

## The Effect of Perceived Usefulness of Augmented Reality Applications on The Enjoyment of The Museum Visitor Experience: A Serial Mediation Analysis

\* Çağla ÇETİNKAYA <sup>a</sup> 

<sup>a</sup> Istanbul Nişantaşı University, Vocational School, Department of Tourism and Hotel Management, Istanbul/Türkiye

### Article History

Received: 23.03.2025

Accepted: 16.06.2025

### Keywords

Augmented reality

Visitor experience

Digitalization

Emotional experience

Technology usage

### Abstract

With the progress of technological developments in all areas, digital applications have started to be used more and more in cultural heritage areas in order to improve the visitor experience. For this reason, the effect of augmented reality applications on the museum visitors' experiences has started to be of interest to researchers. However, there is limited information in the literature about the variables through which the effect of augmented reality applications on the visitor experience occurs. Augmented reality stands out as an innovative tool designed to enrich visitors' interactions with historical sites and present cultural heritage in a more engaging way. This study conducts field research to how the perceived advantages of AR applications contribute to the perception of enjoyment during museum visits. Although various studies have examined the role of AR in historical places, a comprehensive and integrated analysis of this topic is still lacking. This research aims to address this gap by providing insights into how AR applications can improve the visitor experience, providing practical recommendations for museum and heritage site managers to optimize the use of these technologies. Specifically, the study explores the sequential mediation role of emotional engagement and technology use in the relationship between the perceived usefulness of AR applications and the enjoyment derived from museum visits. The study sample includes 437 people who visited museums in Istanbul. The findings show that the perceived usefulness of augmented reality applications has a significant and positive effect on the enjoyment of the museum visitor experience. Emotional experience and the use of technology play a partial mediating role in this relationship. As a result, as the perceived benefit of augmented reality applications increases, the fun of the museum visitor experience has directly increased. This effect is partly due to emotional experience and the use of technology.

### Article Type

Research Article

\* Corresponding Author

E-mail: cagla.cetinkaya@nisantasi.edu.tr (Ç. Çetinkaya)

DOI: 10.21325/jotags.2025.1647

## INTRODUCTION

The increasing use of digital technologies in the tourism sector has led to significant transformations in visitor experiences, especially through Augmented Reality (AR) applications. AR not only enhances the attractiveness of historical sites but also offers innovative ways to preserve their authenticity while adapting them to contemporary expectations (Kapp, 2012). For example, studies conducted in various contexts—such as Polonnaruwa in Sri Lanka, the United Kingdom (Dieck & Jung, 2017), and the Lingaun Valley in Ireland (Barnes, Mills, & Cleary, 2023)—have consistently shown that AR increases visitor satisfaction, deepens cultural engagement, and improves understanding of heritage through virtual reconstructions. These technologies allow visitors to visualize historical objects and monuments in their original form, making the experience both educational and emotionally engaging (Wu, Chou, & Li, 2023). Moreover, AR contributes not only to learning and entertainment but also supports economic and promotional benefits for cultural institutions.

The perceived usefulness of augmented reality (AR) applications has become an important tool that strengthens the connection of visitors with the place, especially in the fields of museums and cultural heritage. However, how the perceived benefit in AR applications affects the fun of the visitor experience, the emotional experience processes and to what extent these processes are supported by technological factors have not been sufficiently studied in the literature. For this reason, in this study, the direct and indirect effects of the perceived benefit in AR applications on the fun of the visitor experience were analyzed and the role of emotional experience and technology use in this relationship was tested.

This research seeks to uncover the mechanisms underlying the influence of perceived benefits of augmented reality applications on the enjoyment aspect of the museum visitor experience. It also aims to explore how this relationship is shaped through emotional engagement and technology usage. The study aspires to enrich the academic discourse on the integration of augmented reality on museums while offering fresh insights for enhancing visitor experiences. Furthermore, it intends to provide a practical framework for historical site administrators and cultural heritage professionals on optimizing augmented reality applications to maximize visitor satisfaction. In this regard, the primary objective of this study is to investigate the impact of the perceived advantages of augmented reality applications on the enjoyment of museum visits, emphasizing the sequential mediating roles of emotional experience and technology utilization in this process.

## Theoretical Framework

### Augmented Reality (AR) in Museums and Visitor Experience

The use of digital technologies in historical places enriches the visitor experience, while at the same time making significant contributions to conservation and sustainability. Digitalization is an important process that allows these venues to reach a wider audience and be promoted more effectively. While these technologies make it possible to preserve and document historical structures with 3D modeling and visualization methods (Deliyiannis & Papaioannou, 2014), they provide visitors with impressive and meaningful experiences about the past with applications such as augmented reality (AR) and virtual reality (VR) (Ergen, 2020). In this sense, historical sites are of critical importance in terms of protecting cultural heritage and transferring it to society. In addition, digitalization increases the sustainability of historical sites by reducing the human density in physical spaces and provides access

to a wider audience (Garipağaoğlu & Akova, 2022). In this context, digital technologies stand out as a powerful tool for preserving historical sites and effectively connecting with new generations, and the value and accessibility of these places are gradually increasing with the increased adoption of technology.

Augmented reality technology is applied in a wide range from museums to natural areas, from urban tours to cultural heritage areas. Museums and cultural heritage sites are one of the tourist attractions where AR technology is used most recently. (Neuburger & Egger, 2018). In addition, in the field of tourism, AR-based mobile applications help tourists to learn more about historical sites, museums and natural areas (Ünal, Bostancı & Güzel, 2021). For example, in a study examining the effect of AR on museum visitors, it was found that AR helps visitors to understand historical events and figures in more depth (Partala, Kosonen, Riissanen, Laurila, Korhonen, & Leskinen, 2024). It has been shown that AR applications increase visitor satisfaction by making historical artifacts and narratives in museums more attractive (Dieck, Jung, & Tom, 2018). It has also been determined that AR increases social interaction in museums and allows visitors to find the museum experience more enjoyable (Shahab, Mohtar, Ghazali, Rauschnabel, & Geipel, 2022).

The process of transition from the traditional understanding of museology to digitized and interactive experiences makes the visitors' relationship with the place more impressive and meaningful (Buhalis & Amaranggana, 2015). Understanding the impact of augmented reality applications on the visitor experience is especially important in terms of information transfer, sensory richness and spatial perception (Tussyadiah et al., 2018). Many studies have shown that augmented reality technologies create a positive perception on museum visitors and improve the quality of experience (Han, tom Dieck, & Jung, 2019). In particular, it is stated that museum visitors interact more through augmented reality experiences, access to information becomes easier and the experience becomes more enjoyable. It also provides easy access with mobile devices and provides a fun experience. It is an attractive element especially for children and young visitors (Hidayat, Noica & Daud, 2019).

According to the research conducted by Jung, Tom (2017), AR-supported museum experiences increase visitors' satisfaction, making them find the experience more fun and interactive. Similarly, Yung and Khoo-Lattimore (2019) state that augmented reality technologies attract visitors attention, positively affecting their participation in exhibitions and perception of entertainment. In this context, the effect of perceived benefit with augmented reality applications on the enjoyment of the museum visitor experience has been a matter of curiosity, and the following hypothesis was created based on this;

H1: Perceived benefit with augmented reality applications affects the enjoyment of the museum visitor experience in a statistically significant and positive way.

According to research conducted by Han, Tom Dieck, and Jung (2019), AR-based museum applications help visitors establish a stronger emotional bond with the exhibited works. A recent study by Ifeanyi (2024) reveals that augmented reality in museum exhibitions enhances visitor engagement and fosters deeper emotional and educational connections. Based on these, the following hypothesis was created.

H2: The perceived benefit of augmented reality applications affects the emotional experience in a statistically significant and positive way.

For museum visitors, the entertainment experience is shaped not only by the content offered, but also by the

emotional reactions experienced during the visit. A study by Shahab, Mohtar, Ghazali, Rauschnabel, and Geipel (2022) shows that emotional engagement significantly contributes to the level of enjoyment and learning among museum visitors using immersive technologies. Gretzel and Jamal (2009) revealed that technology-supported museum experiences strengthen the perception of entertainment by increasing the emotional involvement of visitors. Based on all these, the following hypothesis was formed:

H3: Emotional experience has a statistically significant and positive effect on the enjoyment of museum visitor experience.

Many studies have shown that augmented reality technologies shape users perceptions of technology and increase technology use. Buhalis and Amaranggana (2015) emphasise that augmented reality applications increase interest in technology in tourism and museum experiences, leading users to adopt digital tools more. Similarly, Neuhofer, Buhalis, and Ladkin (2020) found that AR applications used in museums and cultural heritage sites improve visitors' positive attitudes towards technology and encourage them to use these technologies. In addition, Huang, Backman, Backman, Backman, and Chang (2016) found that AR encourages visitors to use digital tools in museum experiences by increasing their interest in technology. Based on all these, the following hypothesis was formed;

H4: The perceived benefit of augmented reality applications has a statistically significant and positive effect on technology use.

Technology-enhanced experiences play a crucial role in increasing the entertainment factor for museum visitors. Jung and Tom Dieck (2017) highlighted that museum visitors' engagement with technology-based applications positively influences their enjoyment. Additionally, Neuhofer, Buhalis, and Ladkin (2020) emphasized that technology use is one of the key factors contributing to the overall entertainment level of museum visitors. Based on these findings, the following hypothesis has been proposed:

H5: The use of technology has a statistically significant and positive effect on the enjoyment of the museum visitor experience.

### **Emotional Experience and Technology Usage**

Technology use in tourism refers not only to the adoption of digital tools, but also to the extent to which users integrate these tools into their experiential and cognitive engagement with destinations (Neuhofer et al., 2015; Wang, Li, & Li, 2013). The use of technology is creating new opportunities in the tourism industry by transforming the visitor experience on both a cognitive and emotional level. The satisfaction and memorability of visitors' travel experiences depend largely on emotional reactions (Hosany, Prayag, Deesilatham, Čaušević, & Odeh, 2015). In recent years, AR and mobile Technologies to enable visitors to establish an emotional connection with destinations (Mohd et al., 2019; Pham et al., 2021). In a study conducted by Akkuş and Akkuş in 2018, it has been examined how AR technology enriches tourist experiences. The results showed that mobile AR applications support learning processes by increasing the interaction of visitors in historical places. These findings show that mobile augmented reality applications in historical tourist areas enrich tourist experiences and increase visitor satisfaction. For this reason, augmented reality and virtual reality (VR) technologies are increasingly being used to improve the visitor experience in the tourism sector (Moro, Rita, Ramos, & Esmerado, 2019).

One of the most important components of creating a fun and meaningful experience for museum visitors is the

capacity for emotional connection. The interactive and immersive experiences offered by augmented reality applications make it easier for visitors to make an emotional connection with the museum content. Strengthening the emotional connection allows visitors to find the experience more satisfying and unforgettable (Gretzel & Jamal, 2009). However, how the use of technology shapes the visitor experience is also an important research topic. According to the Technology Acceptance Model (Davis, 1989), perceived ease of use and perceived usefulness are essential factors that influence how users engage with new technologies, which in turn affect their overall experience in tourism contexts. The increasing use of digital technologies facilitates visitors' access to information, while also strengthening entertainment and satisfaction factors (Neuhofer, Buhalis, & Ladkin, 2020). Museum visitors interact more and make the learning process more enjoyable, especially through innovative technologies such as augmented reality. In addition, in research conducted using emotional experience scales, it has also been shown that elements such as destination dependence and place identity positively affect tourists' experiences. This shows that the high emotional experience positively affects the visitor experience. (Moraga, Buitano, & Sanhueza, 2020). In addition, emotional experience is an important factor that determines the level of entertainment that visitors get from augmented reality applications.

In a study conducted by Han, tom Dieck and Jung (2019), it was found that AR enhances entertainment experiences by helping visitors to form an emotional connection with the displayed content. Similarly, AR-based museum applications strengthen the perception of entertainment by increasing the emotional participation of visitors. The emotional participation in museum experiences is one of the main factors that increases entertainment (Han et al., 2019). While augmented reality technologies make the visitor experience more satisfying with their capacity to create emotional bonds, the use of technology increases the efficiency of this process (Tussyadiah et al., 2018).

The use of technology improves the relationship between augmented reality experiences and visitors' perception of entertainment. Buhalis and Amaranggana (2015) found that AR enhances the immersiveness of visitors' entertainment experiences through technology integration. Huang et al., (2016) discovered that the entertainment experience of visitors using AR is directly linked to their adaptation to technology. Yung and Khoo-Lattimore (2019) stated that smart tourism technologies serve as a tool that positively influences visitors' perception of entertainment. Based on these findings, the following hypotheses have been proposed:

H6: Technology use has a mediating effect on the relationship between the perceived benefit of augmented reality applications and the museum visitor experience.

H7: Emotional experience has a mediating effect on the relationship between the perceived benefit of augmented reality applications and the museum visitor experience.

Visitors entertainment experience is shaped not only by the presence of augmented reality applications, but also by the emotional experience and technology use offered by this technology. In the research conducted by Han, Tom Dieck, and Jung (2019), it was stated that AR-based applications first strengthen the emotional responses of visitors, and then this emotional connection, combined with the use of technology, increases the entertainment experience. Similarly, Tussyadiah et al., (2018) found that digital and augmented reality technologies strengthen the entertainment experiences of users by increasing both their emotional engagement and technology use. Neuhofer, Buhalis, and Ladkin (2020) showed that emotional experience and technology use together are effective in increasing museum visitors' satisfaction and perception of entertainment. In this context, it is seen that the effect of augmented

reality applications on museum visitors is not caused by a single variable, but rather emotional experience and technology use also have an effect. In this context, the following hypothesis was created;

H8: Emotional experience and technology use have a serial mediating effect on the relationship between the perceived benefit of augmented reality applications and the museum visitor experience.

A research model for the relationships between variables was created in line with the conceptual and theoretical framework presented in the literature section. In this context, the applied serial multiple mediation analysis is a modeling technique that examines the effect of an independent variable on the dependent variable sequentially through multiple mediation variables (Hayes, 2013). In this study, it was preferred to understand the effect of perceived benefit in augmented reality applications on the enjoyableness of the visitor experience. Although it is thought that perceived benefit can directly affect the visitor experience, mediating mechanisms such as emotional experience and technology use need to be determined in order to understand how this effect occurs. Moreover, beyond acting as a mediator, the level of technology use could function as a moderator that influences the strength of emotional experience and enjoyment relationship (Yung & Khoo-Lattimore, 2019). Future research might explore this potential interaction.

## Methodology

### Research Design and Model

This research was conducted using a quantitative, cross-sectional research design. The study investigates the effect of the perceived benefit of augmented reality (AR) applications on the enjoyment of the museum visitor experience, with a focus on the serial mediating roles of emotional experience and technology use. In this context, the PROCESS macro Model 6, developed by Hayes (2013), was used to perform serial multiple mediation analysis.

Three indirect effect paths were tested within the model:

- Ind1 =  $a_1b_1$ : the indirect effect of perceived benefit on visitor enjoyment through emotional experience
- Ind2 =  $a_2b_2$ : the indirect effect of perceived benefit on visitor enjoyment through technology use
- Ind3 =  $a_1d_1b_2$ : the serial indirect effect of perceived benefit on visitor enjoyment first through emotional experience and then through technology use

Since real-world behavioral processes are often not explained by a single mediator variable, this model provides a more realistic and comprehensive representation of indirect effects. The conceptual model showing the relationships between the study variables is presented in Figure 1.

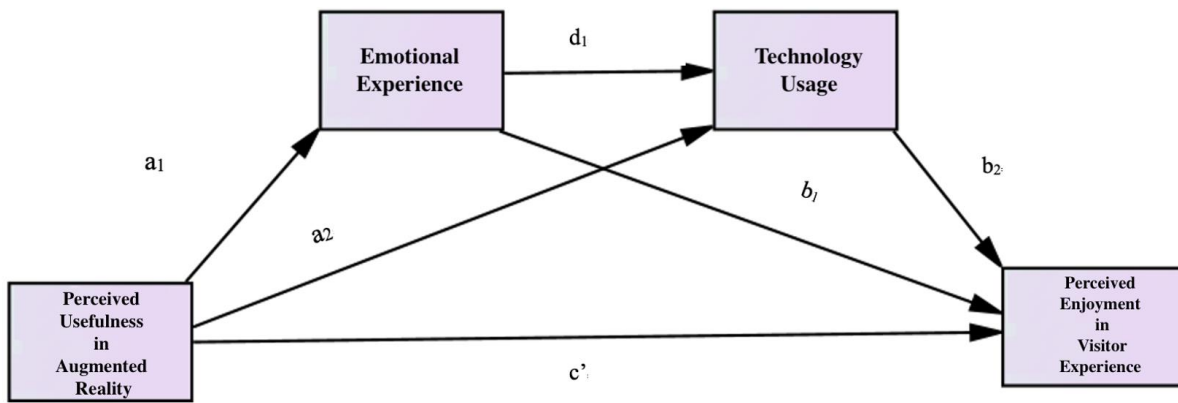


Figure 1. Research Model

The sum of these three indirect effects shows the total indirect effect of the independent variable, perceived usefulness in augmented reality applications, on the dependent variable, the museum visitor experience being enjoyable ( $c = a_1b_1 + a_2b_2 + a_1d_1b_2$ ). Finally, the total direct effect analysis of the model is calculated by adding the direct effect of perceived usefulness in augmented reality applications on the visitor experience being enjoyable to the determined total indirect effects ( $c' = c + a_1b_1 + a_2b_2 + a_1d_1b_2$ ).

**Population and Sample**

The sample of the study consists of individuals who visited various museums in Istanbul. Data were collected through surveys conducted with visitors at the Istanbul Archaeological Museum, Topkapi Palace Museum, and the Hagia Sophia History and Experience Museum. Using a convenience sampling method, 489 participants were invited, and 437 fully completed questionnaires were included in the final analysis.

Regarding demographics, 192 participants (43.9%) were female, while 245 (56.1%) were male. Age distribution was as follows: 28 participants (6.4%) aged 18–25, 129 (29.5%) aged 26–35, 149 (34.1%) aged 36–50, 85 (19.5%) aged 51–65, and 46 (10.5%) aged 65 and over.

**Data Collection**

A self-administered questionnaire was used to collect data in order to examine the impact of augmented reality applications on the enjoyment of the museum visitor experience, as well as the mediating roles of emotional experience and technology use in this relationship. The questionnaire was revised based on expert feedback before implementation. Data collection was carried out between March 16 and July 22, 2024. After removing incomplete or invalid responses, 437 valid questionnaires were included in the analysis.

The questionnaire consisted of four sections. The first section gathered demographic information, while the remaining sections focused on the main variables of the study: perceived benefit of AR applications, emotional experience, technology use, and perceived enjoyment in the museum visitor experience. All items were rated on a 5-point Likert scale (1 = Strongly Disagree, 5 = Strongly Agree).

**The Scale and The Study Constructs**

The participants' perceived benefit levels in augmented reality applications, emotional experiences, technology use and perceived entertainment levels in the visitor experience were evaluated. In order to measure the Perceived

Benefit in Augmented Reality Applications, it was evaluated with a 5-point Likert-type scale used by Bilici and Özdemir (2019), consisting of four questions. The emotional experience scale, consisting of six questions, was used by Çağlar (2021) to measure the positive and negative emotions of individuals and the level of emotional experience in their lives. The technology usage scale, a three-dimensional scale developed by Zincirkıran and Tiftik (2014), was used. In order to measure the perceived entertainment in the museum visitor experience, the perceived entertainment dimension of the museum visitor experience scale, which was used by Mesut Uzun and Selda Uca (2024), was used.

All statements were rated on a 5-point Likert scale ranging from 1 = Strongly Disagree to 5 = Strongly Agree. These validated and reliable scales were used to examine the mediating roles of emotional experience and technology use in the relationship between perceived benefit and visitor enjoyment. Ethics committee approval for the study was obtained from the Ethics Committee of Istanbul Nisantasi University (Date: 21.03.2025, Decision No: 2025-03).

### **Population and Sample Size**

The study sample comprises individuals who visited various museums in Istanbul. Research data were collected from participants who visited the Istanbul Archaeological Museum, Topkapi Palace Museum, and Hagia Sophia History and Experience Museum. Surveys were administered to participants during their visits to these museums to obtain the necessary data. A total of 489 individuals were invited to participate in the study using the convenience sampling method, and 437 fully completed surveys were included in the final analysis.

An analysis of the demographic characteristics and descriptive statistics of the sample revealed that 192 participants (43.9%) were female, while 245 (56.1%) were male. In terms of age distribution, 28 participants (6.4%) were aged 18-25, 129 (29.5%) were aged 26-35, 149 (34.1%) were aged 36-50, 85 (19.5%) were aged 51-65, and 46 (10.5%) were aged 65 and above.

### **Data Analysis Techniques**

Statistical analyses were performed using Microsoft Office Excel, IBM SPSS Statistics 23, IBM SPSS AMOS 23, and SPSS PROCESS macro version 3.5. Descriptive statistics were first calculated for all variables. Pearson correlation coefficients ( $r$ ) and their significance levels were used to analyze relationships between the main variables.

Confirmatory factor analysis (CFA) was conducted to confirm the construct validity of the scales used in the study. Considering the one-dimensional nature of the scales for perceived benefit, emotional experience, technology use, and museum visitor experience, CFA was applied at the first level. Reliability of the scales was evaluated by calculating Cronbach's alpha coefficients.

To analyze the mediating effects of emotional experience and technology use on the relationship between perceived benefit and museum visitor enjoyment, regression-based serial multiple mediation analysis was conducted using PROCESS Model 6 (Hayes, 2012). The significance of the mediation effects was assessed through bootstrap confidence intervals.

**RESULTS**

**Measurement Model (Outer Model)**

**Convergent Validity**

A confirmatory factor analysis (CFA) was conducted to assess the structural reliability and validity of the model. The results indicated that convergent validity was established, with all factor loadings exceeding 0.7. Specifically, factor loadings ranged from 0.717 to 0.996, aligning with the threshold recommended by Hair et al. (2017). Additionally, composite reliability (CR) values for all variables were above 0.7, meeting the criteria set by Bryman & Cramer (2011) and Hair et al. (2017). The CR values obtained were 0.955 for emotional experience, 0.988 for technology usage, 0.982 for augmented reality, and 0.930 for visitor experience.

Furthermore, the average variance extracted (AVE) values exceeded the threshold of 0,5 ranging from 0.731 to 0.942, which is in accordance with the standard proposed by Fornell and Larcker (1981). These findings confirm that the model is both reliable and valid (See Table 1).

**Table 1.** Confirmatory Factor Analysis Results

Construct	Item	Factor Loading	AVE	CR	VIF
<b>Emotional Experience</b>	EE1	,852	,780	,955	1,195
	EE 2	,742			
	EE 3	,925			
	EE 4	,955			
	EE 5	,934			
	EE 6	,844			
<b>Technology Usage Factor1</b>	TU1	,909	,942	,988	1,153
	TU 2	,985			
	TU 3	,986			
	TU 4	,982			
	TU 5	,586			
<b>Technology Usage Factor2</b>	TU 6	,623	,942	,988	1,153
	TU 7	,583			
	TU 8	,754			
	TU 9	,971			
	TU 10	,745			
<b>Technology Usage Factor3</b>	TU 11	,838	,942	,988	1,153
	TU 12	,722			
	TU 13	,724			
<b>Augmented Reality Perceived Usefulness</b>	AR1	,975	,933	,982	1,165
	AR2	,910			
	AR3	,987			
	AR4	,927			
<b>Visitor Experience Perceived Enjoyment</b>	VEPE1	,776	,731	,930	1,183
	VEPE 2	,733			
	VEPE 3	,744			
	VEPE 4	,853			
	VEPE 5	,961			
	VEPE 6	,936			

**Table 2.** Studies Fit Indices of the Model

Chosen criterion	Good fit	Acceptable fit	Fit value of model
$\chi^2/df$ (CMIN/df)	$\leq 3$	$\leq 4-5$	1,938
GFI	$\geq 0.90$	0.89-0.85	.901
CFI	$\geq 0.97$	$\geq 0.95$	.976
RMSEA	$\leq 0.05$	0.06-0.08	.046
NFI	$\geq 0.95$	0.94-0.90	.951
RMR	$\leq 0.05$	0.06-0.08	.033

**Correlation Analysis**

When the correlation values were examined, it was observed that the relationships between the variables in the study varied between ,276 and ,559 and all relationships were statistically significant. The findings are presented in Table 3.

**Table 3.** Pearson Correlation Coefficients and Descriptive Statistics for Relationships Between Variables

Variables	Mean	SS.	N.	1	2	3	4.
1. Emotional Experience	4,238	,738	437	(,953)	,315*	,330*	,374*
2. Technology Usage	4,221	,493	437		(,924)	,276*	,522*
3. Augmented Reality	4,474	,762	437			(,962)	,559*
4. Visitor Experience	4,459	,828	437				(,957)

Not. \*p < .05

**Serial Mediation Analyses**

The direct and indirect effects obtained within the scope of serial mediation analyses are presented below. In the model, X represents the independent variable (application of augmented reality in historical sites), Y represents the dependent variable (visitor experience), M1 represents the first mediator variable (emotion inventory), and M2 represents the second mediator variable (technology use). The findings regarding the first hypothesis showed that the direct effect of the application of augmented reality in museums on the visitor experience is positive and significant (B = 0.417, t = 11.06, p < .001; See Table 3). This finding supports H1. In order to test H2, the effect of the application of AR in museums on the emotion inventory was tested. According to the results, the effect of the application of AR in museums on the emotion inventory is significant (B = 0.330, t = 7.29, p < .001; See Table 3). In addition, the effect of the emotion inventory on the visitor experience was found to be significant (B = 0.012, t = 3.314, p < .001; See Table 3). These findings support H2. Within the scope of H3, the mediating role of technology use between the AR application in museums and the visitor experience was tested. The analyses showed that the effect of the AR application in museums on the use of technology was significant (B = 0.193, t = 4.085, p < .001; See Table 3). In addition, the effect of technology use on the visitor experience was found to be significant (B = 0.368, t = 9.81, p < .001; See Table 3). This finding supports H3.

Finally, in order to test H4, the serial mediating role of the emotion inventory and technology use in the effect of the AR application in museums on the visitor experience was examined. The direct effect of AR application in museums on visitor experience was found to be significant (B = 0.417, SE = 0.041, p < .001; See Table 4). The first indirect effect, the effect of AR application in historical places on visitor experience through emotion inventory (Ind1

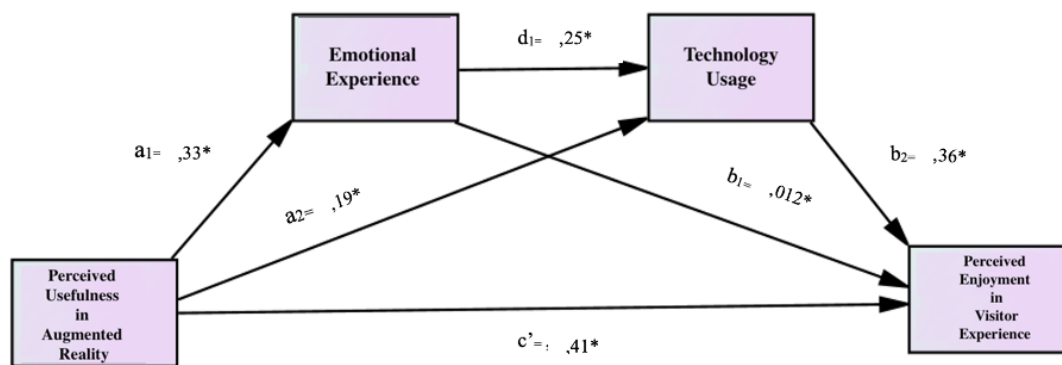
[a1 b1] = augmented reality in historical places → emotion inventory → visitor experience), was significant (B = 0.012, SE = 0.004, CI = [0.004, 0.026]). On the other hand, the second indirect effect, the effect of AR application in museums on visitor experience through technology use (Ind2 [a2 b2] = AR in museums → technology use → visitor experience), was found to be significant (B = 0.368, SE = 0.006, CI = [0.230, 0.442]).

**Table 4.** Serial Mediating Role of Emotional Experience and Technology Use in the Relationship between Augmented Reality and Visit Experience

Predictor	Emotional Experience			Technology Usage			Visit Experience					
	$\beta$	SE	t	$\beta$	SE	t	$\beta$	SE	t			
<b>Augmented Reality (X)</b>	<b>a1</b>	,330	,044	7,29	<b>a2</b>	,193	,0307	4,085	<b>c'</b>	,417	,041	11,06
<b>Emotional Experience (M1)</b>	-	-	-	<b>d1</b>	,250	,031	5,29	<b>b1</b>	,012	,004	3,314	
<b>Technology Usage (M2)</b>	-	-	-	-	-	-	<b>b2</b>	,368	,006	9,81		
<b>Constant</b>	2,89*	,188	15,3	3,21*	,154	20,8	-0,77*	,286	-2,68			
	$R^2 = ,010$ $F = 53,1*$			$R^2 = ,013$ $F = 33,11*$			$R^2 = ,47$ $F = 128,35*$					

\*p<.05. SE (Standart Error). The table includes unstandardized beta values.

The third indirect effect, the serial effect of augmented reality application in historical places on visitor experience through emotion inventory and technology use (Ind3 [a1 d1 b2] = augmented reality in historical places → emotion inventory → technology use → visitor experience), was found to be statistically significant (B = 0.0386, SH = 0.0196, CI = [0.0076, 0.0835]). Accordingly, H4 is supported. As a result, as the augmented reality application in historical places increases, the emotion inventory also increases, which affects the technology use variable and ultimately increases the visitor experience.



Note. \*p < .05. The figure includes unstandardized beta values.

**Figure 2.** Serial Mediation Model for the Effect of Emotional Experience and Technology Use on the Relationship between Augmented Reality and Visit Experience

**Conclusions**

This study investigated the effect of augmented reality (AR) apps on perceived enjoyment in the museum visitor experience, with the focus on the serial mediation effects of technology use and emotional experience. Data from

437 sample participants engaging with a variety of museums in Istanbul revealed that perceived benefits of AR have a significant and positive impact on value and enjoyment during the museum visit, along with emotional experience and technology use as partial mediators. Emotional experience was deemed to be a relatively strong mediator (Mohd et al., 2019). The study results align with theoretical assumptions that AR apps incite emotional and immersive reactions, efforts by museums to focus visitors on more enjoyable, engaging, and memorable experiences (Tussyadiah et al., 2018). Strength of emotional experience during imaging had a greater impact on perceived enjoyment, as opposed to the amount of use of technology application. This finding adds to the notion AR is useful for informing and entertaining visitors, while also fostering some affective engagement that contributes to visitor satisfaction (Yung & Khoo-Lattimore, 2019).

Confirmatory analysis through PROCESS Model 6 provided statistical support for the proposed research model focusing on visitor experiences. The use of serial mediation promoted increased understanding of how perceived benefits of AR are transformed into enjoyment by both an emotional and technological pathway (Pham et al., 2021). This study further contributes to the literature by illustrating how emotional resonance can be interposed between the application of innovative technology and informal experience, influencing meaningful engagement of visitors (Barnes et al., 2023).

Additionally, results of the study emphasized the foundational foundation of a narrative, sensory stimulation, and some personal aspects of content that frame some visitors' responses to AR applications. The relationship between user-friendly design and emotionally designed content was significant in relation to what content they responded positively to in terms of satisfaction and future inquiry about museum-based AR (Dieck & Jung, 2017). These findings illustrate the importance of integrating emotionally engaging content in design that is accessible to AR applications for museums professionals and AR developers. Valuable insights were made towards understanding the role of AR use in cultural and heritage-based tourism, with recommendations made to consider a multidisciplinary approach to creative and augmented/immersive experiences. To understanding visitor behavior, it was necessary to obtain a holistic perspective from the outlining experiences and actions used in relation to visitor behavior rooted in different areas of psychology, tourism management strategies, and technology design (Jung and Tom Dieck, 2017). Emotional and technological remediators should be embraced in developing an AR strategy related to tourism education and cultural heritage. The study also demonstrates AR systems must be contextually aware and respect the historical integrity of the content. The majority of visitors value applications that remain consistent with the narrative of the museum experience and do not divert away from the experience through excessive gamification and fast and simple superficial entertainment. Museums should focus on producing content that is cognitively engaging, but also emotionally engaging to visitors.

This research expands the possibilities for museum professionals to reimagine the engagement strategies received from visitors with the continued advancement of technology. The use of AR has been successful in assisting visitors develop enjoyment through exposure, as well as further educational and emotional experience. Future applications of AR can be utilized with strategies that are able to provide real-time feedback, adaptive learning paths, and multisensory experiences and storytelling methods, which support further engagement from visitors. Developing visitor experiences with specific user preferences and emotionally knowledgeable AR app experiences provide opportunities to develop unique visitor learning contexts which can provide engaging information to visitors while

also being enjoyable. Integrating AR applications with emotional content can further connect visitors to cultural destinations whilst fostering attachment and relevance of cultural sites and spaces in the digitized version of the world. The results of this study pave the way for future explorations of the intersection between technology, emotion, and cultural engagement, reinforcing AR's place as a transformative tool in museum practice.

### Limitations and Future Research

The present study had a number of limitations, which researchers should consider in future research. First, the focus on museums in Istanbul may create limits for the generalizability of the findings of the study. When examined in context, variation in AR perceptions based on regional cultural, technological and educational variations may exist. In addition, the study utilized a cross-sectional design, which was helpful in meeting the research objectives, however, it serves as a limitation in that it cannot measure the effects of AR on an individual over a longer period of time. Future studies may employ longitudinal or experimental approaches to assist in observing causal linkages and emotional effects of AR that may dissipate over time. The current study used a form of quantitative method for the analysis; future studies may also collect qualitative data (i.e. in-depth interviews, focus groups) to carry out a richer depiction of visitor narratives and subjective experiences. Another source of limitation is reliance on self-reported data; these types of results rely on the honesty of the participants, and therefore, can be self-reported biases present. Future research may include behavioral tracking or physiological means to provide verification of the results noted in this study. In addition, the study did not consider moderating variables, such as age, prior AR experience, or digital literacy, which might affect the outcomes in this study. Future research might examine the differences in the study participants as might be made apparent in comparative studies that use multiple demographic groups or through an international sample of participants. Last, future studies may want to look at the social aspect of AR experiences to see if enjoyment is increased by shared experiences with friends and/or family. Overall, the limitations outlined here provide opportunities for further, in-depth and nuanced studies to advance enquiry into the role AR plays in heritage and museum tourism.

### Declaration

Ethics committee approval for the study was obtained from the Ethics Committee of Istanbul Nisantasi University (Date: 21.03.2025, Decision No: 2025-03).

### REFERENCES

- Akkuş, G., & Akkuş, Ç. (2018). Tarihi turistik alanlarda kullanılan mobil artırılmış gerçeklik uygulamalarının değerlendirilmesi. *Journal of Tourism and Gastronomy Studies*, 6(1), 83-104.
- Aksoy, C. (2018). Teknoloji kullanım ölçeğinin geçerlilik ve güvenilirliğinin ölçülmesi: Üniversite öğrencilerine yönelik bir araştırma. *OPUS Uluslararası Toplum Araştırmaları Dergisi*, 8(15), 1111–1131.
- Barnes, S., Mills, I., & Cleary, F. (2023). A design of an augmented reality-based virtual heritage application. *International Conference on Virtual Heritage Applications*
- Bilici, F., & Özdemir, E. (2019). Tüketicilerin artırılmış gerçeklik teknolojilerini kullanmaya yönelik tutum ve niyeti üzerine bir araştırma. *Business & Management Studies: An International Journal*, 7(5), 2011–2033.

- Boboc, R., Bautu, E., Gîrbacia, F., Popovici, N., & Popovici, D. (2022). Augmented reality in cultural heritage: An overview of the last decade of applications. *Applied Sciences*.
- Bryman, A., & Cramer, D. (2011). *Quantitative data analysis with IBM SPSS 17, 18 & 19: A guide for social scientists*. Routledge.
- Buhalis, D., & Amaranggana, A. (2015). Smart tourism destinations. *Information and Communication Technologies in Tourism 2015*, 377-389.
- Challenor, J., & Ma, E. M. (2019). A review of augmented reality applications for history education and heritage visualisation. *Multimodal Technologies and Interaction*, 3(39).
- Çağlar, A. (2021). Adaptation of the brief emotional experience scale to turkish: a study of validity and reliability. *Psychology and Education*, 58(5), 7170-7180.
- Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology *MIS Quarterly*, 13(3), 319–340.
- Deliyiannis, I., & Papaioannou, G. (2014). Augmented reality for archaeological environments on mobile devices: A novel open framework. *Zenodo*.
- Dieck, M. T., & Jung, T. (2017). Value of augmented reality at cultural heritage sites: A stakeholder approach. *Journal of Destination Marketing and Management*, 6, 110-117
- Ergen, F. D. (2020). Isparta ilinin kültürel miras alanlarında artırılmış ve sanal gerçeklik teknolojilerinin uygulanabilirliğine yönelik bir literatür taraması. *Journal of Tourism Theory and Research*, 6(1), ss. 62–74.
- Fornell, C., & Larcker, D. F. (1981). Structural equation models with unobservable variables and measurement error: Algebra and statistics. *Journal of Marketing Research*, 18(3), 382-388.
- Garipağaoğlu, N., & Akova, O. (2022). The use of virtual reality and augmented reality in cultural heritage and deep-diving destinations. In Handbook of Research on Digital Communications, *Internet of Things, and the Future of Cultural Tourism*.
- Gretzel, U., & Jamal, T. (2009). Conceptualizing the creative tourist class: Technology, experience, and travel. *Tourism Analysis*, 14(4), 471-481.
- Hair, J. F., Hult, G. T. M., Ringle, C. M., & Sarstedt, M. (2017). *A primer on partial least squares structural equation modeling (PLS-SEM)* (2nd ed.). SAGE Publications.
- Han, D. I. D., tom Dieck, M. C., & Jung, T. (2019). Augmented reality smart glasses (ARSG) visitor experiences at cultural heritage sites. *Tourism Management*, 71, 190-201.
- Hayes, A. F. (2012). A versatile computational tool for observed variable mediation, moderation, and conditional process modeling.
- Hayes, A. F. 2013. *Introduction to Mediation, Moderation, and Conditional Process Analysis: A Regression-Based Approach*. Guilford Press.
- Hidayat, I. K., Rini, D. R., Novica, D., & Daud, K. A. M. (2019). Implementing augmented reality and gamification

- in tourism. In *Tourism Innovation*.
- Hosany, S., Prayag, G., Deesilatham, S., Čaušević, S., & Odeh, K. (2015). Measuring tourists' emotional experiences. *Journal of Travel Research*, 54(4), 482-495.
- Huang, Y. C., Backman, S. J., Backman, K. F., & Chang, L. L. (2016). Exploring the implications of virtual reality technology in tourism marketing: An integrated research framework. *International Journal of Tourism Research*, 18(2), 116-128.
- Jung, T. H., & tom Dieck, M. C. (2017). Augmented reality, virtual reality and 3D printing for the co creation of value for the visitor experience at cultural heritage places. *Journal of Place Management and Development*, 10(2), 140–151.
- Kapp, K. M. (2012). *The gamification of learning and instruction: Game-based methods and strategies for training and education*. San Francisco: Pfeiffer.
- Katkuri, P. K., Mantri, A., & Anireddy, S. (2019). Innovations in tourism industry & development using augmented reality (AR), virtual reality (VR). *TENCON 2019 - IEEE Region 10 Conference*, 2578-2581.
- Mohd, N. S., Ismail, H., Nor'ain, M. I., & Jaafar, S. (2019). Millennial tourist emotional experience in technological engagement at destination. *International Journal of Built Environment and Sustainability*, 6(1–2), ss. 129–135.
- Moraga, E. T., Buitano, A. V., & Sanhueza, L. S. (2020). Scale to measure the emotional connection with a tourist destination. *International Journal of Tourism Research*, 27(1), 92-112.
- Moro, S., Rita, P., Ramos, P., & Esmerado, J. (2019). Analysing recent augmented and virtual reality developments in tourism. *Journal of Hospitality and Tourism Technology*.
- Neuburger, L., & Egger, R. (2018). Augmented reality: Providing a different dimension for museum visitors. *Proceedings of the International Conference on Augmented Reality and Virtual Reality*, 65-77.
- Neuhofer, B., Buhalis, D., & Ladkin, A. (2020). Smart technologies for personalized experiences: A case study in the hospitality sector. *Tourism Management*, 61, 10-26.
- Partala, T., Kosonen, M., Riissanen, H., Laurila, N., Korhonen, J., & Leskinen, O. P. (2024). Enhancing a historical museum exhibition using a lifelike augmented reality character: Presence and user experience. *Proceedings of the International Conference on Advanced Visual Interfaces*.
- Pham, T. T. T., Phan Thi Thanh, T., & Thi Le, H. (2021). Investigating the user acceptance of augmented reality in heritage tourism. *Information Systems Frontiers*, 23(3), 729–747.
- Poitras, E., Harley, J. M., Compeau, T., Kee, K., & Lajoie, S. P. (2017). Augmented reality in informal learning settings: Leveraging technology for the love of history. In *Culture and Education: Opportunities with Technology*
- Prabuddha, C., Ranasinghe, J. P. R. C., Wasantha, H. L. N., & Dangalla, D. (2024). The augmented reality effect on destination satisfaction towards revolutionizing heritage tourism in Sri Lanka. *Sri Lanka Journal of Marketing*.
- Preacher, K. J., & Hayes, A. F. 2008. Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behavior Research Methods*, 40(3), 879-891.

- Shahab, H., Mohtar, M., Ghazali, E. M., Rauschnabel, P., & Geipel, A. (2022). Virtual reality in museums: Does it promote visitor enjoyment and learning? *International Journal of Human-Computer Interaction*, 39(20), 3586-3603.
- Tussyadiah, I. P., Wang, D., Jung, T. H., & tom Dieck, M. C. (2018). Virtual reality, presence, and attitude change: Empirical evidence from tourism. *Tourism Management*, 66, 140-154.
- Uzun, M., & Uca, S. (2024). Müze ziyaretçi deneyimi ve destinasyon imajı ölçeklerinin uygulanabilirliği üzerine bir araştırma. *Türk Turizm Araştırmaları Dergisi*, 8(1), 24-40.
- Ünal, M., Ünal, F. Z., Bostancı, E., & Güzel, M. S. (2021). Augmented reality and new opportunities for cultural heritage. In *Augmented Reality in Tourism, Museums and Heritage*
- Wang, D., Li, X. (Robert), & Li, Y. (2013). China's "smart tourism destination" initiative: A taste of the service-dominant logic. *Journal of Destination Marketing & Management*, 2(2), 59-61.
- Wu, Y., Chou, W., & Li, F. (2023). The design methods of augmented reality in a historical site. *International Conference on Virtual and Augmented Reality Simulations*.
- Yung, R., & Khoo-Lattimore, C. (2019). New realities: A systematic literature review on virtual reality and augmented reality in tourism research. *Current Issues in Tourism*, 22(17), 2056-2081.
- Zincirkıran, M., & Tiftik, H. (2014). Innovation or technological madness? A research on the students of business administration for their preferences of innovation and technology. *International Journal of Academic Research in Business and Social Sciences*, 4(2), 320-332.

## Appendix 1. Ethics Committee Permission

İSTANBUL NİŞANTAŞI UNIVERSITY <small>NIŞV</small>	T.C. İSTANBUL NİŞANTAŞI ÜNİVERSİTESİ REKTÖRLÜĞÜ ETİK KURULU	Evrak Tarihi 21.03.2025
		Evrak Numarası 20250321-03
Sayın <b>ÇAĞLA ÇETİNKAYA</b> TURİZM VE OTEL İŞLETMECİLİĞİ		
<p>İstanbul Nişantaşı Üniversitesi, Etik Kurulu Başkanlığına incelenmek üzere başvurmuş olduğunuz <b>“THE EFFECT OF PERCEIVED USEFULNESS OF AUGMENTED REALITY APPLICATIONS ON THE ENJOYMENT OF THE MUSEUM VISITOR EXPERIENCE: A SERIAL MEDIATION ANALYSIS”</b> başlıklı çalışmanız, 21.03.2025 tarihli 2025-03 sayılı etik kurul toplantısında değerlendirilmiştir. Sosyal ve Beşerî Bilimler Etik Kurulumuz tarafından yapacağınız araştırmanın etik açıdan uygunluğuna oy birliğiyle karar verilmiştir.</p>		
Bilgilerinize rica ederim.		

**Appendix 2. Scale**

The scale items used to measure perceived benefit, emotional experience, technology use, and visitor enjoyment are provided in Appendix. These items were adapted from previously validated measurement tools and customized for the context of museum-based augmented reality experiences. Researchers aiming to replicate or extend this study are encouraged to use these items for consistency and comparability. The full list of statements used in the questionnaire is presented below as part of the standardized instrument. The following scale items were originally administered in Turkish to ensure clarity and cultural relevance for the respondents. The original items are presented here for transparency and consistency with data collection procedures. English translations are available upon request.

<b>Duygusal Deneyim Ölçeği</b>						
		Çok İyi (1)	İyi (2)	Orta (3)	Az (4)	Çok Az (5)
1	Mutlu					
2	Kaygılı					
3	Sakin					
4	Üzgün					
5	Güvenli					
6	Korkmuş					

<b>Teknoloji Kullanım Ölçeği</b>						
		Hiç Katılmıyorum (1)	Katılmıyorum (2)	Kararsızım (3)	Katılıyorum (4)	Tamamen Katılıyorum (5)
1	Teknolojiyi her zaman yakından takip ederim.					
2	Teknolojinin olmadığı bir yaşam tarzı düşünemiyorum.					
3	Teknolojik inovasyon ve değişimler sosyal hayatım için önem arz etmektedir					
4	Günlük yaşamımdaki her türlü inovasyon, değişim ve gelişim hayatımı olumlu etkiler.					
5	Günlük yaşamdaki yenilik ve değişime ayak uyduramamak beni mutsuz eder.					
6	Yeni çıkan teknolojik bir ürünü teknolojiyi takip etmek için satın alırım					
7	Yeni çıkan teknolojik bir ürünü prestij amaçlı satın alırım					
8	Yeni çıkan teknolojik bir ürünü ihtiyacımı gidermek için satın alırım					
9	Yeni çıkan teknolojik bir ürünü kişisel tatmin için satın alırım					
10	Yeni çıkan teknolojik bir ürünü sosyal statü gereği satın alırım					
11	Yeni çıkan teknolojik bir ürünü eskisinden sıkıldığım için satın alırım					
12	Yeni çıkan teknolojik bir ürünü estetik olması açısından satın alırım					
13	Kullandığım cihazın eskimiş olmasından dolayı yeni bir cihaz satın alırım					

Artırılmış Gerçeklik Uygulamalarında Algılanan Fayda						
		Kesinlikle Katılmıyorum (1)	Katılmıyorum (2)	Ortadayım (3)	Katılıyorum (4)	Kesinlikle Katılıyorum (5)
1	Artırılmış gerçeklik uygulaması, daha fazla bilgi sahibi olmak isteniyorsa oldukça ilgi çekicidir.					
2	Artırılmış gerçeklik uygulamasını kullanmak, fikir edinmek için mantıklı ve yeterlidir.					
3	Artırılmış gerçeklik uygulamasını kullanmak iyi bir fikirdir.					
4	Diğer kullanıcıların da artırılmış gerçeklik uygulamasını kullanmaları onların faydalarına olur.					

Ziyaretçi Deneyiminde Eğlence						
		Kesinlikle Katılmıyorum (1)	Katılmıyorum (2)	Ortadayım (3)	Katılıyorum (4)	Kesinlikle Katılıyorum (5)
1	Müzedeki etkinlikleri izlemek zevkliydi.					
2	Müzedeki performansları izlemek büyüleyiciydi.					
3	Müzedeki yapıları izlemekten gerçekten zevk aldım.					
4	Müzedeki etkinlikleri izlemek eğlenceliydi.					
5	Müzenin etkinliklerini izlemek çok eğlendiriciydi.					
6	Müzedeki yapıları izlemek sıkıcıydı.					