

The effect of immersive experience, user engagement and perceived authenticity on place satisfaction in the context of augmented reality

The context of augmented reality

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Abstract

Purpose – This study aims to measure the effect of augmented reality (AR) on immersive experiences, place satisfaction, user engagement and perceived authenticity.

Design/methodology/approach – The population of the research consists of museum visitors visiting the Sakip Sabanci Museum in Turkey, which provides an interactive experience to the audience using AR technology via iPads. The data were collected both online and offline. The research was carried out with 397 questionnaire forms. The hypotheses were tested through smart partial least squares (PLS) 3.

Findings – Immersive experience positively affects place satisfaction, user engagement and perceived authenticity. It was also concluded that user engagement and perceived authenticity mediated the relationship between immersive experience and place satisfaction.

Research limitations/implications – The entire universe could not be reached, as the study had limitations in terms of time, cost, accessibility and control difficulties. Therefore, the study was carried out with 397 visitors who visited the Sakip Sabanci Museum (SSM) in Turkey and used AR technology.

Practical implications – The study emphasized the importance of AR in cultural tourism. The interactions of museum visitors with AR can be greatly enhanced by immersive experiences. Expanding AR to provide different experiences can increase the number of visitors.

Originality/value – Although there are recent studies on AR, it seems insufficient to investigate and empirically examine this subject in the context of museums. No studies conducted in Turkey have investigated the current topic of this study. Conducting this research in Turkey with the proposed research model will make the topic easier to understand, proving the study's originality.

Keywords Augmented reality, Immersive experience, Place satisfaction, User engagement, Perceived authenticity

Paper type Research paper

1. Introduction

Integrating new realities in museums can create additional value and attract new visitor profiles (Trunfio *et al.*, 2020; Errichiello *et al.*, 2019; Han *et al.*, 2018). Cultural heritage museums combine traditional cultural experiences (such as learning and education) with other emotional and extraordinary experiences (entertainment, enjoyment and socializing) (Trunfio *et al.*, 2022). In this context, the use of augmented reality (AR) is increasingly used in the domain of cultural heritage tourism, providing potential benefits (Jung *et al.*, 2018). AR is a technology that processes and



presents three-dimensional (3D) real-time data over a physical environment (Azuma, 1997). It is defined as the technology where virtual objects are blended with the real world, and where real and virtual objects interact with each other (Günel and Arabacıoğlu, 2019). AR is a computer-mediated mechanism that places virtual content in specific real locations on the screens of mobile devices such as smartphones and electronic tablets through various applications (Georgiou and Kyza, 2017). These applications allow consumers to use cameras, microphones, etc. and be included in AR environments (Zhou *et al.*, 2008). AR is a highly visual and interactive system for accessing and understanding information related to cultural tourism. Technological approaches such as AR can provide visitors with the opportunity to experience a personalized environment (Fritz *et al.*, 2005).

AR is increasingly used in cultural heritage tourism to enhance the experiences of tourists (Jung *et al.*, 2018). Heritage museums around the world are reshaping their missions and roles by combining unified and preserved knowledge (preservation and evaluation of historical collections) with new forms of experience (Trunfio *et al.*, 2022). As an innovative technology, AR has begun to create unique experiences in many touristic places such as museums/exhibitions and outdoor destinations (He *et al.*, 2018). AR systems have been developed in the field of tourism in order to provide broader information about destinations and tourist attractions. The satisfaction of museum visitors increases as a result of their active use of AR (Akkuş and Akkuş, 2018). Today, there is a lot of software to create AR applications. These can be software used with computer systems such as Unity 3D, ARKit, Unreal Engine, Vuforia Engine and ARCore (Akkoc and Coşkun, 2019). Museums displaying cultural items commonly adopt 3D displays for interactive exhibitions (Hashim *et al.*, 2014).

AR helps tourists in the decision-making process, making them spend less effort finding content (Yovcheva, 2015). Technologies such as AR and virtual reality make significant contributions to areas including accommodation, marketing, planning, management, entertainment, museum, food and beverage, transportation, sustainability, accessibility and education (Demirezen, 2019). Numerous historical objects and cultural heritage sites around the world have been digitized in 3D. Thus, the destruction of valuable and historical objects and destinations by tourists is prevented. AR is universally applicable in urban heritage tourism. Together with virtual reality, AR offers an opportunity to preserve heritage sites in destinations (Bec *et al.*, 2019; Jung *et al.*, 2016).

Dalili Saleh *et al.* (2022) stated in their research in the context of libraries that AR can greatly help library management and improve the professional activities of users. Therefore, AR applications can also be used for museums. This technology creates an impressive atmosphere in museums and thus offers museums the opportunity to attract more visitors. It allows visitors to interact with models in a variety of ways, by providing solutions that enable the visualization of artifacts in the museum in 3D in both virtual and real environments. Museums created using AR, put the virtual world right in front of your eyes, bringing exhibitions and works to live in new ways (Demirezen, 2019). Smartphone AR applications provide access to location-based information about the immediate surroundings and to up-to-date content (Yovcheva *et al.*, 2012). AR technology is already used in tourism with different applications. These applications have been brought together in a way that both include applications (3D virtual tours) offered through the website of the tourist (such as museums, and ruins) and the opportunity to experience the technology (Eryilmaz and Aydın, 2020). One of the best museums in Turkey with AR technology is the Sakıp Sabancı Museum (SSM) located in Istanbul. The rare manuscripts exhibition at SSM can be viewed in detail via iPad (Sucaklı and Güzel, 2020). SSM carried out a project called "Digital SSM", in which all collections and archives were transferred to digital media, with more than 77,000 images. The works transferred to the digital environment are also accepted as the basis of AR experience in Turkey (Coşkun, 2021). In this respect, the population of the research consists of the visitors of SSM located in Istanbul, Turkey.

In museums, AR technology can provide additional information about a place or provide a digital re-enactment of places (ruins, ancient cities, etc.) with 3D graphics and sound effects

(Sucaklı and Güzel, 2020). AR provides a high sense of reality by reproducing virtual data in a real environment. Unlike virtual reality, which completely replaces the real world, AR is a viable method in terms of cost and content creation by controlling only a part of the entire environment (Park *et al.*, 2006). Therefore, it provides access to information anytime, anywhere. It meets the needs of the younger generations by taking care of their needs with technology that attracts visitors. AR improves the perception of the real world by personalizing information according to the preferences of the individual. It additionally provides many benefits in terms of increasing the possibility of social interaction and connection and making the learning experience more interactive, interesting and fun (Cranmer, 2017). As an innovative technology, AR provides a unique and interactive experience for museums. Therefore, the research was carried out to determine the effects of immersive experience, place satisfaction, user engagement and perceived authenticity. In the study, the mediating effects of user engagement and perceived authenticity were also tried to be determined. The research contributes to the debate about the impact of AR use in museums in the context of cultural heritage. The study has some theoretical and practical implications for these purposes.

2. Literature review

2.1 Immersive experience-IE

State-of-the-art technologies are used in various contexts in different destinations (historical places, cultural heritage destinations and museums) for tourism experiences (Guo *et al.*, 2021). The new museology emphasizes enriching the participation of visitors, rather than merely exhibiting valuable cultural artifacts (Savenije and de Bruijn, 2017). Cheng (2021) stated that AR applications in technology-enriched museums contribute to improving the visiting experience of users. IE refers to the sense of real presence in virtual reality arising from the design elements of the computer-mediated environment that characterizes liveliness, spontaneity, controllability and enjoyment (Tsai, 2020). In this respect, it refers to an immersion in which a tourist vividly experiences the historical scenes that occur at the tour site, as if they had traveled to the past. AR with audio and videos is used for, i.e. (Park *et al.*, 2006). This experience with AR applications improves the immersive experience by triggering interaction (Arghashi and Yuksel, 2022). Technologies such as AR (Hahn, 2012, p. 429), which adds real-time interactive data to objects in the physical environment, provide new ideas for museum applications (Oyelude, 2018, p. 1), creating an exciting environment by enabling them to be used to support exhibitions in museums (Lo *et al.*, 2019, p. 274). The impact of these technologies on heritage sites renders an accessible and memorable immersive experience important (Dogan and Kan, 2020; Tennent *et al.*, 2020). Baumgartner-Kiradi *et al.* (2018) stated that AR has high potential for users and AR applications provide benefits for users. For this reason, it would be appropriate to use AR more than ever, especially in museums today (Oyelude, 2020). Recently, the prevalence of AR applications on smartphones has caused new excitement and has shown the potential to transform the way we work and experience (Greene and Groenendyk, 2021).

2.2 User engagement – UE

User engagement (UE) is the emotional, cognitive and behavioral experiences of a user with a technological resource that exists at any time (Lalmas *et al.*, 2014). In a world full of choices, where the immediate attention of users becomes the primary source, it is crucial for technology providers to design engaging experiences (Lehmann *et al.*, 2012). Therefore, user engagement refers to the quality of the user experience, which highlights the positive aspects of interacting with an online application and, particularly, the desire to use that application again. Users give their time and attention to using these technologies and try to meet pragmatic and hedonic needs (Lalmas *et al.*, 2014). AR allows users to see the real

environment only with virtual images superimposed on real environmental objects. Therefore, AR enhances reality rather than completely changing it (Li and Liu, 2022). Thus, its technology allows users to interact with virtual figures in a real environment. The way this visual interaction works shows that it can improve the real-world user experience (Huang and Lin, 2017). Therefore, user engagement affects the overall satisfaction of users in a computer-mediated environment (Ardito *et al.*, 2018).

2.3 Perceived authenticity – PA

As an individually negotiated and socially constructed concept, authenticity plays an active role in creating individual experiences for visitors (Ivanovic, 2014). Lin and Liu (2018) stated that authenticity plays a key role in cultural tourism and that perceived authenticity affects the willingness of tourists to spend money (Lin and Liu, 2018). Kolar and Zabkar (2010) emphasized the vital role that authenticity plays in cultural tourism and argued that it helps to understand the behavior of tourists. The concept of authenticity has been regarded as an antecedent of and an important driving force behind the behaviors of visitors (Grayson and Martinec, 2004). PA can become the main source of competitive advantage, even more so than service quality (Ye *et al.*, 2018). Especially within cultural tourism, authenticity is considered a perceptual concept related to the visited places. The concept of PA is associated with the historical accuracy and true representation of attractions from the perspective of tourists, and this often overlaps with the concept of object authenticity (Kim *et al.*, 2017). Attitude toward technology is an important factor in determining the adoption of various digital technologies such as AR technology (Arghashi and Yuksel, 2022). Pallud (2017) found that visitors' perceptions of user experience in a technology-enhanced museum tour are affected by technology. In particular, supporting the perception of curiosity, pleasure and originality with technology reinforces this experience.

2.4 Place satisfaction – PS

PS is defined as the judgment regarding the perceived quality of an environment including the physical characteristics, services and social dimensions (Stedman, 2002). PS is considered an idea related to place-related factors such as how we feel in casual environments and how we behave in them (Masso *et al.*, 2017). AR, experiences and user interactions created by recent technologies provide place satisfaction (Ramkissoon and Mavondo, 2014). It has been stated that there is a positive relationship between satisfaction and attachment, and place satisfaction leads to attachment (Insch and Florek, 2008).

3. Theoretical framework

Immersive experiences help the overall satisfaction of AR users (Scholz and Smith, 2016). AR provides the necessary basis for immersive experience (Park *et al.*, 2006). Immersive experiences increase the value of the experience and the pleasure and satisfaction of visitors (Guo *et al.*, 2021). User interaction triggers participation in user/content interaction. It also combines the continuous interaction between the mind, body and computer-mediated environment to deepen the satisfaction of immersive experiences and increase overall satisfaction (Georgiou and Kyza, 2017). The content created using AR technology at the SSM can be experienced through the iPads provided to the visitors, creating an interactive experience. Thus, the immersive experience increased by user interaction will positively affect perceived authenticity. Wu *et al.* (2019) emphasized the importance of authenticity in cultural tourism by emphasizing that perceived authenticity has a significant positive effect on satisfaction. The following hypotheses were formed on the basis of the above information.

H1. Immersive experience has a positive effect on place satisfaction.

H2. Immersive experience has a positive effect on the user engagement of tourists.

H3. Immersive experience has a positive effect on perceived authenticity.

User engagement triggers participation, creating immersive experiences and consequently increasing satisfaction (Georgiou and Kyza, 2017). Thus, perceived authenticity simultaneously intensifies and increases place satisfaction (Bec *et al.*, 2019). Perceived authenticity also greatly affects the behavior of visitors and creates a strong relationship with place satisfaction (Huete-Alcocer *et al.*, 2018; Ramkissoon and Uysal, 2011). According to Engeset and Elvekrok (2015), authenticity has an important mediating role between visitor satisfaction qualities and overall satisfaction. They also stated that real experiences contribute to a higher level of satisfaction. In other words, perceived authenticity increases the positive effect of the immersive experience created by AR applications (Tsai, 2020). Thanks to AR applications, tourists experience the real historical scene that took place at the tour site vividly as if they traveled to the past. Since this provides an experience close to reality, immersion is the key element (Park *et al.*, 2006). User participation combines the seamless interaction between mind, body and computer-mediated environment (Miller and Clark, 2018). User engagement triggers participation, facilitating the creation of an immersive experience and consequently increasing satisfaction (Georgiou and Kyza, 2017). Therefore, it can be stated that user participation mediates the relationship between immersive experience and place satisfaction. Perceived authenticity, on the other hand, affects the behavior of visitors (Domínguez-Quintero *et al.*, 2020) and creates a real sense of presence with the immersive experience in the computer-mediated environment (Tcha-Tokey *et al.*, 2016), resulting in an increase in overall satisfaction. Therefore, it can be said that perceived authenticity mediates the relationship between immersive experience and place satisfaction. The following hypotheses were formed on the basis of the above information.

H4. User engagement has a positive effect on place satisfaction.

H5. Perceived authenticity has a positive effect on place satisfaction.

H6. User engagement has a mediating role between immersive experience and place satisfaction.

H7. Perceived authenticity has a mediating role between immersive experience and place satisfaction.

4. Methodology

4.1 Sample and data collection

This research was carried out to determine the effects of immersive experience, place satisfaction, user engagement and perceived authenticity. In the study, the mediating effects of user engagement and perceived authenticity were also tried to be determined. Figure 1 presents the research model employed in this study.

The population of the research consists of the visitors of SSM in Istanbul, Turkey. The rare manuscripts exhibition at the SSM can be viewed in detail via iPad [1] (Sucaklı and Güzel, 2020). The works in the SSM have been transferred to the electronic environment and the works created in this environment are presented to the visitors with animations via iPads (see Plate 1). The content created using AR brings together traditional art with technology, giving visitors an interactive experience. SSM offers a multi-faceted museum experience that is open to everyone, across borders and disciplines, in both physical and digital spaces (Sakıp Sabancı Museum, 2022).

AR applications are used through tablets in the artistic manuscripts section. It is possible to examine the artistic manuscript book samples in detail by scanning the relevant code in this section. The museum provides the opportunity to examine the works digitally on tablets

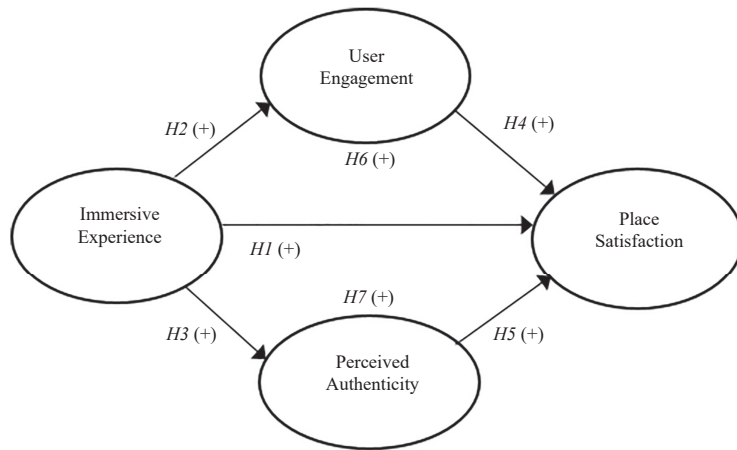


Figure 1.
Proposed
research model



Plate 1.
Book arts and
calligraphy collection
showcase augmented
reality pointer

Source(s): Sakip Sabanci Museum, 2022

for visitors who do not have the opportunity to thoroughly examine these works, such as books, which are small in size and prepared with fine craftsmanship (Coşkun, 2021).

The convenience sampling method was used, and data were collected through a questionnaire from 397 participants. This method was chosen in order to collect data easily, quickly and economically from the main population (Malhotra, 2004). Questionnaire forms were conducted face-to-face and online between 03 January and 18 February 2022, on visitors who viewed the works in the SSM using AR technology. Questionnaires were first distributed to individuals who visited the museum face to face. In the process of filling out the questionnaire, the visitors were first asked whether they used AR technology in the museum. Questionnaires were collected from a total of 227 visitors using AR technology. A total of 32 questionnaire forms were removed from the list due to the incomplete filling of some data. The questionnaires were also distributed online. The created forms were distributed through social media sites (Facebook, WhatsApp, WhatsApp groups, Twitter and Instagram). While creating the online questionnaire, attention was paid to filling it out by people who visited the SSM using AR technology. Additionally, visitors who did not agree to physically fill out the questionnaire due to the effects of the COVID-19 process were asked to fill out this form online. A total of 202 valid responses were received from the distributed forms. Thus, the study was conducted with 397 questionnaire results.

The study is a quantitative study. The data were collected through questionnaires. The questionnaire consists of two sections. The first section includes questions on the demographics of the participants. In the second part, five (Tsai, 2020) to measure immersive experience, four (Ardito *et al.*, 2018; Georgiou and Kyza, 2017) to measure user engagement, four expressions (Huete-Alcocer *et al.*, 2018; Oleksy and Wnuk, 2016) were used to measure perceived authenticity and place satisfaction. The statements were adapted into a five-point Likert-type scale, ranging from “strongly disagree” to “strongly agree” (1–5).

4.2 Data analysis

The model was tested using Smart PLS 3 (PLS-SEM). According to Hair *et al.* (2011), PLS-SEM allows researchers to predict complex models with many structures, indicator variables and structural ways without applying distribution assumptions to the data. PLS does not require any normality assumptions and can operate with small samples (Hair *et al.*, 2019). It can also work with the resampling method, which is more powerful than classical tests such as the Sobel test and is recommended for indirect effects analysis.

Smart PLS evaluates the data analysis method in two stages: measurement and structural model (Hair *et al.*, 2014). In order to calculate the reliability coefficients, Cronbach Alpha (CA) and rho-A values were used. Composite reliability (CR) is calculated for internal consistency reliability while factor loadings and average variance extracted (AVE) values are calculated to determine convergent validity. Fornell-Larcker criteria and Heterotrait-Monotrait Ratio (HTMT) tests were conducted to determine discriminant validity. In the evaluation process of the structural model, multicollinearity analysis (Variance Inflation Factor-VIF), determination coefficient- R^2 , effect size- f^2 , predictive relevance- Q^2 and path analyses were made.

5. Results

5.1 Participants profiles and the measurement model

The demographics of the participants are shown in detail in Table 1. 54.4% of the participants are male, 45.6% are female and 52.6% of them are married. Most of the participants are aged between 18 and 24 with a percentage of 22.4–32.2% of the participants have an undergraduate degree while 46.1% have a medium income.

The partial least squares structural equation model Smart PLS 3.3.3 (PLS-SEM) was used to test the proposed structural model. Bootstrapping technique was used to test the hypotheses.

The CA, CR and rho_A values of the variables in the research model were above 0.70 (Fornell and Larcker, 1981; Hair *et al.*, 2019) and had sufficient reliability and internal consistency (see Table 2).

Factor loadings and AVE values were calculated to determine convergent validity. The factor loadings (Kaiser, 1974) and AVE values (Hair *et al.*, 2019) of the expressions were found to be above 0.50. Thus, the research model has convergent validity (see Table 2).

In order to determine the discriminant validity of the research model, the AVE square root values were compared with the correlation loading between each variable and it was found that the square root AVE values were high (Fornell and Larcker, 1981) (see Table 3). In addition, to verify the discriminant validity, the Heterotrait-Monotrait Ratio (HTMT) value was examined, and it was concluded that the values were below 0.9 (Henseler *et al.*, 2009) (see Table 3). Thus, discriminant validity is provided for the model. After these evaluations, the tests for the measurement model were finished and structural evaluation started.

In order to determine the structural model, VIF, R^2 , f^2 , Q^2 and path coefficient analyzes were conducted. Variance inflation factor (VIF) is a structural model analysis performed to determine whether there is a multicollinearity problem among the variables (O'Brien, 2007).

LHT

| Variable | | <i>n</i> | % |
|----------------|-----------------------|----------|------|
| Gender | Female | 216 | 54.4 |
| | Male | 181 | 45.6 |
| Marital Status | Married | 209 | 52.6 |
| | Singles | 188 | 47.4 |
| Age | 18< | 56 | 14.1 |
| | 18-24 | 89 | 22.4 |
| | 25-34 | 83 | 20.9 |
| | 35-44 | 85 | 21.4 |
| | 45-54 | 31 | 7.8 |
| | 55-64 | 27 | 6.8 |
| | 65≤ | 26 | 6.5 |
| Education | Primary education | 17 | 4.3 |
| | High school | 83 | 20.9 |
| | Associate degree | 104 | 26.2 |
| | Bachelor's degree | 128 | 32.2 |
| | Master's degree/Ph.D. | 65 | 16.4 |
| Income | Very low | 26 | 6.5 |
| | Low | 39 | 9.8 |
| | Average | 183 | 46.1 |
| | High | 125 | 31.5 |
| | Very high | 24 | 6.0 |

Table 1.
Demographics of
the participants

| Variables | λ | <i>t</i> value | CR | rho_A | AVE |
|--|-----------|----------------|------|-------|------|
| <i>Immersive Experience (IE) ($\alpha = 0.881$)</i> | | | 0.91 | 0.88 | 0.67 |
| 1 I feel like I am there while using the AR app | 0.803 | 30.680 | | | |
| 2 Augmented reality is similar to the real world | 0.802 | 38.340 | | | |
| 3 I feel like there is something unnatural about augmented reality | 0.889 | 66.049 | | | |
| 4 I can control my movements in augmented reality | 0.844 | 50.418 | | | |
| 5 My presence in augmented reality is enjoyable | 0.774 | 29.482 | | | |
| <i>User engagement (UE) ($\alpha = 0.929$)</i> | | | 0.95 | 0.92 | 0.82 |
| 1 My mind is deeply absorbed in interaction with augmented reality | 0.902 | 71.598 | | | |
| 2 I feel excited about interacting with augmented reality | 0.924 | 98.431 | | | |
| 3 I devote myself to activities in augmented reality | 0.919 | 52.119 | | | |
| 4 I find interactions with augmented reality impressive | 0.887 | 45.671 | | | |
| <i>Perceived authenticity (PA) ($\alpha = 0.823$)</i> | | | 0.88 | 0.82 | 0.65 |
| 1 The Sakıp Sabancı Museum fits the way I see myself as a cultural tourist | 0.825 | 41.662 | | | |
| 2 I cherish the cultural significance of the Sakıp Sabancı Museum | 0.841 | 47.111 | | | |
| 3 I feel connected with the cultural heritage of the Sakıp Sabancı Museum | 0.823 | 39.282 | | | |
| 4 The visit to the Sakıp Sabancı Museum enriches the meaning of my life | 0.744 | 25.014 | | | |
| <i>Place Satisfaction (PS) ($\alpha = 0.945$)</i> | | | 0.96 | 0.94 | 0.86 |
| 1 I am happy with the museum I visited | 0.914 | 77.208 | | | |
| 2 The museum I visited meets my tourism needs and desires | 0.944 | 124.123 | | | |
| 3 Overall, the museum I visited met my expectations | 0.954 | 154.779 | | | |
| 4 I will recommend the museum I visited to other tourists | 0.896 | 61.349 | | | |

Table 2. Reliability and validity
Note(s): * λ = Factor loadings, CR=Composite reliability, AVE = Average variance extracted, α = Cronbach Alpha

| Değişkenler | 1 | 2 | 3 | 4 | The context of augmented reality |
|--|-------|-------|-------|-------|----------------------------------|
| <i>Fornell-Larcker Criterion</i> | | | | | |
| IE | 0.823 | | | | |
| UE | 0.459 | 0.908 | | | |
| PA | 0.537 | 0.549 | 0.809 | | |
| PS | 0.525 | 0.449 | 0.549 | 0.927 | |
| <i>Heterotrait-Monotrait Ratio (HTMT)</i> | | | | | |
| IE | | | | | |
| UE | 0.502 | | | | |
| PA | 0.628 | 0.627 | | | |
| PS | 0.574 | 0.478 | 0.619 | | |
| Note(s): Italicized values represent the square root of the average variance extracted (square root of the AVE values - $\sqrt{\text{AVE}}$) | | | | | |

Table 3. Discriminant validity

Diamantopoulos and Siguaw (2006) stated that VIF values below 3 would not cause a multicollinearity problem. The results show that the VIF values were acceptable (Table 4). The R^2 value was examined to reflect the predictive power of the model. R^2 is a coefficient showing what percentage of the exogenous variants explain the endogenous variants. The results are shown in Table 4. Q^2 analysis was made to determine the level of predictive interest of endogenous variables on exogenous variables. The obtained values are higher than 0 which means that the prediction of the structural model for the endogenous variables is accurate (Hair et al., 2019) (see Table 4).

The effect size in the structural model was evaluated by the f^2 analysis. If the coefficient of the effect size is 0.02 and above, it is considered low; 0.15 and above is moderate; 0.35 and above is considered high (Cohen, 1988). The results show that the values were generally at a moderate level (see Table 4).

Chi-square, SRMR and NFI values were examined for calculating the goodness of fit values of the research model. The chi-square value was found to be 769.636, while the SRMR result of 0.051 was lower than the critical value of 0.08 (Hu and Bentler, 1999). Hair et al. (2013) stated that an NFI value close to 1 shows a good fit. The results show the NFI value to be 0.882. These values prove that the research model is a good fit.

The hypotheses in the research model were analyzed by structural equation modeling via PLS-SEM. The results of the analysis are shown in detail in Table 4. According to the results obtained, the place satisfaction of the immersive experience ($\beta_{IE-PS} = 0.290$, $t = 6.144$, $p < 0.001$), user engagement ($\beta_{IE-UE} = 0.459$, $t = 9.760$, $p < 0.001$) and perceived authenticity

| Hypotheses | β | t -values | p -values | VIF | f^2 | Q^2 | R^2 | Results |
|---------------------|---------|-------------|-------------|-------|-------|-------|-------|-----------|
| H1 IE >>> PS | 0.290 | 6.144 | 0.000*** | 1.485 | 0.093 | 0.33 | 0.39 | Supported |
| H2 IE >>> UE | 0.459 | 9.760 | 0.000*** | 1.000 | 0.266 | 0.17 | 0.21 | Supported |
| H3 IE >>> PA | 0.537 | 11.950 | 0.000*** | 1.000 | 0.404 | 0.18 | 0.28 | Supported |
| H4 UE >>> PS | 0.143 | 2.685 | 0.007** | 1.513 | 0.022 | | | Supported |
| H5 PA >>> PS | 0.315 | 5.439 | 0.000*** | 1.678 | 0.097 | | | Supported |
| H6 IE >>> UE >>> PS | 0.066 | 2.426 | 0.015* | | | | | Supported |
| H7 IE >>> PA >>> PS | 0.169 | 5.088 | 0.000*** | | | | | Supported |

Note(s): $p < 0.001$ ***; $p < 0.01$ **; $p < 0.05$ *, IE: Immersive Experience, PS: Place Satisfaction, UE: User Engagement, PA: Perceived Authenticity

* Goodness-of-fit index = $\chi^2 = 769.636$, NFI = 0.88, SRMR = 0.051

Table 4. Structural properties (hypothesis testing)

($\beta_{IE-PA} = 0.537$), $t = 11.950$, $p < 0.001$) were determined to have positive effects on it. Therefore, hypotheses H1, H2 and H3 were accepted. In addition, it was determined that user engagement ($\beta_{UE-PS} = 0.143$, $t = 2.685$, $p < 0.01$) and perceived authenticity ($\beta_{PA-PS} = 0.315$, $t = 5.439$, $p < 0.001$) had positive effects on place satisfaction, so H4 and H5 hypotheses were also accepted.

The study aimed to investigate the mediating effects of user engagement and perceived authenticity. Zhao *et al.* (2010) stated that if the indirect effects are significant in the mediating effect analysis, then there is a mediating effect. According to Zhao *et al.*, the mediation is partial if the indirect effect and direct effect are significant, and the total effect is positive or negative. If the indirect effect is significant while the direct effect is not, the mediation is full. As the analyzes show that the indirect and direct effects on the, IE>>> UE>>> PS path were significant and the path coefficients were positive, user engagement was found to have a partial mediation effect between immersive experience and place satisfaction. This supports the H6 hypothesis. Similar effects were also found on, IE>>>PA>>>PS which shows that perceived authenticity has a partial mediation effect between immersive experience and place satisfaction. This finding supports the H7 hypothesis.

6. Discussion and conclusion

6.1 Conclusion

This research was carried out to determine the effects of immersive experience, place satisfaction, user engagement and perceived authenticity. In the study, the mediating effects of user engagement and perceived authenticity between immersive experience and place satisfaction were also tried to be determined.

It was concluded in the study that immersive experience has a positive effect on place satisfaction, user engagement and perceived authenticity. User interaction and perceived authenticity were also found to have a positive effect on place satisfaction. These results are compatible with the literature (Park *et al.*, 2006; Georgiou and Kyza, 2017). Hilken *et al.* (2017) stated that immersive experience helps general satisfaction of AR users and authentic experiences act as a mediator which is an indicator of how immersive experience positively increases place satisfaction, user engagement and perceived authenticity. With the immersive experience of AR, people can control their movements as if they are there and feel as if it is reality. The positive effect of the perceived authenticity of this experience on place satisfaction shows the importance of cultural heritage in museums.

The study lastly concluded that user interaction and perceived authenticity mediated the relationship between immersive experience and place satisfaction. This result is compatible with the literature (Bec *et al.*, 2019; Domínguez-Quintero *et al.*, 2020; Tsai, 2020; Hilken *et al.*, 2017). Accordingly, user engagement and perceived authenticity can help individuals interact with AR and do activities perceived as exciting by mediating the relationship between immersive experience and place satisfaction. As Tsai (2020) suggested, partial mediation of user engagement and perceived authenticity increases the positive effect of the immersive experience. Similarly, the importance of museums as a part of cultural heritage confirms the mediating effect of perceived authenticity between immersive experience and space satisfaction.

6.2 Theoretical implications and practical applications

This study discusses AR in the context of museums and demonstrates the effects of innovative practices on visitors and emphasized the importance of AR in cultural tourism. The immersive experience was found to positively affect user engagement, perceived originality and place satisfaction. The interaction of tourists and their perceived authenticity also mediate the relationship between immersive experience and place satisfaction.

Although this research provides similar theoretical contributions to the literature, no study examined user engagement, perceived authenticity and place satisfaction together. Visitors' interactions with AR applications can be greatly enhanced with immersive experiences. For this reason, the study proposes that AR applications be expanded to provide different experiences. The mediation effect of user engagement and perceived authenticity also contributes to the gap in the literature.

AR can be regarded as an opportunity to increase competitive power as a promising technology of the modern age (Tscheu and Buhalis, 2016, p. 608). Therefore, it is important to develop more AR applications within the domain of cultural tourism. The interactive experience between AR systems and visitors can increase satisfaction by producing valuable results (Neuhofer *et al.*, 2014). Innovative strategies implemented in museums offer new ways to transfer cultural heritage (Serravalle *et al.*, 2019; Trunfio *et al.*, 2022). Carried out in a museum which is considered an important element of cultural tourism, this study analyzed the effects of the experiences of tourists with AR applications on place satisfaction. The results showed the mediating role of perceived authenticity and that AR applications used in museums can contribute to place satisfaction through different experiences. Museums should adopt different strategies in this regard and preserve their cultural heritage to pass it on to future generations. First of all, in order to protect valuable historical objects, visitors should be provided with opportunities to have personal experiences with AR applications and should be allowed to examine the artifacts from all aspects. Thus, the use of AR applications would prevent the destruction of artifacts by visitors and protect cultural heritage. Secondly, visitors should be provided with a personalized environment to engage in authentic experiences through user engagement. This would increase perceived authenticity and satisfaction. Lastly, the number of visitors can increase thanks to AR and virtual reality.

6.3 Limitations and future research

The data of the research were collected from the visitors of SSM in Turkey. Evaluation of the museums may be different in each region and city. Conducting future studies in different countries would allow for comparability. The results of the research may differ depending on the increase in the number of existing AR software and the developing technology. New research can be carried out by associating different variables (such as objective authenticity, and existential authenticity) with virtual content created with the newest technology.

Note

1. See Sakıp Sabancı Museum-AR (<https://www.youtube.com/watch?v=IDtdGwiL0t0>)

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