DOI: https://doi.org/10.31410/ERAZ.2023.357

Digital Experience Scale Development: An Application in Rural Heritage Tourism

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Received: November 29, 2023
Accepted: December 29.2023
Published: March 16, 2024

Keywords:
Digital experience dimensions;
Scale development;
Experience measurement;
Rural heritage tourism

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Abstract: *By using qualitative and quantitative research approaches, this study aims to develop a measurement scale for evaluating digital experience in the context of heritage tourism. The three-step procedure was used to conceptualize, create, and validate a digital experience scale. Conceptualization is based on key digital experience dimensions extracted from the literature review. The developed digital experience scale consists of seven dimensions: expectation confirmation, perceived enjoyment/entertainment, engagement, perceived ease of use, education, escapism, and aesthetics. The scale was tested in a small heritage site located in a rural tourist destination in Croatia. The results show adequate reliability and validity of the measurement scale, implying its applicability in future research on the digital experience of heritage visitors. Therefore, this study extends the experience measurement literature and adds to the knowledge of digital technology implementation in small rural heritage sites.*

1. INTRODUCTION

Many cultural heritage sites have implemented new digital technologies (e.g. virtual and augmented reality) to innovate their products and services, and to enrich the visitor experience. What is more, the rapid development and increasing implementation of digital technologies in the leisure context resulted in the need to explore their nature and implications within the user experience scope.

Previous research found that digital technologies enhance the tourist experience (e. g. Jung et al., 2016). What is more, digital technologies like virtual and augmented reality have the potential to create immersive heritage tourism experiences. In this vein, Bec et al. (2019) demonstrated that integrating history with cutting-edge technology enriches visitor experience and subsequent engagement with history. In addition, Han et al. (2017) found that augmented reality benefits cultural heritage tourism, while Han et al. (2019) put forward the importance of using the latest technologies in enhancing the cultural tourism experience.

Since experiences are service/product specific, and depend on the context, it is important to know service/product factors that contribute to user experience in a particular environment. What is more, tom Dieck and Jung (2018) revealed the necessity of exploring context-specific factors to increase the success of technology adoption. Following this approach, it is important to explore digital experience features in small and less developed tourism destinations (e.g. rural destinations), to better understand the effects that new technologies have on visitor experience in this specific context.

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There has been increasing research that focused on digital technology applications in the heritage context. However, Han et al. (2017) concluded that research regarding the tourist experience is still limited and lacks both theoretical and empirical studies. Similarly, Trunfio et al. (2019) pointed out that research on how new technologies impact visitor experience is mainly conceptual and in its early stage of development. Particularly, Liu (2020) noted that the measurement framework for digital experience is lacking.

Therefore, in an attempt to address previously identified gaps in experience measurement literature, this study aims to develop a measurement scale for evaluating digital experience, focusing on small heritage sites located in rural environments.

2. DIGITAL EXPERIENCE: CONCEPTUALIZATION AND SCALE DEVELOPMENT

Digital technologies are creating an environment where real and virtual elements are mixed in different ways. Currently, literature distinguishes between the following types of new digital technologies, namely virtual reality, augmented reality, and mixed reality. According to Weber Sabil and Han (2021), virtual reality (VR) fully immerses the user into a computer-simulated environment, augmented reality (AR) enhances real-world vision through the overlay of computer-generated content, while mixed reality (MR) merges the real world with the virtually generated content into creating a third viewing dimension, where both realities can interact with each other in real-time.

Due to these features, implementing digital technologies in the tourism industry changes tourism services and products, and affects tourist experience by creating new types of experiences. In the context of tourist interaction with digital devices, digital experiences are formed. Thus, it is important to understand the attributes that describe the digital experience concept.

Based on the literature review on digital experience, the main digital experience features in the cultural and heritage context were identified from past empirical research, as presented in Table 1.

Table 1. An overview of digital experience dimensions

Reference	Research context	Digital experience dimensions
Jung et al. (2016)	Museum in the United Kingdom	• Education experience • Aesthetics experience • Entertainment experience • Escape experience
Chung et al. (2017)	Cultural heritage site in South Korea	• Expectation confirmation • Perceived advantage • Aesthetic experience • Perceived enjoyment
Jung et al. (2018)	Cultural heritage site in South Korea and museum in Ireland	• Aesthetics • Perceived usefulness • Perceived ease of use • Perceived enjoyment
Trunfio et al. (2019)	Museum in Italy	• Heritage valorization • Education • Entertainment • Socialization • Escape
Bae et al. (2020)	Cultural and artistic attraction in South Korea	• Interactivity • Vividness • Perceived immersion • Perceived enjoyment

Reference	Research context	Digital experience dimensions
Liu (2020)	Cultural heritage site in Taiwan	• Interpretation and presentation • Usability • Information/knowledge • Entertainment • Engagement
Guo et al. (2023)	Digital museum	• Joviality • Personal escapism • Localness

Source: Own research

As displayed in Table 1, digital experience is a multidimensional construct. According to these results, the most emphasized digital experience dimensions are entertainment and enjoyment, education, as well as escapism (escape) and immersion. In addition, in their analysis of best practices relating to the application of smart technologies in the cultural heritage context, Buonincontri and Marasco (2017) found that technological applications are mostly oriented to intensify and support education and entertainment, while Han et al. (2019) confirmed enjoyment as dominant factor that participants experienced while using augmented reality smart glasses in the cultural tourism context.

Following the digital experience features identified in the relevant literature, a measurement scale was developed. It consisted of 25 items, grouped in seven dimensions.

Namely, the dimension "expectation confirmation" was made up of 3 items (experience better than expected, service level better than expected, confirmed expectations), adapted from Chung et al. (2017). Dimension "perceived enjoyment/entertainment" consisted of 4 items (fun, captivating, enjoy, interesting), based on Jung et al. (2016), Chung et al. (2017), and Liu (2020). Dimension "engagement" comprised 4 items (spending time, immersive experience, participating experience, unique experience), as suggested by Liu (2020). Dimension "perceived ease of use" was made up of 3 items (clear and understandable interaction, low level of effort, ease of use), adapted from Jung et al. (2018). Dimension "education" consisted of 5 items (learning something new, becoming more knowledgeable, learning a lot, stimulating curiosity, good learning experience), based on Jung et al. (2016) and Chung et al. (2017). Dimension "escapism" comprised 3 items (imagining being someone else, living in a different time or place, escaping from reality), as suggested by Jung et al. (2016). Finally, dimension "aesthetics" was made up of 3 items (attractive, design details, pleasant), adapted from Jung et al. (2016) and Jung et al. (2018).

The digital experience features in the developed measurement scale were assessed with response options from "strongly disagree" (as 1) to "strongly agree" (as 5).

The validity of the measurement scale was established using a two-step approach. Firstly, in scale development stage, previously validated items related to the measurement construct were extracted using literature analysis (Table 1). In addition, to evaluate items in terms of sufficiency, coherence, clarity and relevance, a panel of academic and professional experts was addressed. Their review confirmed the items to be valid. Secondly, the scale validity was tested empirically. These results are reported in the next section of this paper.

The developed digital experience scale was validated by conducting a pilot study. According to Baker (1994), pilot studies are used to pre-test a particular research instrument. They are

conducted to increase research quality (Malmqvist et al., 2019), and to enhance research validity and reliability (Gudmundsdottir & Brock-Utne, 2010). Therefore, to meet the research goals in the present study, it is justified to conduct the pilot study.

To empirically test the developed digital experience scale, self-administered questionnaires were distributed to visitors of a medieval castle, a small heritage site located in a rural tourist destination in Croatia. The castle dates from the 13th century and is newly renovated and revitalized. Among other activities, visitors can experience the history of the castle in multimedia exhibitions using virtual and augmented reality technology. The questionnaires were distributed only to those visitors who have experienced digital technologies in the castle and showed interest in participating in the study.

Following the suggestions regarding minimum sample size, further analysis is based on data gathered from 54 participants. This sample size fulfills the rule of thumb of 30 participants as the minimum sample size for a pilot study recommended by Browne (1995) and is in accordance with a minimum acceptable sample size of 50 for performing exploratory factor analysis, as suggested by Hair et al. (2010).

A combination of statistical analysis methods was performed. Data was described with descriptive statistical analysis, calculating percentages, mean, and standard deviation. Scale validity was empirically examined using exploratory factor analysis and correlation analysis. Reliability analysis with Cronbach's alpha coefficients was performed to determine scale reliability.

3. PILOT STUDY RESULTS

The pilot sample consisted of 44.4 per cent male and 55.6 per cent female respondents. Their mean age was 25.8 years (SD = 7.85, ranging between 18 and 45 years). In terms of their employment status, the majority of the respondents identified themselves as students (74.1 per cent), and 25.9 per cent were employees. Accordingly, 70.4 per cent of respondents completed a secondary level of education, while 29.6 per cent reported a higher level of education. Moreover, more than half of them (51.9 per cent) indicated previous experience with digital technology usage, and the majority of respondents (88.9 per cent) reported a positive attitude toward using digital technology for heritage interpretation. Thus, the pilot sample structure suggested appropriate respondents' profiles, since young adults are deemed as the most prominent users of digital technology.

Data analysis was performed in two steps. Firstly, the validity and reliability of the tested digital experience scale were evaluated. Next, descriptive statistics for measurement items and interpretation of extracted factors (dimensions) of the tested measurement scale were conducted.

Prior to assessing the validity and reliability of the proposed measurement scale, data adequacy was checked. Kaiser-Meyer-Olkin (KMO) measure was higher than the minimum acceptable value of 0.5, as suggested by Stewart (1981), and Bartlett's Test of Sphericity was significant, as recommended by Leech et al. (2005) (see Table 2). These results imply that it is appropriate to perform exploratory factor analysis.

Table 2 summarises the results of descriptive statistics, exploratory factor analysis, and reliability analysis.

Table 2. Digital experience scale analyses

Factors and items	Mean (SD)	Factor loadings	Eigen values	% of Variance	Cronbach alpha
Factor 1	*4.00 (0.720)*		*5.996*	*23.985*	*0.927*
The experience of using digital technologies has made me more knowledgeable	3.85 (0.960)	0.859			
Using digital technologies has stimulated my curiosity to learn new things	3.70 (0.924)	0.832			
I learnt a lot by using digital technologies	3.43 (0.815)	0.795			
I learnt something new using digital technologies	4.09 (1.086)	0.780			
Digital technologies offered me the experience of participating in the history	4.30 (0.816)	0.756			
The setting reality of digital technologies showed attention to design details	4.20 (0.919)	0.726			
Digital technologies provided a good learning experience.	3.85 (0.878)	0.712			
The way the history was presented through digital technologies was interesting	4.59 (0.599)	0.680			
Factor 2	*4.36 (0.676)*		*4.392*	*17.567*	*0.917*
I was willing to spend time exploring different areas with digital technologies	4.59 (0.599)	0.856			
The interaction with digital technologies is clear and understandable	4.67 (0.752)	0.842			
The interaction with digital technologies does not require a lot of effort	4.65 (0.955)	0.775			
Digital technologies offered me a personalized, unique experience	4.22 (0.861)	0.730			
My experience of using digital technologies was better than what I expected	3.98 (0.789)	0.699			
Digital technologies offered me an immersive experience	4.04 (0.823)	0.619			
Factor 3	*3.35 (0.897)*		*3.404*	*13.616*	*0.896*
I felt like I was living in a different time or place when using digital technologies	3.19 (0.992)	0.923			
Digital technology experience let me imagine being someone else	3.44 (0.984)	0.912			
I completely escaped from reality when using digital technologies	3.41 (0.981)	0.767			
Using digital technologies was very pleasant*	4.48 (0.795)	0.477			
Factor 4	*4.37 (0.495)*		*3.153*	*12.613*	*0,784*
Using digital technologies was captivating	3.83 (0.637)	0.823			

Factors and items	Mean (SD)	Factor loadings	Eigen values	% of Variance	Cronbach alpha
I enjoyed using digital technologies	4.50 (0.607)	0.793			
Using digital technologies was fun	4.70 (0.571)	0.758			
Overall, most of my expectations from using digital technologies were confirmed*	3.80 (1.035)	0.590			
Using digital technologies was very attractive	4.43 (0.716)	0.565			
Factor 5			-	-	-
The service level provided by digital technologies was better than what I expected*	3.98 (0.789)	0.845			
Factor 6			-	-	-
I find digital technologies easy to use*	4.81 (0.392)	0.700			
Total				*67.780*	*0.923*
Kaiser-Meyer-Olkin (KMO)	0.647				
Bartlett's Test of Sphericity	1601.830 ($p < 0.01$)				

Note: mean scores range from 1 to 5; values in parentheses are standard deviations;
* removed from further analysis

Source: Own research

In addition to content validity addressed in the methodology section, the validity of the proposed digital experience measurement scale was assessed using exploratory factor analysis, as well.

The data analysis (see Table 2) showed that of 25 items, one item ("Using digital technologies was very pleasant") had factor loading value lower than 0.5, one item ("Overall, most of my expectations from using digital technologies were confirmed") was strongly loaded on several factors, and two items ("The service level provided by digital technologies was better than what I expected" and "I find digital technologies easy to use") were loaded as factors with single-item solution. To meet the criteria for an acceptable factor solution, as proposed by Hair et al. (2010), these four items were excluded from further analysis. Accordingly, further analysis is based on a four-factor solution with 21 items.

Therefore, as shown in Table 2, exploratory factor analysis, using principal component analysis with varimax rotation resulted in the final factor solution explaining 67.78 per cent of the total variance in the data. Factor loadings ranged from 0.565 to 0.923, and eigenvalues were between 3.153 and 5.996. According to the cut-off criteria recommended by Taherdoost (2016), these results confirm the validity of the tested measurement scale, since all items had factor loadings above 0.4, and eigenvalues for all factors were greater than 1. In addition, as displayed in the correlation matrix in Table 3, correlation coefficients did not exceed the value of 0.70, meaning that extracted factors are not highly correlated and are distinct from each other, confirming adequate scale validity, as well.

Table 3. Correlation matrix for extracted factors

Factor	Factor 1	Factor 2	Factor 3	Factor 4
Factor 1	1.000			
Factor 2	0.635**	1.000		
Factor 3	0.351**	0.376**	1.000	
Factor 4	0.183	0.247	0.316*	1.000

Note: ** correlation significant at 0.01 level; * correlation significant at 0.05 level

Source: Own research

Next, the reliability of the measurement scale was examined using Cronbach's alpha coefficients (see Table 2). The values for each factor varied from 0.784 to 0.927, and for the overall scale, the coefficient was 0.923, exceeding the value of 0.70, as proposed by Hair et al. (2010). These results suggest good internal consistency and high reliability of the measurement scale.

Thus, the results of the validity and reliability assessment imply that the tested digital experience scale met the validity criteria, and confirmed the reliability of the scale.

Furthermore, as shown in Table 2 and explained above, the final factor solution resulted in four factors (dimensions). The first factor was made up of eight items, explained the largest percentage of variances among the four factors, and was named "learning experience". The second factor consisted of six items, had a second-highest overall mean score, and was labelled as "interaction". The third factor called "escapism" included three items, and had the lowest overall mean score among the extracted factors. The fourth factor, "enjoyment/entertainment" was made up of four items, and had the highest overall mean score among the four factors.

4. CONCLUSION

By developing a digital experience scale and testing it with quantitative data, this study provided a set of features that affect visitor experience when using digital technologies in a small rural heritage setting.

As a result of conducted pilot testing, the developed measurement scale was improved. Research results confirmed the validity and reliability of the proposed digital experience scale, which in the final stage, after item purification, consisted of 21 items. In addition, four distinct factors were identified to measure digital experience in small rural heritage settings: learning experience, interaction, escapism, and enjoyment/entertainment. They align with the theoretical foundation in the development stage of the tested measurement scale.

Additionally, these results indicated a four-dimensional digital experience in a rural heritage context. The first dimension "learning experience" includes items related to knowledge, curiosity, learning, and the way of presenting history. The second dimension "interaction" consists of items related to ease of use, engagement, and personalization, and reflects visitors' way of interaction with technology used and presented historical contents. The third dimension "escapism" describes visitors' experiences that differ from their everyday lives, and take them to different times and places. Finally, the fourth dimension "enjoyment/entertainment" regards items reflecting captivating, enjoyable, funny, and attractive aspects of digital experience.

Even though all methodological recommendations were met for conducting a pilot study, and reported results were valid and supported by the theory, several research limitations should be addressed in future research. Future studies should further test the measurement scale and try to improve the final factor solution proposed in the present study, using a larger sample that would allow testing of other psychometric properties of the scale. A larger sample would also allow easier generalization of the findings. In addition, future research is suggested to explore how features included in the developed digital experience scale influence visitors' satisfaction and behavioral intention.

Although further research is needed to additionally validate the proposed measurement scale and four-dimensional digital experience structure, this study extends the experience measurement literature and adds to the knowledge of digital technologies implementation in small rural heritage sites. It also contributes to the conceptualization of digital experience, by reflecting the rural heritage site digital experience as an educational, interactive, enjoyable and entertaining escape from reality. Thus, the present study provides useful guidelines to better understand the key digital technology experience factors and implications in small heritage sites located in rural destinations.

Acknowledgment

This paper is the result of the scientific project "Tourism Experience Measurement in Physical and Virtual Space", which is supported by the University of Rijeka (project ZIP- UNIRI-116-1-21).

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