This development of technology has given impact to visitors' expectation to explore and engage with the museum. Visitors can enhance and transform their experience beyond the physical objects exhibited [3, 9]. At the moment, there are many digital applications developed and are available in the museum in order to enhance visitors' experience and engagement with the museum collections [10]. For example, iMuse, which is a mobile type of digital technology that contains a virtual presenter which can expand visitors' experience by assisting

the visitor during walks inside the museum and give digital information along with interactive games [10, 11]. Another example of a digital application in the museum is PuzzleBeo which is an interactive mediated jigsaw puzzle. This application is designed to stimulate the curiosity of children regarding the maritime museum. From this application, the children can construct stories about the maritime museum that they visited [10, 12].

This study focused on the field of museums under cultural heritage, within the category of tangible objects that are exhibited in the museum. The motivation of this study is to analyse the behaviour of visitors based on demographic information and visitor activity patterns while visiting the museum. This research is conducted to discover how a visitor interacts and communicate with different tangible objects that are exhibited in the museum space. This study will present the characteristic of participants based on their demography information and analyse visitor behaviour based on their activity patterns during the visit to a museum.

BACKGROUND OF THE STUDY

A museum is known as a place which allocates and stores a variety of authentic objects, artefacts, materials, specimens and is also responsible for displaying and exhibiting the artifacts and material through the exhibitions and education activities [16, 17]. Current trends in museums involve digitising their collections to make it more enticing and using a variety of interactive approaches to engage and attract their visitors. Technology nowadays transforms user experiences beyond the physical object exhibited to more exciting, enthralling and inspiring experiences.

A definition of a museum by the International Council of Museums (ICOM) can described as, "A permanent non-profit institution which open to public for the service of community and society development, which acquires, conserves, identifies, communicates and exhibits material evidence of people and their environment for purposes of study, education and enjoyment" [18]. In the context of Malaysia, a museum is known as an institution that gathers and distributes knowledge to the public about the history, identity, and culture of the nation and its natural history [16].

However, digital technology facilities adopted to Malaysian museums are still significantly low compared to other developed countries such as Australia, Canada, Japan, the United States, and the United Kingdom. Museum collections in Malaysia only display the authentic physical objects or artefacts inside glass boxes or behind barriers because these artefacts are very valuable which cause the interest of visitors to know more beyond the artefacts. This curiosity feeling will evoke the visitors a sense to touch, explore and manipulate the objects or artefacts.

Besides, the presentation of information that is related to collections display in the museum in Malaysia are limited in information because of label constraints, and some labels miss important points or information that are related to the collections. On other critical aspects, museum visitors are having trouble to read the labels because of small and long writing.

Most of the studies focused on aspects of usefulness and usability of technology application to be applied in the museum [13] but does not take into account on visitor needs and visitor expectation to interact and communicate with each tangible objects or artefacts that are exhibit in the museum before developing the digital technologies.

METHOD

This research was designed using qualitative research and an exploratory approach. The participants of this research are museum visitors who are local visitors and visitors from overseas. Structured observational studies were used in this observation study procedure. The objective of observational studies applied in this research was to analyse activity patterns of museum visitors during visits to the Museum Negeri Sembilan using the Observation Framework suggested by Robson [15].

Meanwhile, a set of observation checklist has been designed to suit the objective of this observation activity. This process was adopted from the Foster Evaluation Toolkit for Museum Practitioners approach [19]. This observational study also wants to discover how these visitors interact and communicate with tangible objects that are exhibited in the museum space.

The observation framework is integrated with nine elements suggested by Robson which are space, actors, activities, objects, acts, events, time, goals and lastly, feelings, as in Table 1. By using this framework, Robson is encouraging the observer to focus on the context of the activity [15].

Space	What is the physical space like and how is it laid out?
Actors	What are the names and relevant details of the people involved?
Activities	What is the actor doing and why?
Objects	What are physical objects are present, such as furniture?
Acts	What are specifics individual actions?
Events	Is what you observe part of a special event?
Time	What is the sequence of the event?
Goals	What is the actor trying to accomplish?
Feelings	What is the mood of the group and individuals?

Table 1. The Observation Framework [15].

DATA COLLECTION

The research methods used in this study is structured observation and unstructured interview. For observational

process, researcher will track and record the participants activity patterns using two mobile devices and write down all the findings inside the museum observation log and checklist. This process adopted from Foster, Evaluation Toolkit for Museum Practitioners approach [19]. As this is an exploratory approach, photos and video recordings helped to analyse how the user interacts and communicates with the tangible objects displayed in the museum and explores the museum space. The researcher who conducts this observational activity is a nonparticipant-observer which is an observer that collects the data needed without becoming an integral part of the participants or joining the group [20].

Two mobile devices were used in this observation and tracking activity. One mobile camera was used to record the participant's movement, and another one was used to capture still photos of participants' interaction with the materials displayed at the Negeri Sembilan State Museum. The participants were not time-bound and were allowed to interact with each other and speak out loud about their feeling during this journey. These participants also can move around and explore the museum space at their own pace, route, and agenda. At the end of the visit, the researcher will ask the participants some questions to fill in the observation log and asked the representative of the participants to confirm the checklist that has been completed.

RESULTS AND DISCUSSION
This observational study was carried out by thirty (30) participants which were further divided into four types of categories. The observation was conducted at the Negeri Sembilan State Museum in March 2018. The participants were randomly selected among the visitors who visited the museum during the observational study. The participants are visitors who agree to volunteer and to be involved in this study.

The participants were categorized into four types of categories which are Individual, Family, Pair, and Group (which is more than three persons). Table 2, shows the members of the family for each family group.

Family 1	• Grandparents • Parents • Children (2)
Family 2	• Father • Children (2)
Family 3	• Grandfather • Parents • Youth • Children (2)
Family 4	• Parents • Youth

Table 2. Members of the family for each family group.

Demographic and general Information of Participants
As shown in Table 3, the age range of participants is various from five (5) years old to 50+ years old. From these 30 participants, 11 participants, which is 37%, are in the age group of 15 – 25 years old. Meanwhile, 20% or 6 participants are in the age group of 5 – 10. 17 %, which is 5 participants, are from the age group 25 – 35 years old. Lastly, 13% or 4 participants from the age group 35-45 and 45-55 years old respectively.

Observation Log	Type of visitor	Age Range of participants	Number of Participants	Race	Types of technology visitor bring/use during the visit
1	Family 1	5 - 50	6	Chinese	Mobile
2	Family 2	5 - 50	3	Malay	Mobile
3	Family 3	5 - 50	6	Malay	Mobile
4	Family 4	20- 50	3	Minang	Mobile
5	Group 1	15-25	4	Malay	Mobile / Camera/ Video
6	Group 2	15-25	5	Malay	Mobile /Camera/ Video
7	Pair	25 - 30	2	Malay	Mobile
8	Individual	50 +	1	British	Mobile

Table 3. Participant's demography and background information.

As shown in Figure 1, the participant's background is from four races: Chinese, Malay, Minang and British. From this data, it can be interpreted that there are visitors or tourists from inside and outside Malaysia that will come and visit the Negeri Sembilan State Museum. Malay participants are the highest which is 67%, followed by the Chinese participants 20%. Meanwhile, there are 10% participants who is Minang and 3% is British.
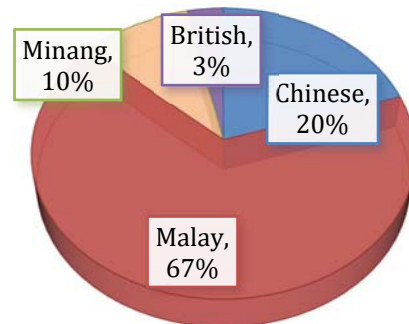

Figure 1. Race of participants.

Table 3 also shows that almost all of the participants (except the children) brought and used the mobile devices actively during the visit. Based on Table 3, both groups brought a video camera and a single-lens reflex camera (SLR) during the visit. Throughout the interview, the SLR camera and video camera were used to record the museum exhibition space and artefacts for their group assignment.

Based on the participants information from Table 4, there are five reasons visitors visit the Negeri Sembilan State Museum. The reasons are to spend time with their family members, to learn the detailed history of Minangkabau and Negeri Sembilan, to do an assignment by searching for particular information about the history of Minangkabau and Negeri Sembilan, spend time together and lastly because it is one of the participant's hobbies to visit the museum. From four categories of participants, only two categories of participants had been to the museum before which is Family 3 and Group 1. Other participants never visited the Negeri Sembilan State Museum before.

Table 4 also shows that none of the participants has tried or used any digital technology in the museum before. From this finding, it can be concluded that digital technology at museums in Malaysia is still new and not optimal. Museums in Malaysia still lack in developing and exposing the visitor to digital technology experiences.

Observation Log	Purpose of visit to Museum Negeri Sembilan	Have you visited this museum before?	Experienced digital technology in the museum before?
1	Spend time with family	No	No
2	Spend time with family	No	No
3	Spend time with family	Yes	No
4	To learn the history of Minangkabau in Negeri Sembilan	No	No
5	Assignment: Searching for particular info about the history of Minangkabau and Negeri Sembilan	Yes	No
6	Assignment: Searching for particular info about the history of Minangkabau and Negeri Sembilan	No	No
7	Spend time	No	No
8	Hobby	No	No

Table 4. Participant's information about the museum visit.

Observation

From the observation, findings were analyses from observation log and checklist, still photos, video recording and unstructured interview from the participants. Data was extracted in the perspective of visitors' activities and interaction with the tangible objects in museum space. Visitors activity patterns are presented in Table 5.

The data from participant activities in Table 5 shows that most of the participants will look at the exhibition displayed in the museum space and read the label (text, maps, photos). There are three types of tangible objects that are exhibited in the Negeri Sembilan State Museum which are dioramas, artefact displays and labels (text maps, photo). Table 6 shows that dioramas received much attention from the participants because they can take photos with the diorama and touch the replica objects. The estimated time the participants spent is around 2 minutes especially for grouping, family 1 and family 3 because of the large number of members.

Observation Log	Look at the exhibit	Ask question to the staff	Take notes	Read text (e.g., label)	Talk to another person / in a pair	Take picture	Touch the material display	Record the video
1	✓			✓	✓	✓	✓	
2	✓			✓	✓	✓	✓	
3	✓			✓	✓		✓	
4	✓			✓	✓	✓	✓	
5	✓	✓	✓	✓	✓	✓	✓	✓
6	✓			✓	✓	✓		✓
7	✓			✓	✓			
8	✓			✓				

Table 5. Participants activity patterns.

Type	Estimate time spent (In minutes)	Estimate participants stopping
Diorama	2	30
Artefact Display	1	26
Labels, text, maps, photos	1	20

Table 6. Exhibit types and estimate time spent.

All the tangible artefacts are displayed inside a glass box and the participants need to read the labels to get the information about the objects or artefacts. Some of the artefact displayed will make the participants imagine how to use it or how it works or function.

For the artefact displayed, it can also be seen from observations and interviews that most participants are not pleased due to the lack of information displayed regarding the artefacts. This condition makes the visitor leave the museum full of curiosity. From the observations it can also be seen that the participants will have verbal interaction, talk between each other especially for categories of family, where parents or grandparents offer explanations to children about the artefact displayed. Same goes to categories of groups; they are questioning among themselves and to get the answer to the question, they will use mobile phones to search for more information to respond to their curiosity. From the observation, we can also can see that participants from Group 1 asked the exhibition staff member about information they need and took note during the explanation.

For labels, text, maps and photo the estimated time for participants spent with these materials is around one minute, and many of the participants will pass these materials and only look for other exhibits that capture their attention only. There are challenges, especially for children, to read the labels, text and to understand some of the photo or maps. From the observation, the difficulties of participants to read long and small sizes of text for the poster or label exhibited can be seen. Some visitors will use fingers to highlight the text that they read so they will not miss the paragraph.

Figure 2. Participants use fingers to highlight the text.

Results of the observation show that throughout the observation, all of the participants had and brought their mobile devices in the museum and actively used it during the visit. Due to the fact that most of the participants have a mobile device such as a smartphone, except for the children, this can be a good platform to enhance visitor experience and engagement with the objects exhibited in the museum.
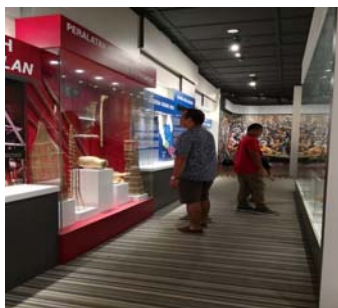

Figure 3. Participant stop and look at the artifacts display.

Therefore, it is suggested that museums in Malaysia to embrace technology to adapt their exhibition by digitizing their artefacts as to deliver the information and knowledge to visitors. In addition, it is paramount to find suitable digital technologies to put in place in order to ensure that visitors will have a more interesting and thrilling experience during their visit.

CONCLUSION

This study focuses on analysing the behaviour of visitors in the museum based on visitor demographic information and activity patterns from observation activities that has been conducted at the Negeri Sembilan State Museum. This observational study is done to investigate visitor behaviour pattern during visits to the museum and to discover how do these visitors interact and communicate with the tangible objects that are exhibited in the museum space. This observational process is the beginning of establishing a set of requirements for design and develop, a suitable of digital technology for specifics exhibit types in a museum. This requirement will guide the application or final product on what it should do and how it should perform along with fulfilling all the users' needs to interact and communicate with tangible objects that are exhibit in the museum space.

The limitation of this observational study is that this study focuses on visitor interaction with tangible objects that exhibited in museum and visitor's activity patterns only. Furthermore, the discussion on data collection only presents the observational study. Besides, the results of the participants are in general for various societies. In the future, it is recommended to explore specific behaviours for categories of museum visitors such as children, the elderly or disabled people only. Finally, it is hoped that this study could be a reference to other researchers to initiate and plan before developing digital technologies in a museum.

REFERENCES

1. John H. Falk and Lynn D. Dierking. 2000. Learning from museums: Visitor experiences and the making of meaning. Walnut Creek, CA: AltaMira Press.

2. Aeni Z. Saidin and Nassiriah Shaari. 2018. Digital media to enhance museum visit: Experience in digitising the royal museum of Kedah. *Journal of Tourism*, *3*(11), 37-44.

3. Jonathan Bowen, James Bradburne, Alexandra Burch, Lynn Dierking, John Falk, Silvia Filippini Fantoni, Ben Gammon, Ellen Giusti, Halina Gottlieb, Sherry His, et al. 2008. Digital technologies and the museum experience: Handheld guides and other media. Rowman Altamira.

4. Ula Ilnytzky. 2016. 5 ways museums are using technology for new experiences. Retrieved January 9, 2019, from https://www.seattletimes.com/nation-world/5-ways-museums-are-using-technology-for-new-experiences/

5. Panagiotis Apostolellis. 2017. *Evaluating Group Interaction and Engagement using Virtual Environments and Serious Games for Student Audiences in Informal Learning Settings*. Ph.D dissertation. Virginia Tech.

6. Rabee M. Reffat and Eslam M. Nofal. 2013. Effective Communication With Cultural Heritage Using Virtual Technologies. In *The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences*, *XL-5/W2*(September), 519–524. https://doi.org/10.5194/isprsarchives-XL-5-W2-519-2013

7. Nancy Proctor. 2010. Digital: Museum as a platform, curator as champion, in the age of social media. *Curator: The Museum Journal*, 53 (1), 35-43. Httpps://doi.org/10.1111/j.2151-692.2009.00006.x.

8. Arta Moro Sundjaja. 2018. What Indonesia's Museum Visitor Needs in the Digital Era? In *International Conference on Information Management and Technology* (ICIMTech), 1-9. IEEE.

9. Barbara J. Soren. 2009. Museum experiences that change visitors. *Museum Management and Curatorship,* 24(3),233-251. https://doi.org/10.1080/09647770903073060

10. Nurul Fathihin M. N. Shah and Masitah Ghazali. 2018. A Systematic Review on Digital Technology for Enhancing User Experience in Museums. In *International Conference on User Science and Engineering* (IUSER2018),35-46. http://doi.org/10.1007/978-981-13-1628-9_4

11. Althanasios Fevgras, Nikolaos Fraggogiannis, Panagiota Tsompanopoulou and Panayiotis Bozanis. 2014. The iMuse Virtual Museum: towards a cultural education platform. *In The 5th International Conference on Information Intelligence Systems and Applications IISA2014*,171-175. http://doi.org/10.1109/IISA.2014.6878817

12. Sarah Hayes, Michelle O'Keeffe and Trevor Hogan. 2017. Piecing Together the Past: Constructing Stories with Jigsaw Puzzles in Museums. In *Proceedings of the 2017 ACM Conference Companion Publication on Designing Interactive Systems* (DIS'17 Companion), 79-83. http://dx.doi.org/10.1145/3064857.3079123

13. Yu-Chang Li, Alan Wee-Chung Liew and Wen-Poh Su. 2012. The digital museum: Challenge and solution. In *International Conference on Information Science and Digital Content Technology* (ICIDT2012), 646–649.

14. Mohd Kamal Othman. 2012. *Measuring visitors' experiences with mobile guide technology in cultural spaces.* Ph.D dissertation. University of York.

15. Yvonne Rogers, Helen Sharp and Jennifer Preece. 2007. *Interaction design: beyond human-computer interaction*. John Wiley & Sons.

16. Shamsidar Ahmad, Mohamed Yusoff Abbas, Wan Zaiyana M. Yusof and Mohd Zafrulah M. Taib, M. 2018. Creating Museum Exhibition: What the public want? *Asian Journal of Behavioural Studies*, *3*(11), 27-36.

17. Susan Pearce. 1995. Collecting as Medium and Message, In *Museum, Media and Message*, Eilean Hooper-Greenhill. Routledge, New York, 15-16.

18. "Museum definition," Retrieved January 10, 2019 from http://icom.museum/en/activities/standards-guidelines/museum-definition/

19. Harriet Foster. 2008. Evaluation Toolkit for Museum Practitioners. *The East of England Museum Hub*, 90. https://doi.org/10.1002/ccd.10041

20. John W. Creswell. 2014. Research Design Qualitative, Quantitative and Mixed Methods Approaches (4ᵗʰ Edition). SAGE Publication.