

The Composition of Usability Evaluation in Assessing Quality of the Display Case Lighting

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Abstract

This paper presents and discussed discusses the need for usability evaluation as a tool to support an assessment of museum quality in-use by exploring the meaning of users' experiences. In this study, usability evaluation is a preliminary study to identify the design issues associated with the museum visitor's context of use. The finding from usability evaluation reveals that the visitors need an improvement on the lighting in the display cases. need the museum to make improvements on the lighting in the display cases. However, there are a few considerations in applying Lux reading because it will give an impact to the display artifacts. Therefore, the main case study is focusing on identifying the Lux reading in display cases for protecting the artifact and making it ideal for museum visitors. In addition, this paper provides a discussion on "usability concept and the importance of Lux reading of artifact display. Later the main study result will be validated by the museum end user to help suggest usable Lux reading. This usability evaluation is useful to the museum curator, designers and facilities management. The usability evaluation is beneficial in identifying the important usability design issues to be investigated and explored. Besides the Lux data is highly significant in improving the museum design practice and provide a guide in monitoring the performance of lighting, which is more valuable to their end-users.

Keywords: Lux reading, Quality in-use, Usability evaluation, User experience.

1.0 Introduction

The nature of building design shows that the design of a building can be thoughtful and imaginative, but sometimes does not respect the sustainable design because of the considerable gaps between what the users say, what they want, and what the designer or architect builds. Moreover, the design and facilities are less user-friendly because the design does not reflect the users' characteristics that will be using the building (Dickerman, 2008; Carr, 2009; Woon et al., 2014). Meanwhile, the quality of design depends on how the whole architecture is used consistently to satisfy and benefit its users (Riegel, 2007; Aripin, 2010; Carr, 2010; Dilani, 2010; Nawawi et al., 2013). While the opinion of the real users is important, in order to see the loops in the design process the designer must bear it and accept the loops for continuous improvement of the design (Lawson, 2006). This is in line with Frank Lloyd Wright (1869-1959) as cited in Voordt and Wegen (2005), who considered that the idea of a design is to suit the needs of its occupiers or desires, activities, and functions, for which they are to be used for optimum experience. Therefore, a design should not be seen as a project, but as a process of recognising people's expectations because they are the reasons for its existence.

The most essential point in the design is to introduce the quality of the environment with a usable, friendly and attractive environment for everyone that successfully serves the purposes of the user. Moreover, a building's usability never depends on the building alone but the use of the building. Aligned to the meaning of quality design is the design that can satisfy its users. Hence, the usability evaluation has brought a new dimension by implementing the meaning of users' experiences and known as a process tracking quality in-use. Where the usability evaluation will serve as a tool for exploring the usability issues and those issues are the parameter to usability criteria. Those parameters are based on end-users' situation context of use ; understanding and interacting with their surrounding either the design, setting, task or facilities with their characteristics (culture, knowledge and background) (Alexander, 2007; Alho et al., 2008; Hansen et al., 2011; Lindahl et al., 2011). This shows that there are many hidden factors other than users' satisfaction that need to be explored and investigated, and it will come from an in-depth knowledge and understanding of the users' experience. Each user's difficulty will produce a different usability criteria term.

The International Organization for Standardization (ISO) ISO 9241-11 defines usability as, “*The extent of which a product can be used by specified users to achieve the specified goals in the specific context of use with the particular environment*” (ISO 9241-11, 1998). By referring to ISO standards for software quality and a broad view from usability studies, usability as quality in-use (ISO 9241-11, 1998 in Petrie & Bevan, 2009) refers to the users’ overall experience of the quality of the product and is determined by three primary parameters; effectiveness, efficiency and user satisfaction. In the built-environment “Usability” means “utility” and the same goes to architectural fields, it used the term “functionality” to reflect the usability design. Where, the functional quality of a building as “its ability to fulfil the functions envisaged for it” (Voordt & Wegen, 2005). The functionality of a building is also described as the extent to which buildings’ spatial and physical qualities support functions of climate, the economy as well as spatial organization of activities (Voordt & Wegen, 2005).

Aligned with the purpose of museum design itself which is to meet visitor’s expectation, as they are the main users, so that the design and facilities must benefit and satisfy them, increase their knowledge, create enjoyable moments and motivate them to come again. However, there are some errors in the design of the museum associated with service design. These are related to the effectiveness of design which affects the efficiency of service. In line with these issues, the quality assessment that is based on users’ feedback is needed. Due to this, in this study the implementation of usability evaluation is in the early stage of this research process. Where, the pilot studies This pilot study will serve as a preliminary study to explore and identify the main issues of museum design and its impact towards user’s experience.

2.0 Museum environmental design and importance of artefact preservation

The goal of museum design is to make the objects accessible to the public, researchers and to other institutions besides to ensure the long-term safety and preservation of their artifacts and collections (Thomson, 1986) in Karim et al., (2012). Hence, there are six (6) environmental factors that affect those goals which include temperature; relative humidity; particulate matter and pollutant; biological organisms; reactivity of material and natural or artificial lighting (Dean, 1994).

Artefact collection must be cared and preserved in a manner so that it does not change in terms of form and information and remain as the original for the foreseeable future. There are two category of artefacts and known as ‘sensitive and ‘non-sensitive artefacts’. A sensitive artefact such as manuscript and textile needs care and a sensitive artefacts consists of non-organic materials such as ceramic, coins and weaponry. However, the organic material can easily react to the heat, humidity and Lux. Therefore, the temperature, humidity and LUX reading is are very important in protecting the artefacts in the display case from deteriorating. Deterioration can be prevented from occurring if the curator is constantly monitoring and checking the reading of the display showcase. This is to get the information from the visitors and their level of satisfaction. Hence the need to conduct an exploration of museum visitor’s expectation is important to gauge the effectiveness of the display and efficiency in delivering information (Karim et al., 2014).

3.0 Usability evaluation result

There are two (2) methods of measurement involved in the usability evaluation. A structured interview with visitors was used to measure their perception on the display showcase lighting. The second method is on-site measurements of showcase lighting placement and Lux/UV reading as explained in the next section.

3.1 Structured Interview with experts

At this stage, the researcher will get a response from the museum expert on the objective of this research and their experience in designing, managing and using a museum environment. Hence, the result from this interview will support the problem statement of the research, provide reliability to the studies and focus on display artifact. There are seventeen (17) museum experts involved in this interview session. The participants were museum directors, conservators, curators, and museum designers. The structured interview questions are divided into three (3) main sections as explained in Table 3.1.

Table 3.1: The main questions with museum expert.

Section	Main Interview Questions	The Purpose
A	The questions in this section discuss the definition, philosophy and function that are utilised by museums in Malaysia based on definitions from sources like ICOM (1956-2001) in Michalski (2004)	<ul style="list-style-type: none"> To find out the respondents' opinions and their perception and feedback on 'Museum' and galleries definition and the nation's aspirations and mission in designing a museum. The direction of the respondent's museum in the future amidst the wave of globalisation in the Malaysian context. The background, function, philosophy and the development of museum in Malaysia.
B	Museum Artifact	<ul style="list-style-type: none"> These questions-focus on museum artifacts in Malaysia To find the rules and requirements that will enable artifacts to be a part of a museum's display. To explore the regulations for artifact management from the aspects of placement, preservation and positioning of artifact which include the old and fragile artifacts.
C	Display designs in museums	<ul style="list-style-type: none"> These questions are aimed at getting explanations on definition and the differences in Permanent and Temporary Exhibition To explore the design guidelines that are utilised in designing a Display Design for a particular artifact that have been set by certain museum regulating bodies in Malaysia.

Source : Karim et al., (2014)

3.2 On-Site Measurement of Display Showcases

Identification of display showcases and inventories initial visits to all three museums were made to identify types of showcases for five (5) local artifacts; textile, manuscript, coins, ceramic and weaponry in these museums. Before choosing which showcase to measure, the types of showcases for the five (5) local artifacts at each museum were evaluated and the researcher noted the quantity and categorised the showcases according to individual characteristics and then recorded them in a form of an inventory (Karim et al., 2012). Three (3) forms of inventories were made for the showcase selection process (stated in Table 3.2).

Table 3.2: The Form of Inventories of Display Showcases.

Measurement on Lighting Placement in Showcases	<ul style="list-style-type: none"> Type of hot light or cool light as well as the placement of direct or indirect light has been identified to show that the type of lighting and its placement has had an impact to the deterioration of the artefacts. Duration of display time is also identified whether it is permanent or temporary.
Measuring the Readings of Lux /UV for Display Showcases	<ul style="list-style-type: none"> Lux reading is measured using the Digital Lux Meter (MASTECH-MS6610), The UV reading is using Manual UV Meter. The UV measurement is not required on the display showcase in some of the museums
Measuring the Visitors' Perception on the Display Showcase Lighting	<ul style="list-style-type: none"> Interaction between the visitors and the display showcase lighting is identified through questionnaire survey. The visitors are divided into several categories which include adults, the elderly, teenagers, children and the handicapped. Each category is then divided according to their age

Source : Karim et al., (2014)

4.0 Results

The results from the interview with the expert shows that there was an importance in exploring the issues on Lux towards user's experience. It is important because it is added value to the current design guideline and as a database in designing and improving the existing and future design. Based on the interview session, the main problem was related to the deterioration of artifact due to environmental factors during the process of display process in the showcases. The issues that often occur are the deterioration of the quality of the artifact caused by oxidation and dullness due to the exposure level of light. In addition, light is a form of energy and can cause colour fading as well as deterioration in the materials from which museum objects are made. Dean (1994) argues

there are three environmental factors or deterioration agents of display artifacts; (a) temperature, (b) relative humidity and (c) natural and artificial lighting.

The results from the interview with the expert also shows that the lux for display showcases present major issues that affect the comfort of the user and it also affects the clarity of the information. However, these studies also need to ensure that the visitor’s needs should be paralleled to the suitability of lux due to the material of artifact display in the showcases. Therefore, the main case studies will investigate the appropriate lux for artifact preservation and its suitability for end-users. Aligned with those issues table 4.1 shows the result from on site *Measurement of Display Showcases based* on three (3) case studies within three museums which include a national museum, state museum and Islamic art museum. This study involved an inventory of 35 display showcases ; it was which were on-site measurements of display case environmental performance of Light intensity (*Lux*). The scope of study focuses on two (2) types of showcase design; ‘Free Standing Showcase’ and ‘Wall Mounted Showcase’. The result in table 4.1 shows that 90% of the visitors preferred fibre optic light for their showcase display. However, the result shows that although the artefacts are well-preserved from deterioration by using fibre optic light and LED light on the display showcase, the museums are still applying the ordinary lightings and using the filter due to the high cost. It can cause the gloomy view and reduce the visitor’s interest towards the artefact and its information. The application of light causes the display showcases to be ineffective and not efficient in delivering the information to the visitors. This scenario is one of the challenges for the curators to explain to the visitor on the purpose of gloomy lighting for the artifacts.

Table 4.1: The Lux readings taken for the measured sensitive and non-sensitive artifacts display showcases

Artifact Display Showcase	Light Intensity (Lux) Readings	ICOM (Lux)	Types of Display Lighting	Lighting Effect	Light Control System	Respondent Feedback (%)	Artifact Deterioration (%)
NM/T	26 – 733 Lux	<50 Lux	Fluorescent, Halogen down light, Spot Light	Direct & Indirect Light, Track Light	No	Like (80%)	3%
TM/T	20 – 1100 Lux		LED, Halogen	Direct Light	Sensor	Like (30%)	1%
IAMM/T	44 – 66 Lux		Fibre Optic	Adjustable Light	Light box	Like (90%)	0%
NM/M	28 – 975 Lux	<50 Lux	Halogen down light, Fluorescent, Spot Light	Direct Light, Track Light	No	Like (60%)	80%
TM/M	20– 400 Lux		Spot Light, Halogen down light	Direct Light, Adjustable Light	No	Like (60%)	85%
IAMM/M	44 – 73 Lux		Fluorescent tube	Direct Light, Indirect Light	Filter	Like (90%)	0%
NM/C	50 – 60 Lux	>50 Lux	Fluorescent	Indirect Light	No	Like (70%)	50%
TM/C	40 – 300 Lux		Spot Light	Indirect Light	No	Like (40%)	60%
IAMM/C	176– 285 Lux		Fluorescent	Light Effect	No	Like (90%)	0%
NM/CP	120 - 220 Lux	>50 Lux	Spot Light	Track Light	No	Like (80%)	2%
TM/CP	80 - 3000 Lux		Halogen down light	Direct Light	Dimmer	Like (80%)	4%
IAMM/CP	44 - 66 Lux		Fibre Optic	Adjustable Light	Light box	Like (60%)	0%
NM/W	40 - 480 Lux	>50 Lux	Halogen down light, Spot Light	Direct Light, Track Light	No	Like (80%)	20%
TM/W	30 – 340 Lux		Halogen down light, Spot Light	Direct Light, Indirect Light	Dimmer	Like (70%)	40%
IAMM/W	45 – 46 Lux		Fiber Optic	Adjustable Light	Light box	Like (90%)	0%

*T-Textile, M-Manuscript, C-Coins, CP-Ceramic/Pottery, W-Weaponry

Source: Karim et al., (2014)

5.0 Discussion

The purpose of this usability evaluation was to explore the real and current issues on the quality in-use of the museum environmental design based on visitors' experience. The findings reveal the problems of museum design and the reasons behind them had been identified. The result shows that the visitors are more concerned on the quality in delivering the information. However, the information not only comes from the lettering or words but also from the form of the artifacts. Hence, in designing a museum the needs of an appropriate guideline must be considered so that the artifact remains undamaged. Aligned with that consideration, so that the main case studies was carry on from pilot studies but focusing in suitability of lux according to the material of artefact. Later, the result will be the testing of the museum visitors again. This process is aimed at making a comparison between main cases and pilot study results with the readings of lux which are is not damaging the artifacts based on the current guideline. The goal of this paper is to increase the number of visitors as stakeholders in museum exhibition design through the use of participatory design methods. Besides, the methodology is to support and strengthen the current museum design practices in collaboration with museum production teams. Therefore, the findings from the study are presented to the architects and their opinion on the relevance of the research for future projects is are evaluated by means of a questionnaire survey.

6.0 Conclusion

It can be concluded that, the application of display lighting for artifact preservation in the Malaysian museums are still low especially on the sensitive artifacts in permanent display. It is hoped that this research can be a reference for curators to educate the visitors on the purpose of lighting design on display showcase. Besides, it is the task of curators to design more efficient lighting display in terms of artifact preservation and visitors' satisfaction. This paper presents a proposition for an initial usability evaluation that seeks to transform the design of museum environments from passive vessels to active participants in design process. These evaluations give a more realistic and transparent platform for design improvements compared to theoretical data and provide opportunities to improve the end-user satisfaction with the potential for significant genuine guide in design brief.

7.0 References

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