A Study of User Experience towards Virtual Reality Technology in The Context of Cultural Heritage Learning

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Abstract

The past few years have seen an increase in the use of virtual reality (VR) in museum environments in an attempt for museums to embrace technological innovations and adapt to the challenges of the digital era. Moreover, the Covid 19 pandemic has led to museum visits being reluctant and has been transited into digital cultural heritage using virtual technology. However, solid evidence of the effectiveness and the measurability of User experience (UX) in virtual environments remains contentious. Therefore a study has been conducted by analysing existing frameworks and models to enhance the elements of user experience by using literature matrix approaches. This analysis will show the limitation and potential enhancement of the existing UX model. In conclusion, the finding shows user experiences must be considered and measured in designing a virtual museum because the value of user experience could affect the behaviour and attitude of the virtual museum user. The gaps and limitations of the existing model become the main finding in this research because these gaps and limitations would be used to extend the existing user experience model, which could increase cultural heritage learning performance and user appreciation towards heritage content.

Key Words: User experience (UX), Virtual Museum, Cultural heritage.

1. Introduction

The past few years have seen an increase in the use of virtual reality (VR) in museum environments in an attempt for museums to embrace technological innovations and adapt to the challenges of the digital era. Despite solid evidence of the effectiveness, the measurability of User experience (UX) in virtual environments remains contentious. The fundamental research for most existing frameworks is on interactivity, design, and 3d modelling and less on architecture and cultural heritage information, which is the crucial aspect of UX design that focuses on organising information. Study shows that users are having difficulties in the virtual museum related to information retrieval because the categories are not in accordance with the content, the labelling is inappropriate, and the information structure is incomplete. Moreover, the Covid 19 pandemic has led to museum visits being reluctant and low engagement in cultural heritage and tourism activities. Therefore, providing an immersive VR with cultural heritage information of user experience design will solve challenges visitors face due to how it is perceived and its dynamic nature and complexity. The proposed interactive element in the virtual museum could improve the visitor engagement and user learning experience about cultural heritage information.

According to previous research, cultural heritage like historical site preservation or museums have incorporated VR and Augmented Reality (AR) presentation technology to enhance their exhibition. A European survey showed that 35% of the museum already applied VR and AR technologies to build user engagement and interest in the museum collection within an exhibition. However, past research has produced information technology less focused on the user experience (UX) components (Chandini Pendit et al., 2016). Hence, the development of existing Virtual Museum applications lacked consideration of UX aspects and would affect the effectiveness of the application outcome, such as learning performance and heritage appreciation specifically.

Many researchers focused on the product's usefulness and usability without considering user experience in their development (Rahim et al., 2018). However, according to Peng et al. (2018), the value of user experience is significant and should be considered from a holistic point of view to ensure that a proper application can be developed. Therefore, the user experience value should be considered and measured in designing virtual museums for cultural heritage learning. The value of user experience could affect the behaviour and attitude of the virtual museum user. Thus, this study aims to highlight appropriate user experience

elements embedded in virtual cultural heritage applications for learning purposes to impact user performance and heritage appreciation better.

2. Literature matrix on user experience model

This study has used a literature matrix analysis to discover the limitation and potential enhancement of the existing UX model. All the related model on UX, Cultural heritage learning, and digital application were collected and analysed comprehensively before all the information were synthesised in the literature matrix, as shown in Table 1.

Eleven (11) related models based on mentioned scope above were analysed according to their salient features and limitation based on the researcher's observation and evaluation.

Table 1: Literature Matrix of User Experience Model

Conceptual Model	Salient Features	Limitation
iTACITUS	o The information delivers through an annotated landscape, superimposed environment o The contents are presented in 3D objects, 3D characters, texts, pictures, audio, and video o It provides interactive planning tools	o It does not integrate with the learning element. o It does not include the element of UX in development. o Lack of enjoyment and learning guideline
Architecture System of SHMAR (Angelopoulou et al., 2012)	o it presents AR education games o To assist the visitor in understanding the exhibition. o The system explains the flow of visualisation.	o Even though the objective is to help visitor to understand cultural heritage sites, it does not provide cultural heritage learning element evidence and does not evaluate the UX
TechCoolTour	o It is developed to promote Roman and Byzantine tourism o It is embedded with 3D characters, 3D objects, video, and 360-degree panorama o Information Sharing	o No Empirical evidence of Interactivity, and it does not evaluate the UX o No learning guideline o It does not consider the engagement element
Design Guideline for Mobile AR System for Heritage Interpretation and Visitor Guiding at Historic Sites	o It contains five requirements like technology, user interface, contents, interactivity and features o Interpretation and visitor guidance at historic sites	o Does not measure the (UX) o Does not consider learning component in their guideline development o No empirical evidence of User experience
Mobile AR Museum Guide	o Consist of five themes; description, techniques, iconography, context and artist. o Guiding for museum o Developed based on text, audio, image, slideshow and animation	o Does not measure the User Experience o Not considered engagement, enjoyment, and learning guideline
Theoretical Framework of AR-guidance System	o Consist of three constructs; the sense of place (SOP), Place on attachment (PA), place dependence (PD), and place identity (PI) o It combines interpretation and guiding theory.	o Lack of UX evaluation o Even though educational activities were included in this research, however, No empirical evidence of Interactivity
Smart Exhibition	o The system architecture is built with three constructs; web contents management platform, web platform for content presentation, and mobile application for accessing virtual exhibitions.	o It does not measure the UX o Not include learning guidelines or theory in developing application
MUSETECH Model	o Evaluation framework with multiple components that can assist museums, and heritage institutions in planning for and managing the deployment of digital technology	o little about how museum audiences interact with and make sense of experiencing heritage through digital. o No empirical evidence of interactivity
Model of gesture-based interaction (Rahim et al., 2011)	o The framework consists of three components: Storytelling, Interface design, Evaluation of user experience	o Little user experience evaluation and does not measure hedonic quality in UX o Not include Learning guidelines or concepts in their development
Theory and methodology of interpretation (PrEDiC)	o Effective learning, communication and management tool that increases visitors' awareness of and empathy o the frameworks consist: Satisfaction, Provocation/Empathy, Learning, Multiple perspectives of the past	o Even though the research takes into account visitor's awareness, however, it does not measure systematically and scientifically o No empirical evidence of Interactivity
Conceptual Model of Mobile Augmented Reality for Cultural Heritage Site Towards Enjoyable Informal Learning (Marchsteil),	o Using informal learning in Cultural heritage Leaning o Consist of interactivity, navigation and interaction in the model	o It does not integrate the UX elements into model development

Past research shows unclear suggestions on how to design a virtual environment to support the development of virtual heritage for cultural learning (Ibrahim & Ali, 2018). Additionally, Stone & Ojika (2000) stated that the primary goal of virtual heritage is to provide formative educational experiences. However, unclear suggestion or description is provided on formative educational experience or intended pedagogical of designing learning environment in cultural heritage. Moreover, there is no extensive description or discussion on the possible elements for cultural learning

using virtual reality applications. Supported by Rahaman and Tan (2011) stated that cultural learning cannot be facilitated due to a lack of a method of producing valuable content in an existing virtual heritage environment. Therefore, the cultural heritage learning concept should be embedded in the conceptual model to intensify user learning performance.

According to the literature matrix, nine (9) out of eleven (11) existing models ignore the vital components, such as user experience components. Only a few models have been produced for cultural heritage that included user experience components, and how the user experience is embedded in the application remains unclear. These user experience components would enhance user interaction, engagement, and user satisfaction to improve cultural heritage learning performance. The user experience elements could allow the user to gain new knowledge about the cultural heritage without knowing they are in the learning process. This issue can be raised and make the usage of a Virtual Museum for cultural heritage interactive and at the same time as interpretive media to assist the user in learning about heritage practically. Furthermore, the user experience approach decisively contributes to cultural heritage preservation by raising the understanding of cultural heritage among the user, especially the young generation. The virtual museum conceptual model, with inclusive engagement, interactivity and aesthetic aspects, can change user behaviour into a positive attitude by improving the performance of cultural heritage learning as well as awareness of the young generation to appreciate and preserve the cultural heritage.

The user experiences must be considered and measured in designing a virtual museum. This is because the value of user experience could affect the behaviour and attitude of the virtual museum user. The existing model's gaps and limitations would become the main finding in this research because these gaps and limitations would be used to extend the existing user experience model, which could increase cultural heritage learning performance and user appreciation towards heritage content.

4. Result

The user experience components are critically needed in cultural heritage learning applications to increase user learning performance. However, the research findings show that only a few existing cultural heritages learning application development models integrate the user experience component in their development but with a lack of evidence and unclear about which elements of UX should be applied. Therefore, this study proposes a new user experience model or framework for cultural heritage content using a virtual museum application based on Malaysian culture and perception. It is hoped that this study will be a stepping stone for developing or extending the existing user experience model for cultural heritage learning in the local context of Malaysia.

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