Experiencing Immersive Virtual Reality in Museums

Abstract

Virtual Reality (VR) has been regarded as a highly effective technology that enables people to gain enjoyable and immersive information about museum collections. Drawing from the four realms of the experience economy, we assume absorptive experiences influence immersive experiences, overall museum VR tour experience, and intention to visit a museum. The results show that all the hypotheses are supported. Furthermore, we compared and tested the proposed model and its rival model (postulating the direct influence of the four realms of the experience economy on museum VR experience) and found that the proposed model is better than the rival model.

Keywords: experience economy, absorption, immersion, virtual reality, museum, tourism

1. Introduction

Virtual Reality (VR) is being regarded as the next big step in technological innovation. Palmer Luckey, cofounder of Oculus VR Inc., asserted that 2016 would be the first year in which there would be mass-market consumer VR (The Guardian, 2016). In fact, low-cost and user-friendly VR devices such as the Oculus Rift VR headset, the Samsung Galaxy Gear VR, and HTC Vive have been launched and introduced to the market. In addition, a few years ago, Google established a VR division and launched the VR device, Google Daydream (Fortune, 2016). In addition, the consumer VR market (including both software and hardware) is expected to be worth more than USD 16.3 billion globally in 2022 (Statistita, 2019).

VR has been actively adopted in cultural tourism because some of its characteristics help to achieve the tourism industry's goal of providing tourists with unique and enhanced experiences (Bruno, Bruno, De Sensi, Luchi, Mancuso, & Muzzupappa, 2010). VR also reduces the barrier of distance between potential tourists and a destination by providing information and enhancing their understanding of a destination before their actual visit (Accenture, 2018; Kim & Hall, 2019). In addition, VR provides users with an educational, entertaining, escapist, and esthetic experience (Jung, tom Dieck, Lee, & Chung, 2016) and a complete virtual environment in which they can be fully immersed (Guttentag, 2010). Finally,

VR enhances tourists' experiences by facilitating their interactions with their destinations (Kang & Gretzel, 2012).

In contrast to the aforementioned benefits, some scholars have considered VR to be a substitute for, or even a threat to, physical tourism sites (e.g., Cheong, 1995; Guttentag, 2010). For example, VR can reduce the inconveniences that often accompany an actual tour and can make tourists think it is no longer necessary to visit real tourism sites, with the more advanced and realistic VR simulations (Cheong, 1995). However, evidence has shown that individuals think a virtual field trip cannot serve as a substitute for a real field trip but is rather an effective tool for preparing for a real field trip (Dewailly, 1999; Spicer & Stratford, 2001). Aligned with the evidence, this study focuses on the role of VR in the previsit stage.

The role of VR is becoming increasingly important in the museum context because it is helping museums overcome two major issues they currently face: *authenticity* and *new museology*. In other words, today's museums are required (1) to present an authentic experience and (2) to enhance visitors' experience by providing edutainment (governance of education and entertainment). VR helps overcome these concerns because immersive VR environments enable visitors to perceive the virtual images of artifacts as authentic and to pleasurably obtain information about collections. In fact, a considerable number of museums such as The British Museum, Museo del Prado, and Vatican City have launched VR to provide their visitors with spectacular immersions (BBC, 2016; Financial Review, 2016; South China Morning Post, 2015). Although previous studies have investigated the role of VR in museums (e.g., Jung et al., 2016), few studies have investigated the antecedents and consequences of immersion in VR. In other words, research on the results from immersive settings of VR in museums is still at an embryonic stage.

Therefore, this study aims to (1) investigate the impacts of absorptive experiences (e.g., education and entertainment experiences) on immersion (e.g., escapism and esthetic experiences), overall museum experience, and intent to visit a museum and (2) check whether the proposed model is better than the rival model (direct impact of four experiences on overall museum experience) by comparing these models' fit and the percentage of supported hypotheses.

Following this introduction, the second section provides the theoretical background, including an explanation of the experience economy proposed by Pine & Gilmore (1998), the role of VR in museums, and the use of VR as a marketing tool. The third section presents the development of the hypotheses with the proposed research model. The fourth section explains the methodology, including data collection and measures. The fifth section shows the results of the proposed model and its rival model. The final section discusses the results and provides theoretical and practical implications and some limitations future studies will need to address.

2. Theoretical Background

2.1 The experience economy

Pine and Gilmore (1998) first introduced the concept of the experience economy in the Harvard Business Review when they showed how shifts in economies work, especially the shift toward a more service-oriented approach. The concept has since gained widespread attention, particularly within the tourism context. In the past few years, a notable shift within the tourism industry has taken place from simply providing products or services toward staging tourism experiences. Essentially, this shift has provided tourists with something to remember and thoughts to cherish, rather than simply consuming a standardized offering (Oh et al., 2007; tom Dieck et al., 2017). Accordingly, technology has been identified as an effective way to provide tourists with unique experiences (Kang and Gretzel, 2012), opening the door for the experience economy concept in the area of management information systems (MIS). Nonetheless, research within this area is still scarce. As revealed above, Pine and Gilmore (1998) were the first to emphasize the need for "staged experiences" and the importance of immersion, absorption, and participation as part of enhanced tourism experiences.

According to Pine and Gilmore (1999, p. 12), "experiences can be defined as events that engage individuals in a personal way." The same authors (1998, 1999) explored four types of customer experiences, called the 4Es – esthetic, entertainment, education, and escapism experiences. These 4Es were classified into two concepts: absorption and immersion. Tourists are able to absorb experiences when they are provided with an experience from a certain distance that does not directly influence the experience (Hosany & Witham, 2009). On the contrary, immersion occurs when tourists are fully involved and take part in the experience (Song et al., 2015).

The following definitions are aimed at providing an understanding of the four experience economy dimensions. First, esthetics can be defined as "the beauty that can be expressed through elements such as color, photographs, font style, and layout" (Lee et al., 2015a, p. 481). Education is referred to as "the absorption of events unfolding before [a tourist] at a destination, while actively participating through interactive engagement of the mind" (Oh et al., 2007, p. 121). Third, escapism is defined as the escape from "regular environments to suspend the power of norms and values that govern their ordinary lives or to think about their lives and societies from different perspectives" (Oh et al., 2007, p. 122). Finally, entertainment is "an activity that provides amusement and pleasure" (Benny, 2005, p. 7).

While entertainment and education are part of absorption, esthetics and escapism were classified as immersion within the four realms of the experience economy (Pine and Gilmore, 1998). To successfully stage tourism experiences, Pine and Gilmore (1998) suggested the engagement of all the senses to make the tourism experience more memorable. Technology can play an important role in achieving this, as it engages tourists' various senses. Generally, the positive effects of the 4Es on tourists' experiences have been explored and supported. Previous research, for instance, has found that the 4Es ultimately influence tourists' satisfaction with attractions (Song et al., 2015) and promoted destination loyalty (Quadri-Felitti & Fiore, 2013). Furthermore, Jung et al. (2016) found that the four realms of the experience economy strongly affect the tourism experience and consequently the behavioral intention to visit tourist attractions. However, research on VR content utilizing the experience economy concept is limited. This is surprising considering that, according to a number of studies, the experience economy has a strong focus on immersion and absorption, and VR is a prime example of delivering entertaining, educational, escaping, and esthetical content (Han et al., 2019; Huang et al., 2016; Southall et al., 2019). Consequently, it can be argued that research on VR and the experience economy concept can be particularly valuable, especially considering its increased use in museums and cultural heritage attractions. Particularly, to the best of the authors' knowledge, no MIS study to date has examined the relationship between absorptive experience (education and entertainment) and immersive experience (escapism and esthetic) when visitors are experiencing VR contents in museums.

2.2 Virtual Reality in Museums

Today's museums have two main concerns: *authenticity* (Count, 2009; Hede & Thyne, 2010) and *new museology* (Pallud & Straub, 2014; Vergo, 1989). First, authenticity poses as objectivism in tourism and can be viewed as possessing two vital components in providing touristic value: distance and truth (Taylor, 2001). Therefore, a dialectic between object and subject, there and here, then and now, is a fundamental concept of authenticity (Taylor, 2001). According to the German philosopher Walter Benjamin, "the presence of the original is the prerequisite to the concept of authenticity" (Benjamin, 1968, p. 220, cited in Taylor, 2001). In this context, museums used to focus on the rich historical, cultural, and architectural value of their collections. Such collections were also to remain untouched and be preserved as they were.

However, the issue of authenticity has been a contested issue in the context of the museum. Several researchers have asserted that museums should protect their value by adhering to authenticity, which is the heart of a museum's value and the element that distinguishes it from other museums (Count, 2009). On the other hand, some researchers have insisted it is important to reconcile authenticity with inauthenticity because inauthentic experience is also a part of the experience in today's museums (Halls, 2007; Hede & Thyne, 2010). Realistically, it is difficult to adhere to authenticity because of the degradation of artifacts resulting from both nature and humans (Paquet & Viktor, 2005), economic costs (Hede & Thyne, 2010), and general shifts of museums' mission from focusing on collections to focusing on visitors (Pallud & Straub, 2014). In this context, authenticity can be achieved to some degree by developments in information technology (IT) because such technology enables visitors to fully explore and appreciate museums moving beyond time, space, and language barriers (Chung, Lee, Kim, & Koo, 2018).

Second, *new museology* refers to the paradigm shift of museums from simply exhibiting their rare and precious collections to enriching visitors' engagement (Vergo, 1989). In this context, museum experts are required to focus more on developing ways to enhance visitors' edutainment (education + entertainment) experience (Pallud & Straub, 2014).

In this vein, numerous cutting-edge technologies have been launched at a considerable number of museums around the world to overcome these two concerns. Among them, the present study regards VR as one of the best-suited technologies for museums for the following reasons. First, VR's main characteristics (full immersion and presence) enable visitors to perceive substitute and virtual experiences offered by VR as authentic (Guttentag,

2010). This can provide an opportunity for harmony between authenticity and inauthenticity, which are a part of the visitor's experience in today's museums (Hall, 2007) and further diminish visitors' perceptions about inauthenticity as well. Second, VR provides visitors with education and entertainment experiences, which facilitate *new museology*. In recent years, a number of studies have recognized the potential of VR as a tool that can enhance the museum and cultural heritage experience. For instance, Southall et al. (2019) found that VR provides an opportunity for personalized and tailored cultural heritage experiences. In addition, Han et al. (2019) found that VR can deliver reflective learning experiences within the cultural heritage context. Considering the importance of learning and education as part of museum visits, VR is recognized as a valuable tool for museum experiences. Another issue related to VR and museum experiences has to do with accessibility, as tom Dieck et al. (2019) revealed that VR can enable visitors to access inaccessible sites or objects. This element of accessibility is particularly important in museums to bring objects back to life or to explore hidden sites (tom Dieck et al., 2019).

2.3 Virtual Reality as a marketing tool

Online information platforms and information technologies used to promote tourism to attract visitors to actual tourism sites (Chung, Lee, Lee & Koo, 2015; Jung, tom Dieck, Lee, & Chung, 2016). Pallud & Straub (2014) revealed that museum websites, which are very popular, can encourage travelers to visit the actual museum. Chung et al. (2015) also found that formal websites of destination-marketing organizations motivate visitors who have never visited previously to visit destinations. Furthermore, Jung et al. (2016) examined the impact of tour experiences through AR and VR and confirmed tourists' intentions to revisit after experiencing immersive technologies. In fact, VR has been regarded as a critical destination-marketing tool that offers environmental stimulation and a quality virtual experience (Cho, Wang, & Fesenmaier, 2002; Huang, Backman, Backman, & Chang, 2016). In this perspective, VR facilitates people visiting real destinations. Because of the intangibility of tourism products, it is impossible to assess their quality in advance; thus, tourists tend to depend on what descriptive information is currently available (Gratzer, Werthner, & Winiwarter, 2004). Therefore, rich and immersive information provided by VR enables potential tourists to make more informed decisions (Williams & Hobson, 1995). Moreover, several researchers have acknowledged VR can be an effective marketing tool for the tourism industry (Guttentag, 2010; Williams & Hobson, 1995). For instance, Gibson and O'Rawe (2018, p. 93) revealed that "from a marketing perspective, VR offers the potential to build a sensory experience of a

tourism destination or attraction, and can be used in sales contexts to complement, or indeed, supplant traditional promotional tools." However, according to Bonetti et al. (2018), to date, VR is used more as a promotional tool to catch consumers' attention rather than as a viable in-store (e.g., travel agencies) solution because of the time-consuming process and high costs involved. Finally, Rauschnabel (2018) added that VR is all about the desired enhancement of the real world and therefore can be considered a good marketing tool. Consequently, more research is required into the opportunities and benefits VR offers.

3. Hypothesis development

On the basis of the theoretical background, the extent to which visitors' engage in activities depends on absorption and immersion. These are referred to as the desire with which they engage in experiences (Yuan & Wu, 2008). On the one hand, absorption leads to visitors only receiving some information; on the other hand, immersion means visitors being completely involved in an experience.

According to Pine & Gilmore's (1998) experience economy model, immersion (esthetics and escapism) looks at the psychological state of the key factors to establish visitors' belief that the experience will be enhanced over time, while absorption (entertainment and education) represents the behaviors visitors engage in to influence the psychological experience through VR devices. Therefore, the Pine & Gilmore (1998) model can be extended into a causal model based on the behavioral-attitudinal theory, where absorption (entertainment and education) is the antecedent of immersion (esthetic and escapism), and immersion influences the overall museum experience and encourages future museum patronage. Therefore, we suggest the causal model as shown in Figure 1.

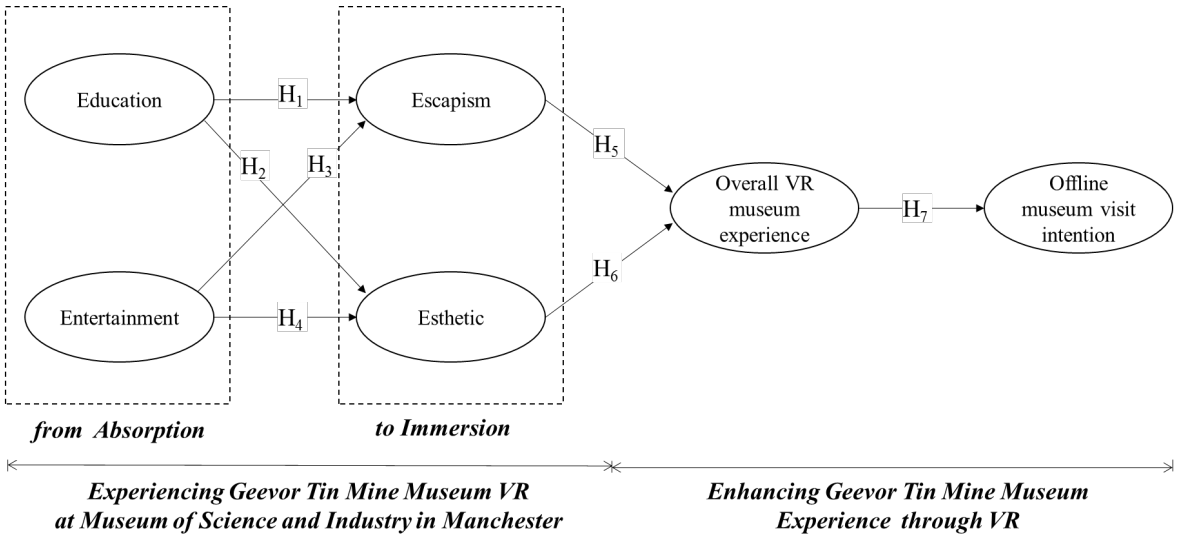

Figure 1. Proposed research model

3.1 Absorption and immersion

Absorption is "occupying a person's attention by bringing the experience into the mind." On the other hand, immersion requires the participant to go into the experience and be part of it. It is "becoming physically (or virtually) a part of the experience itself" (Pine & Gilmore 1999, p. 31). Therefore, an absorptive experience generally should precede an immersive experience. Particularly in the VR environment, users absorb and immerse themselves at the same time; however, education/entertainment and escapism/esthetics are different dimensions, and absorption occurs before immersion. This is because people have more immersive experiences when they have knowledge or interest. According to Song et al. (2015), educational experience is characterized as a mix of active participation and absorption and refers to tourists' desire to learn something new and create new knowledge as part of their travel experience (Hisany & Witham, 2009; Oh et al., 2007). Previous studies have found that technology has positive effects on the learning experience within tourism (tom Dieck et al., 2016). Within the context of film festivals, Park et al. (2010) found a significant effect of educational experience on the escape experience. In an entirely different context, exploring music for educational purposes, Lai (2011) revealed the effect of education experience on esthetic experience.

Pine and Gilmore (1998) described entertainment as the combination of tourists' absorption and passive participation. According to Jung et al. (2016), entertainment is the most important concept in today's tourism context and refers to tourists' ability to enjoy activities

for pleasure. In fact, Hisany and Witham (2009, p. 8) revealed entertainment to be "one of the oldest forms of experience and usually involves a passive involvement of the individual," which is represented in the research model, as tourists can be fully absorbed in the experience. Like this, through VR, device absorption will influence immersion over time. Hence, we hypothesize the following:

H1: Education experience through VR has a positive effect on escapism experience.
H2: Education experience through VR has a positive effect on esthetic experience.
H3: Entertainment experience through VR has a positive effect on escapism experience.
H4: Entertainment experience through VR has a positive effect on esthetic experience.

3.2 Immersion and museum experience

Banos et al. (1999) described the degree of immersion in a virtual experience as one of the key aspects of perceiving the experience as "real." According to Pine and Gilmore (1999), escapism and esthetics are key constructs of immersion. Escapism has often been described as a key reason tourists travel to other destinations and visit various attractions. According to Park et al. (2010, p. 50), "although an escape has been repeatedly suggested as a generic quality of tourism, conceptual and empirical efforts supporting such a role of escape are not well documented in the tourism literature." In the wine tourism context, Quadri-Felitti and Fiore (2013) found that esthetics had the greatest effect on memorable experiences and behavioral intentions. This was confirmed by Chang and Lin (2015), who confirmed that escapism and esthetics through VR influence the experiential value within the tourism industry, and thus, we hypothesize the following:

H5: Escapism experience through VR has a positive effect on overall VR museum experience.
H6: Esthetic experience through VR has a positive effect on overall VR museum experience.

3.3 Overall VR museum experience and intention to visit museum

Research has long established that positive experiences lead to behavioral intentions to visit places in the future (Pine and Gilmore, 1998). Using the experience economy perspective, Chang and Lin (2015) supported the idea that experiences strongly influence behavioral intentions within the tourism context. Similar observations have been made in the museum

context, and a study by Jung et al. (2016) found that positive technology experiences during a museum experience lead to an intention to visit. In addition, Pallud and Straub (2014) and Chung et al. (2015a, 2015b) stated that websites and augmented reality aiming at advertising and providing information to visitors drew more visitors to the museum. In the context of the present study, VR technology is used to promote a museum in a different location, hoping for visitors to plan a visit in the future. Therefore, we hypothesize the following:

H7: Overall VR museum experience has a positive effect on museum visit intention.

4. Methodology

4.1 Data collection

The aim of this study was to investigate the impacts of absorptive experiences on immersion, overall VR museum experience, and intention to visit a museum. Data were collected at The Museum of Science and Industry in Manchester, UK, during the "Wear it" event from March 10 to 13, 2016. The sample included visitors who were interested in industrial cultural heritage and therefore visited the museum in Manchester. These visitors were invited to have a VR experience of the Geevor Tin Mine Museum, one of the UNESCO's Industrial Heritage Sites in Cornwall, UK. The aim of choosing a sample at a different museum was to inquire about participants' intention to visit the Geevor Tin Mine Museum after a VR experience.

Researchers approached every 10th museum visitor at the entrance and asked if they were willing to participate in the study. As part of the study, participants had to try the Samsung Gear VR application before completing a questionnaire on their experience. The VR application consisted of three different stories about the museum. Participants experienced the following: 1. The Dry Room, the changing room of the miners; 2. A lift ride in the mining shaft to reenact how miners originally went down the mine to start their work; and 3. A walk through the mine. Audio was provided to transport visitors into the past and create a memorable experience. After experiencing the museum using VR, 269 participants completed a questionnaire.

The sociodemographic characteristics of the sample are shown in Table 1. The respondents were evenly distributed between men (50.2%) and women (49.8%). The majority of respondents were between the ages of 18 and 54. A quarter of the participants had an

undergraduate degree (24.5%), followed by A-level (19%) and a postgraduate degree (18.6%). With regard to income level, 23% of the respondents reported an annual income of between £40,000 and £49,000, and almost half of the respondents were employed full time (46.1%).

Table 1. Demographic characteristics of respondents

Characteristics		Frequency	%
Gender	Male	135	50.2
	Female	134	49.8
Age	Under 18	9	3.3
	18-24	69	25.7
	25-34	65	24.2
	35-44	63	23.4
	45-54	47	17.5
	55-64	11	4.1
	65+	5	1.9
Education	No Formal Qualification	30	11.2
	GCSE/O-level	34	12.6
	A-level	51	19.0
	Undergraduate Degree	66	24.5
	Postgraduate Degree	50	18.6
	Doctoral Degree	10	3.7
	Professional Degree	28	10.4
Income	Less than £12,999	38	14.1
	£13,000-£19,000	30	11.2
	£20,000-£29,999	34	12.6
	£30,000-£39,999	49	18.2
	£40,000-£49,000	62	23.0
	More than £50,000	56	20.8
Occupation	Full-time employed	124	46.1
	Part-time employed	30	11.2
	Self-employed	32	11.9
	Housewife/husband	7	2.6
	Unemployed	3	1.1
	Retired	6	2.2
	Student	67	24.9
Total		269	100

Nunnally (1967) suggested that the sample size using AMOS (Analysis of Moment Structures)

is required to be greater than 10 times the total number of measurement items. A total of 21 measurement items were used in our study, and therefore, the minimum sample size is 210. In this vein, a total of 269 questionnaires meet this cutoff point.

4.2 Measures

Measurement items were adopted from previous studies (e.g., Chung et al., 2015; Kim & Tussyadiah, 2013; Oh et al., 2007) and modified based on the context of this study: education (4 items), entertainment (5 items), esthetics (3 items), and escapism (4 items) experience items were adopted from Oh et al. (2007); VR museum experience items (3) were adopted from Kim & Tussyadiah, (2013); and intention to visit museum items (3) were adopted from Chung et al. (2015). This procedure yielded a total number of 21 measurement items, which are summarized in Table 2. All of them were measured on a seven-point Likert scale (1=strongly disagree and 7=strongly agree).

5. Results

This study employed a structural equation modeling (SEM) approach to test the hypotheses proposed in Figure 1. SEM is designed to evaluate how well a proposed model or hypothetical construct explains the collected data (Bagozzi and Yi, 2012; Hair et al., 2010). It uses a two-step hybrid method, specifying a measurement model in confirmatory factor analysis (CFA) and testing a latent structural model developed from the measurement model (Kline, 2010).

5.1 Confirmatory factor analysis

We assessed the constructs for convergent validity and discriminant validity through CFA using AMOS 23. In CFA, the measurement model is revised by dropping items that share a high degree of residual variance with other items and have high modification indices (MIs). The MIs indicate the decrease in the chi-square value when a specific parameter that had been constrained is relaxed. Although 21 measurement items were adopted at first, five were eliminated for satisfactory model fit.

For a good model fit, χ^2/df should be less than 3.0 (Bollen, 1989), the goodness of fit index (GFI) should be greater than 0.90 (Doloi et al., 2010; Singh, 2009), the adjusted goodness of fit index (AGFI) more than 0.80 (Hair et al., 2010), the normed fit index more than 0.9 (Doloi et al., 2010), the comparative fit index (CFI) more than 0.9 (Bagozzi and Yi, 2012), and the

root mean square error of approximation (RMSEA) less than 0.07 (Bagozzi and Yi, 2012; Singh, 2009).

An assessment of the measurement model suggested an acceptable model fit (χ^2= 142.62, df=89 (χ^2/df = 1.602), p < 0.001, Goodness of Fit (GFI) = 0.939, Adjusted GFI (AGFI) = 0.907, Normed-Fit Index (NFI) = 0.951, Comparative Fit Index (CFI) = 0.981, and Root Mean Square Error of Approximation (RMSEA) = 0.047). To test reliability and validity, we checked whether the values of composite reliability (CR greater than 0.7), Cronbach's alpha (greater than 0.7), and average variance extracted ((AVE) greater than 0.5)) were greater than their thresholds. Table 2 shows that all of them were satisfactory in terms of reliability and validity.

Table 2. Reliability and Cross-loading [a]

	Constructs and measurement items	Loadings	C.R[b)]	α[c)]	AVE[d)]
Education	I learned something new during VR experience.	0.630	0.745	0.800	0.589
	The experience made me more knowledgeable.	-			
	It stimulated my curiosity to learn new things.	0.832			
	VR provided a good experience for learning.	0.823			
Entertainment	Using VR was amusing.	0.690	0.889	0.900	0.721
	Using VR was captivating.	0.869			
	Using VR was entertaining.	0.911			
	Using VR was fun.	0.906			
Escapism	I felt I played a different character when using VR.	-	0.724	0.702	0.627
	I felt like I was living in a different time or place.	0.802			
	The VR experience let me imagine being someone else.	0.835			
	I completely escaped from reality.	0.802			
Esthetic	Using VR application was very attractive.	0.725	0.615	0.831	0.551
	VR application paid close attention to detail.	-			
	Using VR application was very pleasant.	0.759			
Overall VR Museum experience	Using VR contributed positively to my overall experience in the Geevor museum.	0.882	0.845	0.877	0.777
	Using VR helped me to enjoy my experience in the Geevor museum.	0.881			
	Using VR gave me a meaningful experience in the Geevor museum.	-			
Offline museum visit	Given the opportunity, I intend to visit the Geevor museum.	-	0.839	0.913	0.842

intention	It is likely that I will actually visit the Geevor museum.	0.938
	I will visit the Geevor museum after experiencing VR.	0.897

a) Note: χ^2=142.622, df=89 (χ^2/df=1.602), p =0.000, GFI=0.939, AGFI=0.907, NFI=0.951, CFI=0.981, and RMSEA=0.047
b) Composite reliability
c) Cronbach's alpha
d) Average variance extracted

Table 3 shows that the values of the square root of AVE of each construct (diagonal elements) are greater than the correlations with other constructs, which indicates discriminant validity (Fornell & Larcker, 1981).

Table 3. Correlation and discrimination validity

Constructs	Mean	S.D	(1)	(2)	(3)	(4)	(5)	(6)
(1) Education	5.84	1.00	**0.767**					
(2) Entertainment	6.14	0.95	.485**	**0.849**				
(3) Escapism	5.56	1.20	.450**	.516**	**0.742**			
(4) Esthetic	5.80	1.10	.551**	.733**	.490**	**0.792**		
(5) Overall VR Museum experience	6.04	1.07	.525**	.754**	.575**	.701**	**0.881**	
(6) Offline museum visit intention	4.99	1.37	.303**	.328**	.319**	.336**	.336**	**0.918**

Note: Diagonal elements in the "correlation of constructs" matrix are the square root of the average variance extracted (AVE). For adequate discriminant validity, the diagonal elements should be greater than the corresponding off-diagonal elements.
* p<0.05, ** p<0.01

5.2 Hypothesis testing

As the results of CFA established that the items demonstrated convergent validity, we conducted a structural equation model. Figure 2 and Table 4 present the maximum likelihood estimates for the various overall fit parameters. These multiple indicators suggest that the model has a good fit, justifying further interpretation.

The χ^2 statistic fit was 155.523, with 96 degrees of freedom (χ^2/df = 1.620, p < 0.000). The GFI was 0.933, the AGFI was 0.905, the NFI was 0.947, the CFI was 0.979, and the RMSEA was 0.048.

The results show that all hypotheses are supported. To be more specific, hypotheses H_1, H_2, H_3, and H_4 address the relationship between absorptive (education and entertainment) and

immersive (escapism and esthetic) experiences. Both absorptive experiences were found to have a significant and positive influence on immersion. The results show that education has a slightly stronger influence on escapism (β=0.339, t-value = 4.098, p<0.001) than on esthetics (β=0.265, t-value = 4.535, p<0.001), while entertainment has a stronger influence on esthetics (β=0.763, t-value = 11.254, p<0.001) than on escapism (β=0.385, t-value = 4.872, p<0.001). Hypotheses H_5 and H_6 address the relationships between immersion and overall museum experience. The results show that both escapism (β=0.186, t-value = 3.226, p<0.01) and esthetics (β=0.798, t-value = 10.882, p<0.001) have an impact on museum experience. Particularly, esthetics was found to be the strongest predictor of museum experience. Finally, hypothesis H_7 addresses the relationship between museum experience and museum visit intention, and the results show that museum experience has a significant influence on museum visit intention (β=0.401, t-value = 5.884, p<0.001). Thus, all the hypotheses are supported.

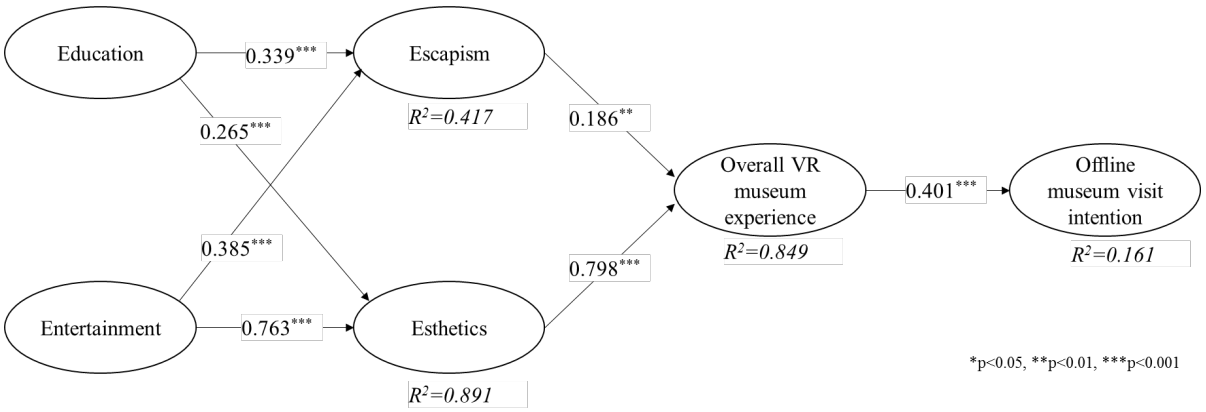

Figure 2. Results of the proposed model

5.3. Competing model testing

As numerous previous studies have regarded the direct effects of four realms of the experience economy (e.g., Jung et al., 2016), it is necessary to check whether the proposed model is better than its rival model. The strongest test of the proposed model is to identify and test competing models that represent different hypothetical structural relationships. Thus, this competing models strategy was adopted as a means of evaluating the proposed model versus rival models.

In the proposed model, education and entertainment influence overall VR museum experience through escapism and esthetics. The model does not have direct paths between escapism and esthetics despite the fact that absorption has been associated with overall experience in past research. On the other hand, the rival model shown in Figure 3 has direct effects. Escapism and esthetics are not allowed to mediate in any of the relationships. It posits only direct paths to overall VR museum experience. The rival model was also examined for explanatory power and path significance using a bootstrapping technique (Figure 4).

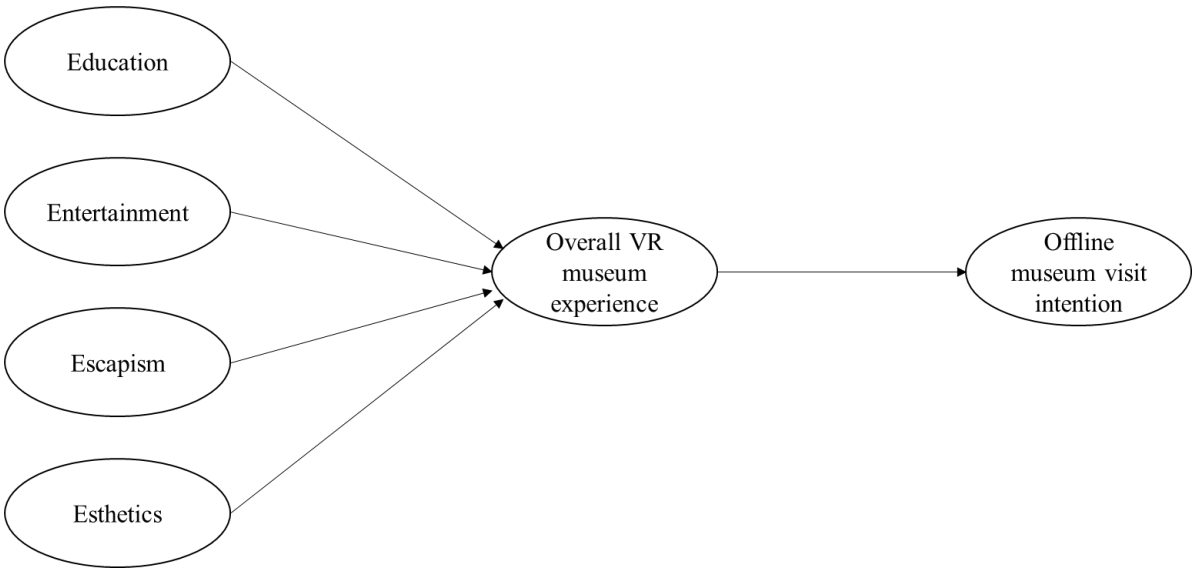

Figure 3. Rival model

The alternative model in this study also has a good level of fit. The χ^2 statistic fit was 150.784, with 93 degrees of freedom (χ^2/df = 1.621, $p < 0.000$). The GFI was 0.935, the AGFI was 0.905, the NFI was 0.949, the CFI was 0.979, and the RMSEA was 0.048.

Both absorptive experiences were found not to have had a significant influence on museum experience. The results show that education (β=-0.022, t-value = -0.205, n.s) and entertainment (β=0.265, t-value = 1.333, n.s) do not have an influence on museum experience. However, both immersive experiences were found to have a significant and positive influence on museum experience. The results show that esthetics has a stronger influence on museum experience (β=0.568, t-value = 2.000, $p<0.05$) than escapism (β=0.168, t-value = 2.448, $p<0.05$). The results also show that museum experience has a significant influence on

museum visit intention (β=0.400, t-value = 5.859, p<0.001).

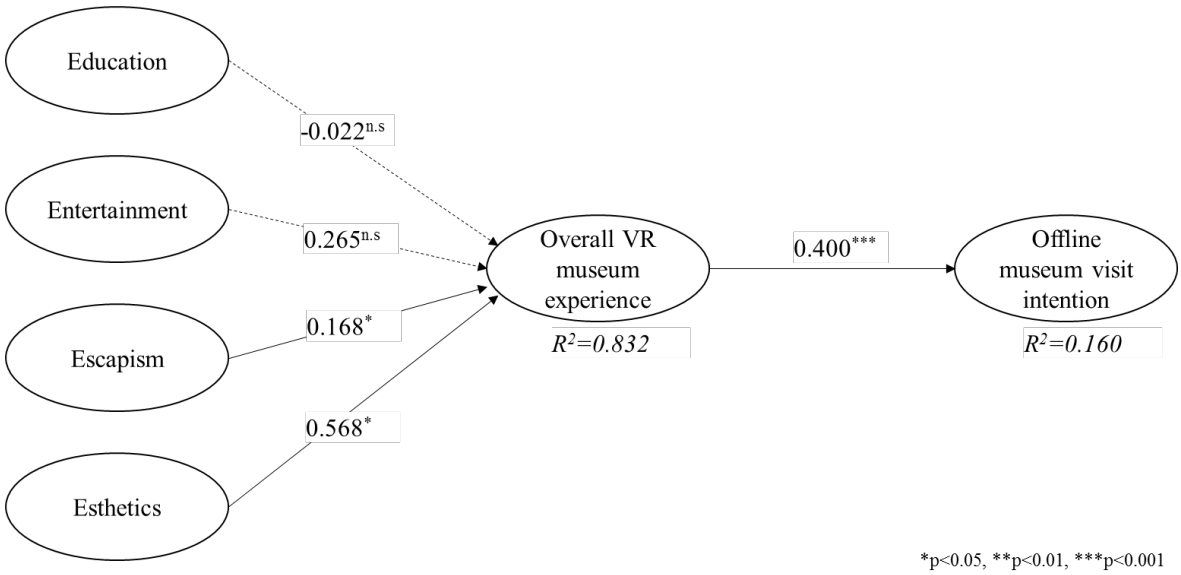

Figure 4. Results of the rival model

There are two criteria for comparing the two models: overall model fits and the percentages of the supported hypotheses (Agag & El-Masry, 2016; Hair et al., 2010). Although the proposed model and its rival have good and almost the same level of model fits, the former has a higher percentage of supported hypotheses than the latter (Table 4). Specifically, 100% of hypotheses are supported, and six out of seven hypotheses (85.7%) are supported at p<0.001 in the proposed model, whereas only three out of five hypotheses (60.0%) are supported, and among them, only one hypothesis (20.0%) is supported at p<0.001. Therefore, the proposed model is better than the rival model, which means the process from absorption to immersion can be statistically significant in a VR environment.

Table 4. Analysis of competing structural models

Hypotheses	Estimate path	
	Proposed model	Rival model
Education → Escapism	0.339***	-
Education → Esthetic	0.265***	-
Education → VR Museum experience	-	-0.022n.s
Entertainment → Escapism	0.385***	-
Entertainment → Esthetic	0.763***	-
Entertainment → VR Museum experience	-	0.265n.s
Escapism →VR Museum experience	0.186**	0.568*
Esthetic →VR Museum experience	0.798***	0.168*

VR Museum experience → Offline museum visit intention	0.401***	0.400***
Model Fits		
χ^2/DF	155.523/96 (1.620)	150.784/93 (1.621)
GFI(≥0.9)	0.933	0.935
AGFI(≥0.9)	0.905	0.905
NFI(≥0.9)	0.947	0.949
CFI(≥0.9)	0.979	0.979
RMSEA(≤0.05)	0.048	0.048

*p<0.05, **p<0.01, ***p<0.001, n.s=nonsignificant

6. Discussion and Conclusion

The aim of this study was twofold. The first aim was to investigate the effects of absorptive experiences (education and entertainment experiences) on immersion (e.g., escapism and esthetic experiences), overall museum experience, and intention to visit the actual museum; the other was to test whether the proposed model is better than its counterpart by comparing these two models' fit and the percentage of supported hypotheses. The results show that absorptive experiences have a great influence on immersive experiences, VR museum experience, and intention to physically visit the museum. These results are in line with the results of previous studies such as the study by Park et al. (2010), which shows the significant impacts of education, entertainment, and esthetic experiences on the escape experience of film festival participants.

On the basis of these results, theoretical and practical implications are provided. First, one of the theoretical implications is that this study emphasizes the roles of immersion in VR environments. Although immersive environments are a critical factor of VR, a considerable number of studies have regarded VR as just a substitute for tourism (e.g., Jung et al., 2016). However, this study focused on the roles of the immersive environment contributing to *authenticity* and *new museology,* which are two major issues today's museums are facing. The results show that an immersive VR environment enhances overall tour experiences and consequently induces the intention to physically visit a museum. The second theoretical contribution is that this study represents causality between absorption and immersion. Contrary to most previous studies that have regarded the direct impacts of the four realms of the experience economy (e.g., Hosany & Witham, 2009), this study inferred and showed the significant causality between absorption and immersion in the light of the features of a VR

environment (immersion). Moreover, this study empirically presented the superiority of the proposed model over the commonly used rival model by comparing these two models. As immersion is a crucial factor of VR environments, this perspective is meaningful and important.

In addition, this study can have practical implications for practice with regard to attracting more visitors to a museum. The results of this study suggest museum practitioners and VR developers should emphasize the edutainment factors of VR, which help immerse visitors in a VR environment and to have an enhanced experience, which ultimately influences their intention to visit the actual museum. It is important to provide exact and plentiful information in a novel and captivating way. For instance, it can help make the process of providing information more captivating by using avatars, audio, and 3D virtual images.

However, this study has some limitations. First, because the data were collected at one place, it is difficult to generalize the results of this study in various VR settings. The VR apps were developed and designed according to the subjects, settings, and characteristics of visitors to museums, and thus, there are functional or design differences between the VR apps of museums. Therefore, future studies could benefit by collecting data from various museums to provide more comprehensive and applicable results. Second, although this study represented the roles of absorptive experiences, there can be other factors that influence immersion, such as interface design quality and presence. Therefore, further studies should include other factors of VR environments, enabling users to be immersed. Finally, this study was conducted in the UK, and considering the importance of cultural differences within the technology adoption stream of research, a cross-cultural comparison could be conducted to fully understand the effect of immersive VR experiences on the behavioral intentions of consumers in different markets.

Both VR and augmented reality (AR) in tourism have much scope for future studies (Chung et al., 2018). Both VR and AR have been launched in a considerable number of museums and cultural heritage sites. They can enhance tourists' experience and complement the limitations of real sites (e.g., currently nonexisting attractions). However, VR provides a completely virtual experience, while AR offers a partially virtual experience by showing superimposed images and information on the real-world view captured by the device's camera (Rauschnabel et al., 2019). Therefore, adopting this research model in the AR context is expected to provide in-depth insights into the ways in which absorptive experiences influence

immersive experiences, AR experiences, and intention to revisit the actual destination. In addition, previous research (e.g., Herz & Rauschnabel, 2019) has explored the angle of esthetics in terms of the fashionability of VR glasses and the effect of behavioral intentions within the business and marketing context. This could be a further avenue of exploration within the museum and cultural heritage context, leading to the question of social acceptance. Finally, the uses and gratification theory has become one prominent theory of AR research in the past years and could be applied to further experience economy research within the VR context to account for the gratifications visitors receive.

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