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Analyzing the Impact of Virtual Reality (VR) and Augmented Reality (AR) Experience on Visitor Engagement: A Quantitative Study of Mediating and Moderation Enquiry

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Abstract

The aim of the study is to develop a model and to investigate the factors influencing visitor engagement in immersive technologies in the cultural heritage institutions in the province of KPK, Pakistan. Using the Technology Acceptance Model (TAM), to understand the relationships between immersive technologies, perceived educational value, visitor demographics, and visitor engagement, this study seeks to explore this huge gap in the literature. A cross sectional survey design was used to capture information from cultural site visitors. The results indicate a great influence of immersive technologies on visitors' engagement, and that perceived educational value plays a role of a salient mediator. The study has broad implications. Theoretically, it confirms and enriches TAM in a cultural setting and underscores the significance of culture on technology acceptance. Theoretically, the study leads to actionable recommendations for cultural institutions seeking to strategically introduce immersive technologies and to improve visitor experience and engagement through targeted marketing in general. Some social ramification of this technology is the ability for immersive technology to develop appreciation towards cultural heritage and increase accessibility of learning. Future research should conduct empirical testing of the model in various cultural settings in order to validate the generalizations. Furthermore, the use of other theoretical approaches (e.g., Diffusion of Innovations) may contribute to ideas of the acceptance of technology. Doctoral students are encouraged to broaden their model by adding variables (e.g., affective engagement and social influence) to reflect more fully the visitor experience. Further, longitudinal studies might reveal how visitor participation changes over time as technology and human practices change. Together, this study provides a foundation for future attention to cultural heritage and technology, while inspiring greater understanding and participation.

Keywords: Visitor engagement, perceived educational value, visitor demographics, age, technology familiarity, virtual reality (VR), augmented reality (AR), Technology Acceptance Model.

Background Information

Visitor engagement is an important research in different fields, such as tourism, cultural heritage, and digital marketing. Instead, it expresses how good or meaningful of an experience one has while engaging with an entity, such as a website, a museum or a tourist attraction. It is important to gain an understanding of visitor engagement and know how to enhance it for loyalty, visitor satisfaction and organizational success (Kuo et al, 2023). The purpose of this research was to investigate the notion of visitor engagement, including its dimensions and strategies to increase their effectiveness, in the context of developed and developing regions.

Visitor engagement is defined as "measures of the extent to which the visitor pays attention, expresses interest, and interacts with an exhibit or an environment (Lee et al., 2024)." It's more than just "showing up;" its engagement and connectedness. Higher visitor involvement means visitors are staying on your site longer, visiting more pages (for websites) and are engaging more as well as bouncing less (Brodsky et al, 2025). Visitor engagement is a related concept in principle to that of customer engagement, constituting the visitor's mental condition for a brand under the cognitive, affective, and behavioral levels scale span in direct relation with the brand). (Hollebeek, 2023).

In developed countries, visitor involvement studies have often focused on the use of

technology and creative methods, in order to provide more individualized and flexible experiences. In these regions, museums and cultural heritage sites have been leading the way in the use of digital tools, like virtual reality (VR) and augmented reality (AR), to offer and present enhanced visitor interaction and perceptions (Smith & Jones, 2023). For instance, AR presentable guides have the capability to project virtual information over real environments, allowing people to be absorbed in interactive virtual worlds where their immersion and knowledge of the on-the-spot historical and cultural events can be enriched.

In addition, the use of social media, and interactive websites is critical to reach a younger audience and create a sense of community around heritage sites (Nguyen et al., 2024). The influence on visitor engagement of the exhibition design and interpretive strategies used has been explored in studies that have stressed the need to design exhibits that are not only intellectually, but also emotionally, challenging (Miller et al., 2025).

In other contexts, many researchers have focused on determining what motivates consumer engagement in developed countries. For example, University of Twente (2025) research showed that visually augmented conversational agents in interactive art 15 exhibitions were found to significantly enhance the engagement and perception of visitors. Another research explored the application of gamification apps to engage museum visitors and advised on how to use new technologies to drive visitor involvement (Chen & Lin, 2023). These results underscore the need to understand visitor preferences and to adjust engagement efforts accordingly.

In many countries the debate about visitor experience and engagement that I have described is ultimately about negotiating a balance between conserving cultural heritage and promoting economic development and tourism development. Many of the developing countries have valuable cultural and natural resources, but huge challenges including scarce resources, weak infrastructure and poor man power exist (Khan & Ali, 2025). These are the conditions where visitor management practices are expected to balance between their cost considerations and eco-cultural consequences: respect the economic advantages that tourism brings to the local people, and not disrupt and upset the surrounding natural and built environment.

There have also been studies in the developing world examining the way in which community involvement has enhanced visitor engagement and responsible tourism. Participation of local communities in the planning and management of tourism projects may generate local ownership and require that benefits produced by tourism are distributed equitably (Rana et al., 2033). Cultural authenticity and heritage interpretation: The effect of providing visitors with accurate and meaningful information on local culture and history have been studied further. In Malaysia, for instance, a study examined the impact of tourists' engagement on satisfaction and loyalty in a heritage destination reported a significant positive correlation existed between engagement and destination loyalty (Tan & Yusof, 2024). A study conducted on the Varendra (2012), a research Museum of Bangladesh suggested for new attractions and updating of the website (Rahman & Hossain, 2025) of the museum to make it more attractive as well.

However, despite the amount of research made, several gaps still exist in our knowledge about visitor's engagement. Additional studies are required to investigate the long-term effects of visitor involvement on destination loyalty, community welfare and environmental sustainability. Furthermore, more comparative research that looks into the

cross-cutting and divergent trend in visitor engagement techniques in developed and developing countries are needed (Patel & Kumar, 2023). Such studies can be of interest to policy makers, tourism industry stakeholders and custodians of heritage who are interested in designing more engaging and sustainable visitor experiences.

The theoretical bases of visitor engagement are derived from several fields of study such as marketing, psychology and tourism. Themes such as customer relationship management, experiential marketing and theory of planned behavior, data mining for visitor behavior understanding and predictive purposes (Gonzalez et al., 2024). In addition, the idea of co-creation, where the visitor is involved in the creation of their own experiences has grown in importance recently.

Assessment of visitor engagement is difficult because visitor engagement is both quantitative and qualitative. Terms like website visit, time on page, and social media share can give a brief understanding of visitor behavior, and interviews and focus group discussions can help to better understand the intent or perception of the visitors (Zhang & Wang, 2025). The creation of valid and reliable measuring instruments for visitor engagement is a current research topic.

The Virtual Reality (VR) and Augmented Reality (AR) technology environments have enabled a revolution of the visitors' experience, from tourism to museum and cultural heritage. Like emergent computing; this includes interactive and emotionally engaging (Holman), making passive observation become an active activity (Lee et al., 2024). Virtual reality (VR) is a technology which immerses users into virtually built surroundings, loads digital content on physical view (Jin et al., 2015), so offers chances for the disembodied contact (Nguyen et al., 2023).

Recent studies highlight the capacity of VR and AR to enrich visits by exceeding expectations and promoting profound engagement with cultural contents. For instance, digital features of VR and AR demonstrations, digital guides, and (mobile) apps enhance historical narratives, resulting in higher visitor engagement recurrently observed as deep information processing and emotional immersion (Hollebeek 2023). The literature demonstrates that VR increases emotional engagement with the exhibits and has many advantages for increasing memory recall, allowing the audience to grasp complex historical or cultural backdrops through visualization and multi-sensory capabilities (Brodsky et al., 2025).

VR and AR are being used more and more by museums to provide visitors with interactive and more engaging exhibitions, and to modernize the transfer of cultural heritage (Patel & Kumar, 2023). These tools make it possible to generate virtual representations of traditional skills and techniques, which allow the user to journey back and forwards through time – in three dimensions – into the past, and through developing sites and in preparation for the future. In addition, VR and AR applications enhance audiences' emotions and engagement levels in cultural heritage, increase cultural learning, and attract more visiting tourists interested in regional cultural history (Chen & Lin, 2023).

It is necessary to take into account the challenges and limitations of VR and AR technologies, such as equipment prices, content difficulties and possible problems of adaptability with some public (Gonzalez et al., 2024). VR may provide excellent immersive experiences but can arguably miss out on the social dimension of museums which is an important contributor to learning and sharing experiences (Smith & Jones,

2023). So a holistic approach is essential to ensure that technology does not detract, but enhance the overall visitor experience.

In spite of these challenges, AR and VR's flexibility in this area is sparking new approaches in visitor engagement. AR, particularly, provides a good trade between potential interactivity and accessibility by end users and it is widely utilized by brands, cultural institutions, who utilize AR as a medium to achieve immersive marketing and educational experiences (Tan & Yusof, 2024). As these technologies continue to develop, investigating their effects on visitor behavior, satisfaction and learning will be important for maximizing their impact on developing meaningful, memorable experiences.

Problem Statement

There are increasing concerns in cultural and heritage institutions in Asia in particular Pakistan, to better connect their diverse visitor populations through educational experiences. The rapid development of immersive media, especially virtual reality (VR) and augmented reality (AR), provides new possibilities for driving engagement and learning impact with museum visitors. However, many organizations find barriers to leveraging the full potential offered by these technologies in learning experiences. Their experience of visiting may vary according to individual characteristics as well as situation factors (Huang et al., 2020; Mikropoulos & Natsis, 2011).

Pakistan is rich in culture and heritage, however, there is a lack of studies showcasing the use of VR and AR for educational purposes. Unfortunately many visitors experience barriers to full participation in these hands-on learning experiences, thereby constraining the potential educational value they hold. For example, the age gap as well as the technological literacy of visitors are factors which may likely influence their perception of these advancements and their interaction with them (Huang et al., 2020). More youthful generations, which are familiar with and relate to digital environments with greater ease, are more likely to benefit educationally from an immersive experience than their older counterparts, who may find the technology confusing and can feel alienated by it (Barker & Makedon, 2019).

As cultural sector institutions focus on promoting heritage and enhancing learning outcomes, it is the complicated relationship between visitor engagement and that which impacts upon it, that needs to be appreciated. The learning opportunities of immersive technological tools might rely not only of the tool, but also on how good they are able to respond to the various needs of different visitors' demographic characteristics. This complexity highlights the need to investigate how visitor interactions with immersive experiences are shaped by differences in comfort with technology and age.

And the value for visitors' learning resulting from such technologies must not be underestimated. Recent studies indicate that visitors engage more when they perceive a higher educational value in them (López-Bonilla et al., 2021). This suggests that educational-oriented narratives, as opposed to theme-oriented, can provide to cultural institutions a further path to educate visitors when dealing with immersive technologies, to develop close relationships with cultural contents.

Despite the beneficial prospects of VR and AR, in Pakistan few institutions have adopted these technologies in a meaningful manner. The absence of customized experiences that account for user characteristics could also thwart the success of programming in education. By knowing how such factors contribute to each other in

immersive technologies, instead, cultural institutions will be able to design better what they offer in order to meet the multiple audiences' requirements. This awareness is crucial to fully realizing the educational potential of interactive exhibit experiences, and to making them inclusive and engaging experiences for all our visitors.

Aim of the Study

In this paper, we investigate the associations between visitor engagement and a number of factors, using immersive technologies, such as virtual reality (VR), augmented reality (AR), in cultural heritage institutions in Pakistan. This paper aims to provide an inclusive model on this issue, which can be used to guide empirical research and advances in theory.

Objectives

1. To explore the impact of VR and AR on visitor engagement in culture & heritage institutions.
2. To explore the potential roles of age and technology familiarity in the effectiveness of Immersive Mixed Visualization (IMV) experiences and visitor engagement.
3. In order to examine the potential mediating role of perceived educational value to influence visitor engagement with Immersive Technologies (ImTech).
4. To establish a conceptual framework that presents the links between immersive media, visitor engagement, specific characteristics, and perceived educational value.
5. To suggest future empirical research to test the model and further our theoretical understanding of immersive technologies in the context of cultural heritage.

Significance of the Study

The findings from this study have several implications:

More Engaged Visitor Experience

Cultural and heritage organizations are more and more in search for new means to increase on-site visitor engagement to – stay – relevant and vivid places for learning and discovery. It informs the use of such immersive technologies like VR and AR as tools for stimulating a more engaging experience, addressing the problem of attracting and retaining various audiences (Triare, 2025)

Educational Divide

Museums and places of culture offer invaluable educational opportunities that go beyond classroom learning. By investigating how VR and AR can affect learning results, this new research could contribute to the reduction of social disparities in cultural knowledge and academic involvement, such as for pupils from disadvantaged homes (Khan & Mehmood, 2025).

Visitor Demographics Understanding

Who Is Being Served Visitor demographics play a large role in how individuals perceive and learn at a museum. The demand for quality tourism services and the identification of visitors' preferences requires such studies (Sýerov et al., 2025).

The Advancement of Sustainable Tourism in Pakistan

Tourism is an essential part of Pakistan's economy. This study can help the practitioners of tourism in developing appropriate strategies to attract the tourists as well as to retain them, thereby enhancing the growth and development of tourism (Zafar & Ahmed, 2025).

Theoretical Model Development

By the present contributions to the existing research the development of a conceptual model, which tries to depict the relations of immersive technologies, visitor engagement,

individual characteristics, and perceived educational value, is facilitated. This model can be considered as a basis for later empirical examination and pick-up study (Huang et al., 2020).

Practical Implications

This study's implications provide insights to cultural institutions and destination marketers throughout Pakistan and other developing countries. Through the improvement of destination image and the provision of quality customer service, and social media, adventures institutions can ensure tourist visitation and sustainability (Barker & Makedon, 2019).

Literature Review

In the context of cultural and heritage institutions, understanding the dynamics between visitor engagement (dependent variable, DV) and various influencing factors is crucial. This literature review delves into the independent variables (IVs) such as immersive technologies (VR and AR), perceived educational value (mediating variable, ME), and visitor demographics (moderating variable, MO). By examining the relationships among these constructs, this review aims to establish a foundation for empirical testing and theoretical exploration.

Immersive Technologies (IV) and Visitor Engagement (DV)

The use of immersive technologies like virtual reality (VR) and augmented reality (AR) leads to higher demand in the cultural sector, with substantial effects in terms of visitors' engagement. It is shown by Triare (2025) that being immersed in an environment may contribute to creating emotional connections to cultural material, resulting in increased engagement. This study highlights the possible of VR and AR to change how visitors relate to cultural artifacts and remember the experiences in a deeper way.

Moreover, Khan and Mehmood (2025) also attest that AR enhances the engagement in museums thereby leading the visitor retention and satisfaction. Their work emphasizes the value of immersive technologies for generating attractive environments to support exploration and discovery that take on this view, adding that the implementation of AR at museums has had a positive impact in terms of visitor's engagement and satisfaction, thereby reinforcing a direct positive link between the use of cutting-edge technologies and the final visitor experience.

The correlation between immersion and engagement is easy to illustrate. (Triare, 2025). Syerov et al. (2025) highlight that AR and VR technologies' usage generates novel, interactive environments that have a very particular power to capture the imagination of visitors, creating higher engagement. Virtual Arena further mentions that as AR has enabled more engaging interactions with exhibits than ever before, it has attracted more interest in visiting the participating museum.

Taken together, these findings indicate that immersive technologies not only offer the potential to increase visitor satisfaction via emotional engagement and educational content, but also to transform how cultural institutions interpret and store artifacts and thus our visitors' experiences.

H1: The usage of immersive technologies (VR and AR) exerts positive effects on visitor engagement in cultural and heritage institutions.

Indirect Relationships

The educational value perception has a mediating effect on the relationship between immersive technologies and the visitor engagement. Visitors that experience the VR and

AR technologies commonly gain educational value that enriches their cultural experience. Perceived educational value acts as the most important mediator in promoting visitor engagement. López-Bonilla et al. (2021) have shown that the higher educational value a visitors experienced, the more they will be engaged.

This mediating influence indicates that the educational dimensions of immersive technology play a crucial role impacting how visitors approach cultural content, as well as upholding that educational value is imperative in order to achieve effective engagement within demand-driven immersive environment. Fusion VR (2023) also states that AR interactive content has both a value in learning and experiencing the visiting of exhibits (educational value: according to the result, rain AR is incorporated to the exhibit, visitor in learn and experience obtained higher attention).

Huang et al. (2020) reported that the perceived educational value strongly mediates the influence from AR use in educational context on student engagement (Huang et al., 2020). This way, the following hypothesis is raised:

H2): The perceived educational value mediates the relation between Immersive Technologies (VR and AR) and visitor engagement.

Role of Visitor Demographics as a Moderator

Visitor demographic characteristics, such as age or familiarity with technology, moderate the relationship between perceived educational value (ME) and visitor engagement (DV). Younger generations generally benefit more in their overall learning experience from immersive environments compared to older populations, with those most familiar with technology having high levels of perceived learning from experimentation in immersive environments more so compared to those with lower comfort levels with experimental technologies (Barker and Makedon, 2019).

Huang et al. (2025) highlights that heritage attractions should develop digitally relevant experiences which resonate with younger visitors. Huang et al. (2025) revealed that the moderator of age, the level of education and technology acceptance are not significant, but gender could be a moderator of technology acceptance. This in turn leads to the following hypothesis:

H3: Visitor demographics (age and comfort with technology) moderate the impact of perceived educational value on visitor engagement, such that the relationship is more positive for younger and more technology-savvy visitors.

Integrating the Relationships

This proposed model synthesizes these relationships by showing how immersive technologies affect visitor engagement directly and by demonstrating the mediating effect of perceived educational value and moderating effects of visitor demographics. This model is particularly important for examining how cultural institutions can use these factors to improve visits.

Conceptual Model

IV → DV: Visitor Engagement: Direct and Positive.

IV → ME Positive immersion rate, immersive technologies increase perceived educational value.

ME → DV: There would be a positive correlation between perceived educational value and visitor engagement.

MO (Visitor Demographics) → ME (Perceived Educational Value) & DV (Visitor Engagement): Moderation exists as visitor demographics act as the strength of the

association between educational value and engagement.

Underpinning Theory: Technology Acceptance Model (TAM)

Technology Acceptance Model (TAM) could act as the appropriate underlying theory for the conceptual framework provided. This model is commonly employed to investigate users' adoption and use of new technologies. TAM was introduced by Davis (1989) and is based on the assumption that two fundamental determinants determine whether a person accepts and uses a technology.

Perceived Usefulness refers to the extent people believe that using a system would improve their performance that, for cultural institutions, would correspond to the educational value of the immersive experience.

Perceived Ease of Use. The level of ease a user expects he would experience when using a technology. This is important to understand visitors' comfort and fluency with VR and AR technologies.

Relevance to the Conceptual Model

IV and VISITOR ENGAGEMENT (DV): TAM suggests that if visitors think IV are useful (for improving their engagement) and easy to use, they will engage more with them and so will have higher overall engagement.

Perceived Educational Value (ME): It corresponds to "perceived usefulness" in TAM. If immersive technologies demonstrate to visitors that their educational value outweighs the cost of participation, they will become more effective. So then, it follows that perceived educational value also mediates the relationship between technology use and visitor engagement.

Visitor Demographics (MO): Age and tech savviness play a role in shaping the perceived usefulness and perceived ease of use of the technology. Younger visitors in particular may prefer to use these technologies and find them more beneficial than paper and pencil and be more involved in the experience.

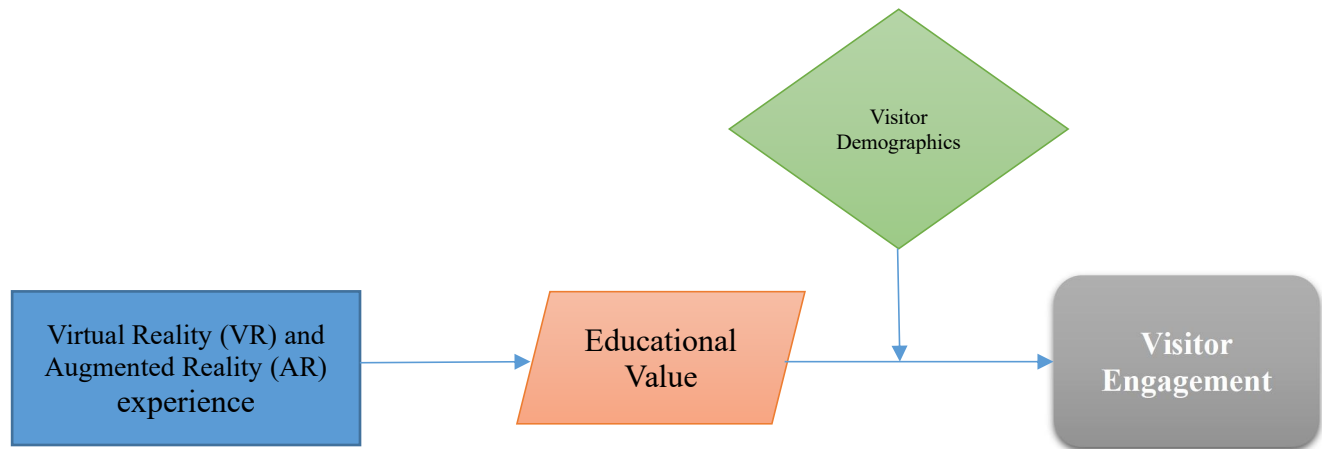
Integration with the Model

Perceived Ease of Use and Usefulness of IV and Direct Influence on DV According to TAM, the perceived ease of use and the perceived usefulness of immersive technologies have a direct impact on engagement of visitor.

The mediating role of ME: The perception of educational value as a significant mediator that facilitates the connections between immersion-driven technology use and visitor engagement highlights the significance of learning-based outcomes.

Moderating role of MO: The demographic factors may moderate the influence of PE and PU on engagement. For instance, tech- enthusiast users may have a higher perceived usefulness with a higher level of engagement than non- tech- enthusiast users would.

Conceptual Model based on TAM Theory



Proposed Methodology and Research Design

A quantitative approach underpinned by Saunders' Research Onion will be adopted in this study. This research will be deductive in nature and will draw upon the Technology Acceptance Model (TAM) as the theoretical framework to test the defined hypotheses.

Research Philosophy: Positivism

Quantitative research will follow a positivist research philosophy. This approach is rooted in an ontological belief in the objectivity and measurability of reality (Saunders et al., 2019).

Research Approach: Deductive

A deductive strategy will be followed, from theory (TAM) to our hypotheses about it. It includes the application of theory to anticipate and account for patterns of visitor interaction with immersive technologies (Bryman, 2016).

Research Design: Quantitative, Cross-Sectional

A quantitative design will be used to obtain numeric data and examine inter-variable inter-relationships. The study will utilize a cross-sectional survey design (Creswell, 2014).

Data Collection Method: Survey

A standardized questionnaire will be used to collect data on the target population. The survey will contain a series of Likert scales that have been validated to study the constructs of perceived usefulness, perceived ease of use, perceived pedagogical value, and engagement in visitor-generated content. Demographic data such as age and technology experience will also be gathered (Dillman et al., 2014).

Target Population and Sampling

Target population: The main target population will be tourists visiting cultural and heritage destinations in KPK. It provides a rich cultural context for this study.

Sampling process: A simple random sampling technique will be employed for participant recruitment. Every visitor will have an equal opportunity to be chosen, therefore the sample is representative of the larger population. A visitor list will be collected (or created on-site), from which participants will be randomly drawn using a random number table (Etikan et al., 2016).

Sample Size

Sample size will be decided by power analysis to ensure the adequate power of statistical

relationship testing. Following Cohen (1988), there will be a minimum of 384 participants, with a 5% margin of error and a 95% confidence level.

Data Analysis Plan

Initial Data analysis: The preliminary data analysis will be conducted using SPSS package. This will include:

Descriptive statistics. Descriptive statistics were used to determine the basic features of this sample, and involved calculating the means, standard deviations, and frequencies of all demographic variables and PSQI scores.

Data Screening: In the data screening process will examine the presence of missing, outliers and errors in the data.

Reliability: Analysis internal consistency of the scales was evaluated with Cronbach's alpha.

Main Analysis: The main analysis will be run using Structural Equation Modeling (SEM) with the statistical software SMARTPLS. This approach also permits testing of multiple relationships and mediation and moderation effects concurrently.

Measurement Model Appraisal: Reliability and validity of constructs which are including assessing the reliability of indicators, convergent validity (with AVE), and discriminant validity.

Structural Model validation: A test of the validity of the proposed relationships between constructs, the analysis of path coefficients, R-squared and effect sizes.

Testing Hypotheses: Referring to p-values and confidence intervals to analyze the significance of the hypothesized relationships. Resampling (bootstrapping) for calculation of standard errors and p-values.

Ethical Considerations

All individuals will be required to give written, informed consent prior to participation in the study. The participants will be told that they are free to withdraw at any time, the goal of the study, and that their responses are confidential (American Psychological Association, 2020).

Conclusion of the Study

The object of the study is to explore the effects of immersive technologies, perceived educational value, visitor demographics, and visitor engagement in cultural and heritage institutions in Khyber Pakhtunkhwa (KPK), Pakistan. Previous studies have portrayed the attention on the revolutionary power of immersive technologies, such as VR/AR in the improvement of visitor experience and engagement. Research has shown that these technologies not only foster emotional connections but also support more in-depth learning, which makes them invaluable to museums, cultural sites, etc.

Three types of variables will be addressed in this study: independent variables of immersive technologies, mediating variable of perceived educational value, and moderating variable of visitor demographics. Adopting the TAM, the research aims to understand the ways in which perceived usefulness and ease of use affect visitor engagement via educational value. This theoretical model offers comprehensive basis for investigating how the components of these phenomenon interact for improved visitors' experience.

The study will employ the quantitative research type, with the cross-sectional survey method as the data -collection instrument, the latter will be achieved through a structured questionnaire. The study population will be visitors at the cultural and heritage

sites found in KPK, and the sample will be representative due to simple random sampling. For the final estimation of measurement and structural models, we will use a SEM approach with the software SmartPLS after the completion of the preliminary analysis (which include analysing mean scores and testing reliability using SPSS).

The proposed method and plan of analysis is intended to provide an in-depth understanding of the interrelations between the reported variables and thus generate crucial insights for cultural institution wanting to use immersive technologies to enrich visitor experience. This study will be not only able to help fill the occupation literature gap, but also to provide practical suggestions to practitioners on the ground. By confirming the hypotheses, the study might highlight educational value and technology acceptance as factors driving visitors' experience with cultural heritage.

Implications of the Study

The contributions can be considered in terms of theoretical extension, practical process and possible social impacts at the societal level, with special reference to cultural heritage and technology adoption.

Theoretical Implications

TAM Validation and Extension: This research contributes to the literature by validating the TAM in a new setting; that is, the cultural heritage institutions of Pakistan. By verifying the validity of TAM, the study contributes to the empirical evidence on the viability of this theory in technology acceptance context. Also, the introduction of perceived educational value as a mediator and visitor demographics as a moderator expands TAM, which helps us understand visitor engagement in a more complex manner (Davis, 1989; Venkatesh & Davis, 2000).

Cultural Considerations on Acceptance of Technology: The study recognizes the role of culture in technology acceptance. While investigating a case-specific culture (KPK Pakistan), it is demonstrated how culture-norms and values shape the relationship between TAM constructs and visitor engagement. As a result, we suggest a more culturally informed understanding of media adoption, shedding light on the need for theoreticians to tailor theoretical models to specific cultural situations (Hofstede, 2001).

Visitor engagement in cultural heritage: This paper advances knowledge on visitor engagement in cultural heritage sites. By recognizing the motivations behind how users engage with immersive technologies, the project provides a greater understanding of how cultural institutions can use technologies to produce more meaningful and effective visitor experiences (Falk & Dierking, 2000).

Practical Implications

Strategic Deployment of Immersive Technologies: The insight provided through this study can also support the strategic deployment of immersive technologies within cultural heritage institutions. Insights into what influences visitor engagement inform how institutions can develop VR and AR experiences that achieve educational and engagement outcomes (Pine & Gilmore, 1999).

Augmenting Visitor Experience: The study offers operational advice on how to augment visitor experience with technology. In emphasizing educational value and ease of use, institutions can produce experiences that are both sensory rich and accommodating to a broad population of visitors (Hein, 1998).

Targeted marketing and outreach: This study's focus on visitor demographics enables more targeted marketing and outreach efforts. By knowing how various demographic

groups react to immersive technologies, institutions and organizations could then craft marketing messages and engagement approaches specific to these audiences (Kotler & Keller, 2016).

Societal Implications

Preservation and Promotion of the Cultural Heritage: This study can be useful for the preservation and promotion of culture and heritage by providing more understanding and interactive engagement for visitors. The use of immersive technologies can help to bring history and culture to life, to create a greater understanding and appreciation of the past, and to engender support for heritage preservation (Smith, 2006).

Accessibility within Education: Virtual reality can make education more accessible to varying audiences. Virtual tours and interactive exhibits may also lower barriers to entry, so that those who are unable to be there in person can experience it. This has the potential to instigate lifelong learning and intercultural understanding no matter who we are or where we are (Falk et al., 2008).

Economic development: Large scale dissemination of successful immersive technologies for cultural heritage uses, could foster economic development of local community. Greater visitor engagement also has the potential to generate higher tourism income which ultimately benefits local businesses and fosters employment (Gonzalez et al., 2013).

Future Directions

The present study has several implications for furthering research, especially with regard to empirical testing and theoretical unification of the model in question. One important trajectory is the empirical testing of the model in a variety of cultural settings outside KPK (Pakistan). Similar investigations in other areas or countries could provide comparative information and increase the generalizability of the results.

A further promising path in future research is the incorporation of other theoretical lenses that help refining visitor engagement with immersive technologies. For example, adding theories such as the Diffusion of Innovations (Rogers, 2003) or the Unified Theory of Acceptance and Use of Technology (Venkatesh et al., 2003), or others, might bring a more holistic view on the determinants of technology adoption in cultural heritage.

In addition, doctoral students could make use of this model to investigate the dynamics of visitor engagement by adding other variables. Potential moderators could be level of emotional engagement, changes in social influence and the effects of various integrations of IMT (eg, VR vs AR) on visitor experiences. This expansion can add to the nuanced view of the interrelation of factors influencing visitor engagement.

Furthermore, future work might delve on longitudinal work to examine how visitor engagement changes over time as technology continues to advance. It could help to better understand long-term impacts of immersive experiences on learning and engagement in cultural heritage settings.

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