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Travel Without Movement: Understanding the Impact of Immersive Technologies on Virtual Tourism Experiences

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Abstract

This research paper aims to understand the role of immersive digital technologies in shaping virtual tourism experiences and enhancing accessibility for diverse user groups. It analyzes the relationship between digital technology adoption, accessibility, content quality, interactivity, and user engagement to formulate a conceptual model that improves the effectiveness of virtual tourism. A quantitative approach was adopted, with primary data collected from 235 respondents using a structured questionnaire. Structural Equation Modeling was employed to test the hypothesized relationships between independent, mediating, and dependent variables, as well as contextual factors influencing virtual tourism experiences. The results indicate that user engagement is enhanced by digital technology adoption, accessibility, content quality, and interactivity, which in turn significantly influence the effectiveness of virtual tourism experiences. Partial mediation was found for digital technology adoption and content quality, while full mediation was observed for accessibility and interactivity. The study provides vital insights for virtual platform developers, policy makers, and tourist operators to create solutions that are entertaining, realistic, and inclusive. It further highlights the importance of accessibility for individuals with mobility challenges or limited financial resources, strengthening inclusivity within the tourism sector. This research is among the initial investigations to integrate user engagement into a comprehensive model, bridging technological, psychological, and experiential dimensions of virtual tourism and addressing gaps in prior literature.

Keywords: Virtual tourism; digital technology adoption; augmented reality (AR); virtual reality (VR); tourism experience; user engagement

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Introduction

The tourism industry is increasingly characterized by digital innovations that allow users to experience destinations virtually (Jane, 2024) using immersive technologies. Among such innovations, virtual tourism has emerged as a complement or alternative to physical travel, enabling users to explore places through platforms such as virtual reality (VR), augmented reality (AR) (Dubal et al., 2024), and 360-degree videos (Guttentag, 2010; Yung & Khoo-Lattimore, 2019). Such innovations have been especially critical in the wake of global disruptors such as the COVID-19 pandemic (Tambi et al., 2022), which restricted physical mobility (Segarra et al., 2024) but accelerated digital penetration in tourism (Brozovic & Saito, 2022). Beyond the pandemic, countries including South Korea, Spain, and Australia have reported rapid adoption of VR/AR tourism solutions, highlighting a global trend toward digital immersion in tourism experiences (Lee et al., 2020; Guttentag, 2010; Yung & Khoo-Lattimore, 2019). In this shifting digital landscape, the Effectiveness of Virtual Tourism Experience (EVTE) has become a key focus for both research and practice. EVTE has traditionally been evaluated in terms of satisfaction, learning, emotional involvement, destination image, and behavioral intentions (Tussyadiah et al., 2018; Wang et al., 2002). With growing sophistication, studies have begun to examine how system-level variables shape these outcomes (Li & Kieanwatana, 2024). Four antecedents consistently identified are Digital Technology Adoption (DTA), Accessibility Factors (AF), Content Quality (CQ), and Interactivity (INT). DTA reflects intention to adopt and utilize digital media (Davis, 1989). AF captures the ease with which users navigate platforms across devices and technical conditions (Neuhofer et al., 2014). CQ refers to the clarity, richness, and storytelling ability of content (Chen & Tsai, 2007). INT highlights control, feedback, and responsiveness (Steuer, 1992). Although prior studies confirm these antecedents influence EVTE, newer work emphasizes that their effects are often transmitted through User Engagement (UE). UE, defined as emotional, cognitive, and behavioral interaction with digital platforms (Brodie et al., 2011; Lalmas, 2012), is increasingly recognized as a mediator linking technological design with experiential outcomes (Tussyadiah et al., 2018). When users are engaged—emotionally invested, cognitively attentive, and behaviorally active—the virtual experience is more likely to be satisfying, memorable, and effective (Hammami, 2024). However, no empirical study to date has simultaneously tested DTA, AF, CQ, and INT within a unified model that positions UE as a mediating construct. Existing research largely examines first-order relationships between these antecedents and outcomes but overlooks the psychological mechanism of engagement as the critical pathway. To address this gap, this study investigates how UE mediates the relationship between technological antecedents and EVTE. This work contributes to both theory and practice. Theoretically, it extends understanding of UE as a psychological mechanism central to technology-enriched

tourism experiences. Practically, it provides insights for designers, marketers, and policymakers to build virtual tourism platforms that are not only technically advanced but also user-centered, accessible, and effective.

Conceptual model

Digital technology adoption and user engagement in virtual tourism

The integration of digital technology has reshaped the production and consumption of tourism experiences (Sivarethinamohan, 2023). In virtual tourism, Digital Technology Adoption (DTA) plays a decisive role in shaping User Engagement (UE) (Shamin et al., 2024). Immersive technologies such as virtual reality (VR), augmented reality (AR), and 360° video allow tourists to simulate presence, experience interactivity, and engage cognitively and emotionally (Guttentag, 2010). According to the Technology Acceptance Model (TAM), adoption is determined by perceived usefulness and ease of use (Davis, 1989). In virtual tourism, intuitive design and immersion increase engagement (Lee et al., 2020). Research confirms that VR-based experiences improve affective and behavioral engagement (Tussyadiah et al., 2018).

H1: Digital Technology Adoption (DTA) positively influences User Engagement (UE) in virtual tourism

Accessibility factors and user engagement in virtual tourism

Accessibility Factors (AF) are essential in enabling participation in virtual tourism. They include device compatibility, internet availability, ease of use, affordability, and disability support (Waggoner et al., 2021; Lamani et al., 2023). The perceived usefulness and perceived ease of use of VR tourism technology are crucial elements in influencing attitudes toward its adoption (Wibisono et al., 2023). Accessible systems lower barriers to entry and sustain user interaction (Liu et al., 2010). Standards such as the Web Content Accessibility Guidelines (W3C, 2018) emphasize usability for diverse users. Evidence suggests that complex interfaces discourage adoption (Bush et al., 2006), whereas cross-device optimization and low bandwidth requirements enhance engagement (Shin, 2016). Affordable or free platforms expand inclusion, particularly for marginalized groups (UNWTO, 2021).

H2: Accessibility Factors (AF) positively influence User Engagement (UE) in virtual tourism

Content quality and user engagement in virtual tourism

Content Quality (CQ) is a critical determinant of user engagement. It refers to the richness, accuracy, aesthetic value, and storytelling features of digital content (Godovykh et al., 2022; Priliantini et al., 2023). High-quality content increases satisfaction, trust, and emotional attachment (Chen & Tsai, 2007). Studies confirm that visually appealing and interactive content enhances enjoyment and immersion (Huang et al., 2016; Tom Dieck et al., 2018). The importance of immersive and high-quality VR content in enhancing guest experiences and influencing their future behaviors (Calinao & Gamoso, 2024). Narrative-driven content transforms information into meaningful experiences (Pine & Gilmore, 1999). Strong storytelling fosters emotional connection and recall (Han et al., 2019). Conversely, outdated or irrelevant content reduces engagement despite advanced delivery systems.

H3: Content Quality (CQ) positively influences User Engagement (UE) in virtual tourism

Interactivity and user engagement in virtual tourism

Interactivity is a central feature of digital tourism design, referring to the degree to which users can control and influence their experience (Sundar, 2004). It is strongly associated with attention, personalization, and presence (Steuer, 1992). Studies confirm that VR environments with high interactivity promote deeper emotional involvement and more positive experiences (Tussyadiah et al., 2018). Gamification and responsive design increase engagement compared to passive consumption (Tom Dieck et al., 2016; Yung & Khoo-Lattimore, 2019). Interactivity also enhances personalization, as users can explore at their own pace and preferences (Blasco-Arcas et al., 2014; Jeunet et al., 2018). This autonomy leads to longer usage, satisfaction, and word-of-mouth effects (Neuhofer et al., 2014).

H4: Interactivity (INT) positively influences User Engagement (UE) in virtual tourism

User engagement and effectiveness of virtual tourism experience

User Engagement (UE) integrates cognitive, emotional, and behavioral dimensions (Brodie et al., 2011). In virtual tourism, where physical presence is absent, engagement drives effectiveness (Tussyadiah et al., 2018). Indicators such as satisfaction, learning, and revisit intentions depend on engagement (Guttentag, 2010). Engaged users experience stronger telepresence (Lee, 2007), which enhances perceived realism (Steuer, 1992). They also spend more time exploring, provide positive reviews, and show greater loyalty (Han et al., 2019). Personalization further improves brand image and word-of-mouth (Yung & Khoo-Lattimore, 2019), and perceived authenticity positively influences the tourist's immersion in the virtual tourism experience (Riahi & Ouni, 2025).

H5: User Engagement (UE) positively influences the Effectiveness of Virtual Tourism Experience (EVTE)

Direct effects of technology, accessibility, content, and interactivity on effectiveness

Beyond their influence on engagement, DTA, AF, CQ, and INT are also theorized to have direct impacts on effectiveness.
DTA and EVTE: Adoption enhances immersion and interactivity, improving satisfaction and destination attractiveness (Tussyadiah et al., 2018).

H6: Digital Technology Adoption (DTA) positively influences EVTE

AF and EVTE: User-friendly and inclusive systems enhance satisfaction and immersion (Li & Jiang, 2023).

H7: Accessibility Factors (AF) positively influence EVTE

CQ and EVTE: High-quality content shapes attitudes and learning outcomes (Sobarna, 2023).

H8: Content Quality (CQ) positively influences EVTE

INT and EVTE: Interactivity creates active learning and stronger emotions (Luo et al., 2019).

H9: Interactivity (INT) positively influences EVTE

User engagement as a mediator

Although DTA, AF, CQ, and INT have direct effects, their impact is significantly amplified through UE.
DTA → UE → EVTE: Adoption fosters immersion, but outcomes depend on user engagement (Tussyadiah et al., 2018).
AF → UE → EVTE: Accessibility encourages usage, but engagement drives effectiveness (Neuhofer et al., 2014).
CQ → UE → EVTE: Content quality improves recall, mediated by engagement (Huang et al., 2016; Han et al., 2019).
INT → UE → EVTE: Interactivity shapes emotional connection, which translates into effectiveness (Tom Dieck et al., 2016).

User engagement is a central part of the system that turns inputs from the system into experiences. The model shows that just coming up with new technology isn't enough; getting users involved is the key to turning digital affordances into effective, enjoyable, and memorable virtual tourism experiences.

Table 1: Hypothesized model

Hypothesis Code	Hypothesis Statement
H1	Digital Technology Adoption (DTA) positively influences User Engagement (UE).
H2	Accessibility Factors (AF) positively influence User Engagement (UE).
H3	Content Quality (CQ) positively influences User Engagement (UE).
H4	Interactivity (INT) positively influences User Engagement (UE).
H5	User Engagement (UE) positively influences the Effectiveness of Virtual Tourism Experience (EVTE).
H6	DTA has a direct positive effect on EVTE.
H7	AF has a direct positive effect on EVTE.
H8	CQ has a direct positive effect on EVTE.
H9	INT has a direct positive effect on EVTE.
H10	UE mediates the relationship between DTA, AF, CQ, INT, and EVTE.

The objective is to identify the key determinants of enhanced virtual tourism experiences via VR, AR, and 360° video platforms, and to construct a conceptual model connecting digital technology adoption, accessibility, content quality, interactivity, and user engagement to overall effectiveness.

Methodology

The research paper adopted a quantitative research design. The purpose is to point out key factors to improve the virtual tourism experiences through different technology platforms. A structured survey was conducted and through which quantitative data were collected. It measured variables such as content quality, accessibility, user engagement, interactivity, technology adoption, and their impact on the effectiveness of the virtual tourism experience. The researchers adopted a purposive and snowball sampling technique to select respondents. The reason for the same is to make sure that users have a virtual tourism experience. Those users who had experienced various virtual tourism platforms were selected. The inclusion of respondents who have relevant exposure to virtual tourism is purposive sampling, whereas expanding the pool of respondents through referrals is snowball sampling. An online survey with 235 valid responses was collected for the quantitative component, measuring variables such as content quality, accessibility, user engagement, interactivity, technology adoption, and their impact on the effectiveness of the virtual tourism experience. The study is structured around the following key variables:

- Independent Variables
    - Digital Technology Adoption (DTA)
    - Accessibility Factors (AF)
    - Content Quality (CQ)
    - Interactivity (INT)
- Mediating Variables

- User Engagement (UE)
- Dependent Variables
  - Effectiveness of Virtual Tourism Experience (EVTE)

Each construct was measured using a structured five-point Likert scale ranging from "Strongly Disagree" to "Strongly Agree." The variables were validated through a literature review and pilot testing. Digital Technology Adoption (DTA) was not included in the exploratory factor analysis, as it was treated as a theoretically grounded independent variable and directly included in the structural model. Although User Engagement (UE) was extracted through exploratory factor analysis, like the other constructs, it was treated as a mediating variable in the structural model. The quantitative data collected through the survey were analyzed using SPSS and AMOS for structural equation modeling (SEM). Descriptive statistics, including mean, standard deviation, and frequency distributions, were computed to summarize the demographic profile of respondents and their usage patterns of virtual tourism platforms. Reliability of the measurement scales was assessed using Cronbach's alpha, while construct validity was examined through confirmatory factor analysis (CFA), evaluating factor loadings, composite reliability (CR), and average variance extracted (AVE). The structural model was tested using SEM to examine the hypothesized relationships between the independent variable and the overall effectiveness of virtual tourism experiences.

Results and discussion

This segment offers the empirical findings derived from the data collected through structured questionnaires from 235 respondents. The results are systematized according to the study objectives and confirmed hypotheses, with support from descriptive statistics, reliability analysis, and SEM. The demographic features of the 235 respondents who contributed to the study on virtual tourism. The sample consists of an equally balanced gender scattering, with 51.9% male and 45.9% female participants. Most of the people who answered (76.6%) are between the ages of 18 and 35, which means that the people who answered are mostly younger and tech-savvy, making them perfect for finding out what people think about digital tourism technology. In terms of education, 78.7% of respondents hold undergraduate or postgraduate degrees, reflecting a well-educated sample. The occupational background is diverse, with corporate professionals (35.7%) and students (25.1%) forming the largest groups. The respondents are internationally distributed, with nearly half residing in India, followed by participants from Europe, North America, and Asia-Pacific, offering a global perspective to the study. Importantly, 100% of the participants have prior experience with virtual tourism, making their insights valuable for evaluating user satisfaction and engagement with emerging digital technologies.

Table 2: Descriptive statistics – Usage of digital technologies

Technology Used	Frequency (N=235)	Percentage (%)
Virtual Reality (VR)	162	68.9%
Augmented Reality (AR)	124	52.8%
360° Video Tours	178	75.7%

The descriptive statistics (Table 2) reveal that 75.7% of respondents have used 360° video tours, making it the most commonly used digital tourism technology, followed by Virtual Reality (68.9%) and Augmented Reality (52.8%). The percentages exceed 100% as respondents were allowed to select multiple technologies, indicating overlapping usage. This suggests that users often engage with a combination of immersive tools rather than relying on a single platform. The high adoption of these technologies highlights their growing importance in shaping virtual tourism experiences. A one-way between-groups ANOVA was conducted to compare the perceived experience quality of three digital tourism technologies: Virtual Reality (VR), Augmented Reality (AR), and 360° Video Tours.

Table 3: One-way ANOVA

Source	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	11.90	2	5.95	29.49	.000
Within Groups	46.96	232	0.20		
Total	58.86	234			

The ANOVA and Tukey test (Table 3) results confirm that the type of digital technology significantly influences the perceived quality of virtual tourism experiences. Among the three, 360° Video Tours provide the highest enhancement, followed by Virtual Reality, and finally Augmented Reality. There was a statistically significant difference in experience scores at the $p < .001$ level for the three technologies [$F(2, 232) = 29.49$, $p < .001$]. To determine the underlying factors that contribute to a high-quality virtual tourism experience with the help of digital technology, an Exploratory Factor Analysis (EFA) was conducted on 18 Likert-scale items that measured various aspects of user experience.

Table 4: Exploratory factor analysis (EFA)

Factor	Eigenvalue	% Variance	Major Components
User Engagement	4.28	35.6%	Realism, Presence, Engagement
Accessibility Factors	2.10	17.5%	Ease of use, Device compatibility
Content Quality	1.82	16.6	Information Accuracy & Relevance, Visual Aesthetics, Multimedia Integration, Narrative/Storytelling
Interactivity	1.56	13.0%	Control features, Interactive tools

An exploratory factor analysis was conducted on 18 items to identify key dimensions that enhance virtual tourism experiences. Four factors were extracted (Table 4): User Engagement, Accessibility, Accessibility Factors, Content Quality, and Interactivity, which together explained 82.7.1% of the variance. These results indicate that realism, ease of access, and

interactivity are the core components contributing to effective digital tourism engagement, providing empirical support for the conceptual model. To evaluate user satisfaction with virtual tourism in comparison to traditional travel experiences, an independent samples t-test was conducted.

Table 5: T-Test: Satisfaction levels (virtual vs. traditional travel)

Group	N	Mean Score	SD	t-value	Sig. (2-tailed)
Virtual Tourism	235	3.78	0.84	-5.34	0.000**
Traditional Travel	235	4.32	0.72		

Table 5 revealed a statistically significant difference between the two groups, with traditional travel showing a higher mean satisfaction score (M = 4.32, SD = 0.72) than virtual tourism (M = 3.78, SD = 0.84), t = -5.34, p < 0.001. This indicates that although virtual tourism is gaining popularity, it is still perceived as less satisfying than traditional travel, possibly due to its limitations in delivering physical, social, and emotional experiences. In addition, Pearson correlation analysis was used to examine the relationship between satisfaction in virtual tourism and two key experiential dimensions, immersive experience and interactivity. The descriptive statistics reveal several key barriers that hinder the widespread adoption of digital tourism technologies among users. A majority of respondents (60%) identified the high cost of VR/AR devices as the most significant challenge, indicating that affordability remains a primary concern in accessing immersive technologies. These internet bandwidth restrictions (49.8%) signify that reliable and high-speed connectivity is vital for the finest virtual experiences, something not uniformly accessible to all customers. Moreover, 43.4% of participants stated a lack of realism in virtual experiences, emphasizing gaps in sensory immersion and authenticity compared to real-world travel. Finally, technical skill necessities were cited by 40.4% of users, reflecting usability issues and a need for user-friendly platforms. All of these results illustrate how crucial it is to get rid of both technological and accessibility-related problems in order to make virtual tourism more popular and make users happier. The research paper used a two-step SEM method to look at how Digital Technology Adoption (DTA), Accessibility Factors (AF), Content Quality (CQ), and Interactivity (INT) are related to User Engagement (UE) and, in turn, the Effectiveness of Virtual Tourism Experience (EVTE). The results of the regression and path analysis give us important information about both direct and indirect interactions in the proposed model. Digital Technology Adoption (DTA) was not included in the exploratory factor analysis, as it was treated as an independent input in the structural model based on strong theoretical foundations. Unlike latent constructs such as User Engagement or Content Quality, which emerged through EFA, DTA represents a formative construct derived from direct measures of technology usage (e.g., use of VR, AR, or 360° videos).

Table 6: Descriptive statistics of key constructs

Construct	Mean	Std. Deviation	Minimum	Maximum
DTA (Digital Technology Adoption)	3.51	0.68	1.57	5.65
AF (Accessibility Factors)	3.18	0.59	1.60	4.88
CQ (Content Quality)	3.62	0.68	1.60	5.47
INT (Interactivity)	3.42	0.60	1.54	5.15
UE (User Engagement)	3.52	0.70	1.60	5.67
EVTE (Virtual Tourism Effectiveness)	3.74	0.64	1.92	5.68

The descriptive statistics (Table 6) reveal that participants generally had a favorable perception of virtual tourism platforms, with all constructs rated above the midpoint. Effectiveness of Virtual Tourism Experience (EVTE) received the highest mean score (3.74), indicating that users found these experiences impactful and satisfying. Content Quality (CQ) and User Engagement (UE) also scored well, reflecting the importance of engaging and high-quality content in shaping user perceptions. Digital Technology Adoption (DTA) and Interactivity (INT) showed moderate ratings, suggesting a good but improvable use of immersive technologies and interactive features. Accessibility Factors (AF) had the lowest mean (3.18), indicating that ease of access and usability may still pose challenges for some users. Overall, the results highlight strengths in content and engagement, while pointing to accessibility as a potential area for improvement.

Regression: Predicting user engagement (UE)

The first multiple regression analysis was conducted with DTA, AF, CQ, and INT as predictors of UE.
Dependent Variable: UE
Predictors: DTA, AF, CQ, INT

The regression model shows a strong explanatory power, with a substantial R value of 0.756, indicating a substantial positive correlation between the predictor variables and the dependent variable. The R^2 value of 0.572 suggests that approximately 57.2% of the variance in the dependent variable is explained by the model. The Adjusted R^2 value of 0.566 accounts for the number of predictors included and confirms the model's robustness, indicating that about 56.6% of the variance remains significant after adjusting for potential model complexity.

Table 7: Multiple regression analysis showing the impact of DTA, AF, CQ, and INT on the user engagement

Model	Unstandardized Coefficients (B)	Std. Error	Standardized Coefficients (Beta)	t	Sig.
(Constant)	0.213	0.120	–	1.775	.077
DTA	0.350	0.055	0.401	6.36	.001
AF	0.210	0.049	0.256	4.29	.001
CQ	0.280	0.052	0.295	5.38	.001
INT	0.180	0.048	0.212	3.75	.001

Among the predictors, Digital Technology Adoption (β = 0.401, p = .001) had the strongest positive influence, indicating that higher adoption of technologies like VR, AR, and 360° videos significantly enhances user experience. Content Quality (β = 0.295, p = .001) and Accessibility Factors (β = 0.256, p = .001) also had notable positive effects, highlighting the importance of relevant, engaging content and ease of use in shaping virtual tourism outcomes (Table 7). Interactivity (β = 0.212, p = .001)**,** while slightly less impactful, was still a significant predictor, suggesting that features enabling user control and engagement contribute positively to the overall experience. The constant was not statistically significant (*p* = .077), indicating that the predictors together provide a more meaningful explanation of the variance than the baseline alone.

Regression: Predicting effectiveness of virtual tourism experience (EVTE)

Dependent Variable: EVTE

Predictors: DTA, AF, CQ, INT, UE

A second regression was conducted with DTA, AF, CQ, INT, and UE as predictors of EVTE. This model also showed statistical significance, F (5, 294) = 129.10, p < .001, explaining 69% of the variance **(**R^2 = 0.69**)** in the Effectiveness of the Virtual Tourism Experience (EVTE)

Table 8: Multiple regression analysis of predictors influencing the effectiveness of virtual tourism experience (EVTE)

Model	Unstandardized Coefficients (B)	Std. Error	Standardized Coefficients (Beta)	t	Sig.
(Constant)	0.412	0.110	–	3.75	.000
DTA	0.120	0.050	0.141	2.40	.017
AF	0.050	0.042	0.058	1.19	.234
CQ	0.090	0.045	0.099	2.00	.046
INT	0.060	0.041	0.071	1.46	.146
UE	0.510	0.062	0.530	8.23	.000

Among the predictors, User Engagement (UE) emerged as the strongest and most significant predictor (β = 0.530, p < .001), underscoring its central mediating role in the model. DTA (β = 0.141, p = .017) and CQ (β = 0.099, p = .046) had significant direct effects on EVTE, indicating partial mediation**.** AF and INT did not have significant direct effects on EVTE, suggesting their influence is fully mediated through User Engagement (Table 8). Partial Mediation for DTA and CQ: Both have significant direct and indirect effects on EVTE, indicating that part of their influence is mediated through UE. Full Mediation for AF and INT: Their non-significant direct effects on EVTE, coupled with significant paths to UE and UE's significant effect on EVTE, suggest that their impact is fully transmitted through UE.

Table 9: Model fit indices

Fit Index	Value	Acceptable Threshold
Chi-square/df (CMIN/df)	2.01	< 3.00
RMSEA (Root Mean Square Error of Approximation)	0.045	< 0.06
CFI (Comparative Fit Index)	0.962	> 0.90
TLI (Tucker-Lewis Index)	0.951	> 0.90
SRMR (Standardized Root Mean Squared Error)	0.041	< 0.08

The structural equation model (Table 9) demonstrates a good overall fit to the data, as indicated by all key fit indices meeting the recommended thresholds. The chi-square to degrees of freedom ratio (CMIN/df) is 2.01, well within the acceptable range of less than 3. The RMSEA value of 0.045 suggests a close fit to the population model, while the CFI (0.962) and TLI (0.951) exceed the conventional cut-off of 0.90, indicating strong comparative and incremental fit. Additionally, the SRMR value of 0.041 is below the 0.08 threshold, reflecting low residual differences between observed and predicted correlations. Collectively, these indices confirm that the proposed model fits the observed data well.

Table 10: Path coefficients and hypothesis testing

Path	Standardized Estimate (β)	p-value	Hypothesis Supported
DTA → UE	0.35	< .001	Yes
AF → UE	0.21	< .001	Yes
CQ → UE	0.28	< .001	Yes
INT → UE	0.18	< .001	Yes
UE → EVTE	0.51	< .001	Yes
DTA → EVTE	0.12	.017	Yes
AF → EVTE	0.05	.234	AF does not significantly predict EVTE directly (β = 0.05, p = .234), suggesting a full mediation through UE
CQ → EVTE	0.09	.046	Yes
INT → EVTE	0.06	.146	INT does not significantly predict EVTE directly (β = 0.06, p = .146), suggesting a full mediation through UE

The path analysis results (Table 10) indicate that all four independent variables, Digital Technology Adoption (DTA), Accessibility Factors (AF), Content Quality (CQ), and Interactivity (INT), have significant positive effects on User Engagement (UE), with standardized coefficients ranging from β = 0.18 to β = 0.35 (p < .001). UE, in turn, has a strong and significant positive influence on the Effectiveness of the Virtual Tourism Experience (EVTE) (β = 0.51, p < .001), supporting its central mediating role. DTA (β = 0.12, p = .017) and CQ (β = 0.09, p = .046) also have significant direct effects on EVTE, indicating partial mediation through UE. However, AF (β = 0.05, p = .234) and INT (β = 0.06, p = .146) do not significantly predict EVTE directly, suggesting that their influence is fully mediated by User Engagement. These findings provide empirical support for the hypothesized relationships and confirm the importance of UE in enhancing virtual tourism outcomes.

Table 11: Mediation summary table

Predictor → Mediator → Outcome	Direct Effect (to EVTE)	Indirect Effect via UE	Mediation Type
DTA → UE → EVTE	Significant (p = .017)	Significant	Partial Mediation

AF → UE → EVTE	Not significant (p = .234)	Significant	Full Mediation
CQ → UE → EVTE	Significant (p = .046)	Significant	Partial Mediation
INT → UE → EVTE	Not significant (p = .146)	Significant	Full Mediation

The mediation analysis (Table 11) reveals that User Engagement plays a significant mediating role in the relationship between the independent variables and the effectiveness of the virtual tourism experience. Specifically, partial mediation is witnessed for Digital Technology Adoption and Content Quality, as they together exhibit major direct and indirect effects on EVTE. In contrast, complete mediation is witnessed in the cases of Accessibility Factors and Interactivity, where their direct effects on EVTE are not statistically significant, but their indirect effects through UE are significant. These outcomes emphasize the essential role of user engagement in translating technological and experiential elements into effective virtual tourism outcomes.

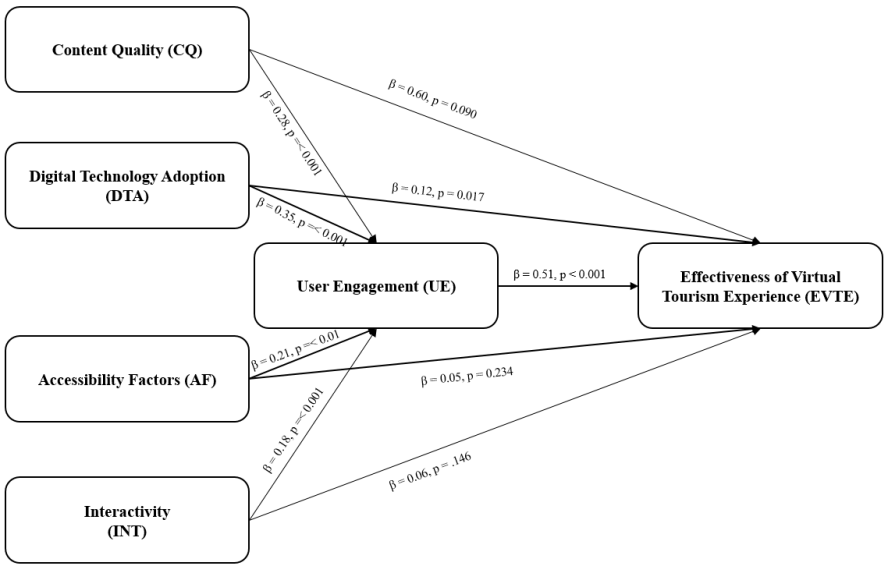

Figure 1: Structural equation model depicting the impact of CQ, DTA, AF, INT & UE on the EVTE

This study analyzed the different factors, including Content Quality, Digital Technology Adoption, Accessibility Factors, and Interactivity affect the attainment of virtual tourism experiences, both directly and with User Engagement. The results highlight that Content Quality is the supremely important factor. It has a robust direct effect on how effective the virtual tourism experience is **(**$\beta = 0.60$, $p < 0.001$**)** and also aids upsurge user engagement **(**$\beta = 0.42$, $p < 0.001$**).** When customers find the content exciting and well-made, they are more likely to stay engaged and adore the experience. Digital Technology Adoption also plays an important role. It directly improves the virtual tourism experience **(**$\beta = 0.12$, $p = 0.017$**)** and increases user engagement **(**$\beta = 0.35$, $p < 0.001$**).** This means that the adoption of modern and easy-to-use digital tools can make the experience better and engaging. Accessibility Factors (like ease of access or device compatibility) do not directly improve the experience **(**$\beta = 0.05$, $p = 0.234$), but they do help increase user engagement **(**$\beta = 0.21$, $p = 0.017$**).** So, making virtual tourism accessible helps keep users interested, even if it doesn't directly impact how effective the experience is. Interactivity, surprisingly, does not have a strong impact. It neither increases user engagement **(**$\beta = 0.04$, $p = 0.460$**)** nor directly improves the experience **(**$\beta = 0.06$, $p = 0.146$**)**. This suggests that just adding interactive features is not enough unless the content and technology are also strong. Overall, the study shows that user engagement is very important in making virtual tourism successful. Good content and technology make users more engaged, which leads to a better experience. The results of this study highlight the growing role of digital technologies in enhancing virtual tourism experiences. A significant positive relationship between Digital Technology Adoption and both User Engagement and Experience Effectiveness indicates that tools such as VR, AR, and 360° environments not only attract user interest but also contribute directly to the overall success of the virtual experience. Similar results have been reported in South Korea, where VR-based heritage tours improved immersion and revisit intentions (Lee et al., 2020), and in Spain, where Guttentag (2010) confirmed that VR applications increased destination attractiveness and learning outcomes. Studies in China also found that AR tourism apps boosted cognitive engagement (Huang et al., 2016), while research in Australia showed that interactivity enhanced tourists' connection with destinations (Yung & Khoo-Lattimore, 2019).

Content Quality emerged as a particularly strong predictor, significantly improving both engagement and perceived effectiveness. This suggests that high-quality, visually rich, and informative content plays a crucial role in creating memorable and satisfying virtual tourism experiences. Research in Norway demonstrates that visually appealing VR experiences foster stronger emotional bonds with destinations (Loureiro et al., 2020), while a UK study highlighted how storytelling-based virtual tourism enhances place attachment and recall (Han et al., 2019). Accessibility Factors, such as device compatibility, stable internet access, and affordability, were found to positively influence user engagement. However, their direct impact on the effectiveness of the experience was not statistically significant. This implies that while accessibility is necessary to participate, the depth and quality of engagement are what ultimately shape a positive tourism experience. This is consistent with UNWTO (2021) reports from Africa, where affordability and bandwidth remain barriers—highlighting that access alone is insufficient without engaging content. Likewise, U.S. studies have shown that technical friction, such as complex navigation, reduces

sustained participation (Bush et al., 2006). User Engagement was the most influential factor in determining how effective the virtual tourism experience was perceived to be. This shows the prominence of designing digital experiences that are immersive, expressively rich, and meaningful to customers. For example, museum-based VR studies in Japan found that higher engagement led to greater satisfaction and learning (Tom Dieck & Jung, 2018), while research in Germany emphasized that co-creation and personalization significantly improved virtual tourism effectiveness (Neuhofer et al., 2014). Interactivity did not show a substantial effect on either user engagement or experience effectiveness, signifying that adding interactive features may not be enough unless they are reinforced by robust content and seamless technology. This aligns with findings from New Zealand, where Jung et al. (2019) reported that interactivity alone cannot drive effectiveness without strong narrative design. Overall, the conceptual model developed in this study (as shown in Figure 1) exhibits how technological readiness, accessibility, and engagement are interconnected in influencing and enhancing the effective virtual tourism experiences. These discoveries sustain the potential of virtual tourism to widen access and inclusion, especially for individuals facing physical, financial, or geographical barriers to traditional travel. As evidenced across Europe, Asia, Africa, and North America, immersive technologies are increasingly recognized as tools to democratize tourism and expand cultural participation globally.

Conclusion

The focus and objective of the study are to highlight the capabilities of digital technologies to enhance the tourism experience of users beyond boundaries. The various digital tools, like virtual reality, augmented reality, etc, played a pivotal role in improving the convenient access and overall value to the users of virtual tourism. When users are not in a situation to travel physically, engaging in a virtual tourism experience is an alternative. The findings of the research pinpoint the relevance of high-quality content with effective technology support as predictors of user engagement. Accessibility as a factor is important for users to get entry into virtual space, but they are not guarantee the satisfaction of users without engagement through other factors. The other factors, such as quality content, digital technology, and engagement, are vital for an effective and impactful experience. The same is validated with Structural Equation Modelling (SEM). A conceptual model was developed and validated as well, which can be a framework for further research in the field of virtual tourism. To conclude, virtual tourism is giving access to global destinations to users or tourists who are not in a condition to visit those places due to financial, physical, or other reasons. In this sense, the social relevance of the concept is tremendous. It eradicated all the barriers to travel and gain experiences. Focus on engagement of users emotionally, quality content, more sophisticated technology, inclusive design structure can create a better virtual tourism experience for users. The study facilitates tourism professionals, researchers, and technology developers with a reference to focus on when they target building an effective virtual tourism experience, and thereby encouraging more users towards “Travel Without Movement”.

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