African Journal of Hospitality, Tourism and Leisure
ISSN: 2223-814X
2025, Vol. 14 No. 4 pp. 848-856

Analyzing Tourist Satisfaction Through Virtual Reality: Mediating Effects of Attitude and Enjoyment

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Abstract

This study sought to analyze the influence of virtual reality (VR) on tourist satisfaction, specifically examining the mediating roles of pleasure by attitude and the determining factors of presence and telepresence. Data for this research were gathered using an online survey from 320 tourists who had experienced VR in a tourism context. We analyzed the collected data with a partial least squares structural equation modeling (PLS-SEM) methodology. Findings reveal that although attitude and enjoyment affect tourist self-perception and add to the perceived advantages of telepresence, their impact on overall satisfaction was not statistically significant. Despite this, the study highlights the potential of VR to enhance the tourist experience and suggests that the interplay between presence, telepresence, and emotional responses warrants further exploration. The findings contribute to more profound understanding of VR's role in tourism and offer recommendations for practitioners to optimize VR-based experiences. Finally, this study outlines several pathways for future research to investigate future phenomena between immersive technologies and consumer satisfaction in tourism contexts.

Keywords: Virtual reality; tourism; presence; enjoyment; Indonesia

How to cite this article: Rubiyanti, N., Pradana, M., Harnadi, A., Widodo, E., Prabowo, R.R. & Musa H.G. (2025). Analyzing Tourist Satisfaction Through Virtual Reality: Mediating Effects of Attitude and Enjoyment. African Journal of Hospitality, Tourism and Leisure, 14(4):848-856. DOI: https://doi.org/10.46222/ajhtl.19770720.669

Introduction

Indonesia is rich with natural and cultural diversity, which has long drawn worldwide visitors. The Indonesian archipelago contains about 17,000 islands, over 300 ethnic groups, and 51 national parks, several of which are World Heritage sites (Dewi et al., 2022). Indeed, tourism has been an essential element of the country's economic prosperity, and with improved international transportation and access to tourism locations, the sector has grown significantly. The Indonesian tourism industry faced its most significant challenge during the COVID-19 pandemic, largely because of the many limitations put in place by the government (Pradana et al., 2020). As a result, tourism-related companies, including hotels, airlines, restaurants, tour operators, gift shops, and tourist attractions, were losing revenue. The pandemic was officially declared over by the Indonesian government in 2023. However, several tourism-related enterprises start to adopt a new perspective in anticipation of future crises or natural disasters. The usage of virtual reality is one such alternative (Dias et al., 2024). A virtual tourism, following Kim & Hall (2019), is a three-dimensional virtual simulation of an attraction, destination, or genuine visitor experience that is generated as a means of extending a prior consumer experience or as a means of preparing for visiting a destination. A virtual tour gives the viewer the impression that they are actually there (Zahorik & Jenison, 1998). This sense of presence heightens the pleasure of the meeting (Sylaiou et al., 2010). Telepresence is a term used to describe how much a person feels present in a mediated environment (Steuer, 1992). An alternative activity that can be used is virtual tourism, often known as virtual tours, which enables visitors to see several tourist spots in Indonesia without having to leave their homes (Jagatya & Aisyianita, 2020). One of the media used to conduct this virtual activity is virtual reality. This technology is well-known in the tourism sector and can support marketing as one of the promotional media in the sector for tourism itself, as well as managing destination providing entertainment, ensuring accessibility, educational purposes, and preserving historical sites (Tussyadiah et al., 2018). It is logical to conclude that intention, telepresence, sensation of presence, attitude, and enjoyment are all potential qualities that may affect virtual tour satisfaction when the findings of the study are taken into account as a whole (Guttentag, 2010).

This study aims to ascertain if virtual tours can assist individuals in managing the emotional distress resulting from the COVID-19 pandemic. This research develops a model to evaluate how enjoyment, intention, and attitude relate to virtual tour satisfaction, as well as two forms of presence (telepresence and sensation of presence). This research highlights the function of telepresence and sense of presence in generating happiness in virtual tours is underlined in this study, which makes a contribution to the field of virtual tours research. Since the epidemic, virtual tours have been more popular in Indonesia, and there have not been many research on the subject, therefore we are motivated to conduct this study. In light of the discussion above, existing studies have largely explored virtual tourism from technological or experiential perspectives in developed contexts, while limited attention has been given to its psychological and emotional implications for users in emerging economies such as Indonesia. Most prior research focuses on virtual reality as a marketing or educational tool rather than as a medium that fosters emotional well-being and satisfaction in post-pandemic tourism recovery (Misganaw & Singh, 2024). This study fills that gap by integrating enjoyment, intention, and attitude with telepresence and sense of presence to explain virtual tour satisfaction among Indonesian users. The originality of this research stems from its specific focus on Indonesia's post-pandemic tourism landscape and its theoretical contribution to understanding how immersive presence can enhance emotional recovery and engagement through virtual tourism experiences.

Literature review

Virtual reality

Virtual Reality (VR) is a comparatively recent technology that enable users to be fully immersed in a 3D computer-generated environment and lets them move around and communicate entirely online (Kim et al., 2020; Li & Chen, 2019). The tourism industry's utilization of the virtual digital world at a time when it is increasingly influencing travelers' lives is crucial (Mura et al., 2017). Virtual reality is used by many industries, such as managing tourism, marketing and disseminating, entertainment, education, accessibility, and historical preservation (Melo et al., 2022). Much attention has been given to applying virtual reality to enhance or perhaps replace tourism-related products (Beck et al., 2019). This is because everything may be altered to create the ideal virtual travel experience in a virtual reality environment (Slater & Sanchez-Vives, 2016). In the meantime, virtual reality (VR) enables travel industry companies to interact with target clients by enabling potential visitors to explore tourist destinations in a rich environment (Huang et al., 2016). Virtual tours can be entertaining for the general public in addition to being a marketing tool for tourism. Guttentag (2010) advocated that researchers look into the factors affecting people's perceptions of virtual tours as a substitute for actual travel. Huang et al. (2012) found that presence, interactivity, and talent all contribute to a satisfying and enjoyable experience in virtual worlds. The presence of VR had a beneficial effect on post-VR experiences, and VR satisfaction during VR experiences was caused by the presence of VR (Tussyadiah et al., 2018).

Sense of presence and telepresence

This mediated sense of presence, people can distinguish between actual and virtual locales (Melo et al., 2022). As a result, "sense of presence" refers to how immersed a user feels in virtual environments generated by VR technology (Yang et al., 2021). In virtual environments, the system parameters linked with display engagement have been studied most closely in relation to the experience of presence and emotional reaction (Melo et al., 2022). The experience of presence grows as virtual reality technologies improve and modernise, providing a greater sense of immersion (Pallavicini et al., 2019). The fundamental components of a sensation of presence are involvement and participation (Melo et al., 2022). Sensory fidelity refers to the virtual environment's ability to allow the user to actively search for and analyse objects inside it, followed by the user's perceived comfort level with engaging with and working in a virtual environment (Alyahya & McLean, 2022). Adaptation or immersion becomes the final phase when the user becomes accustomed to the virtual environment experience (Badari et al., 2024). Interface quality concerns the user's perception of the VR interface and its subsequent effect on their ability to perform tasks in that environment. (Dias et al., 2024). An individual is aware of a sentient creature in a mediated telepresence setting through psychological engagement (Angelino et al., 2022). The amount of engagement in a virtual environment is determined by the level of co-presence and involvement. Spatial telepresence, or the perception of physically existing in a virtual space, is a specific aspect of VR (Yang et al., 2021). Virtual reality (VR) technology, in a similar way, provides users with a sense of plausibility (an illusory perception of events) and an illusory notion of the entire experience (Slater et al., 2009). As a result, telepresence refers to the appearance of participation in distant or virtual contexts (Tella & Ogbonna, 2023). Various VR applications now allow users to sense as if they are in a real experience, although actually they are virtual or imagined environment (Yang et al., 2021).

Attitude and enjoyment

A person's attitude influences how they react to objects and can anticipate their behavioural goals (Uhm et al., 2019). Because of the current advancements in digital technology, one of the primary goals of the study was to demonstrate the links between the representative features of VR, such as presence and attitude (Tussyadiah et al., 2018). The effect of presence on perceptions of advertisements and businesses has been studied by tourism marketing researchers (Uhm et al., 2019). Finally, research shows that being present promotes pleasurable sensations and, as a result, contributes to the development of a constructive attitude (Nelson et al., 2006). For instance, research by Li et al. (2002) discovered that the physical appearance of objects in 3D commercials had a greater persuasive influence on customers' views towards advertisements and buy intentions. Enjoyment, on the other hand, whether in physical or virtual tourism, is a mental state that promotes pleasurable sentiments (Suhartanto et al., 2021). VR can boost enjoyment while also increasing the frequency of these emotions (Brom et al., 2017). A stronger sense of presence led to greater satisfaction (Damme et al., 2019). Tourists may also be interested in using virtual reality to learn more about tourism destinations (Zarzuela et al., 2013). Enjoyment is a significant driver for adopting new technologies, such as virtual reality, wearable technology, and robotics, which are all rapidly expanding markets in the development of ICT, is heavily influenced by enjoyment (Lee et al., 2019). The relationship between presence and attitude has also been explored by researchers in contexts beyond advertising. Other sectors such as medical, education, and tourism, also explore the current conceptual extension of VR, diversification of technical categories, and expansion of application domains (Melo et al., 2022). Examining how virtual reality affects travel decisions, for instance, demonstrated that presence influenced how people see tourism attractions (Tussyadiah et al., 2017).

Satisfaction

People may construct happiness as an evaluative appraisal even in virtual encounters (Verhagen et al., 2011). As a result, previous research has investigated people's contentment with VR settings (Pizzi et al., 2019). This research indicates that virtual retail environments can generate user satisfaction. Using virtual reality technology as a business tool can help develop unique consumer experiences and increase customer satisfaction (Srinivasan & Srivastava, 2010). This factor may influence how satisfied viewers are with their virtual tour experience (Yang et al., 2021). People with high involvement in a virtual tour tend to be more aware of others in the virtual space and report greater happiness with the experience (Melo et al., 2022). Those aforementioned reviews lead to a research model which is illustrated by Figure 1.

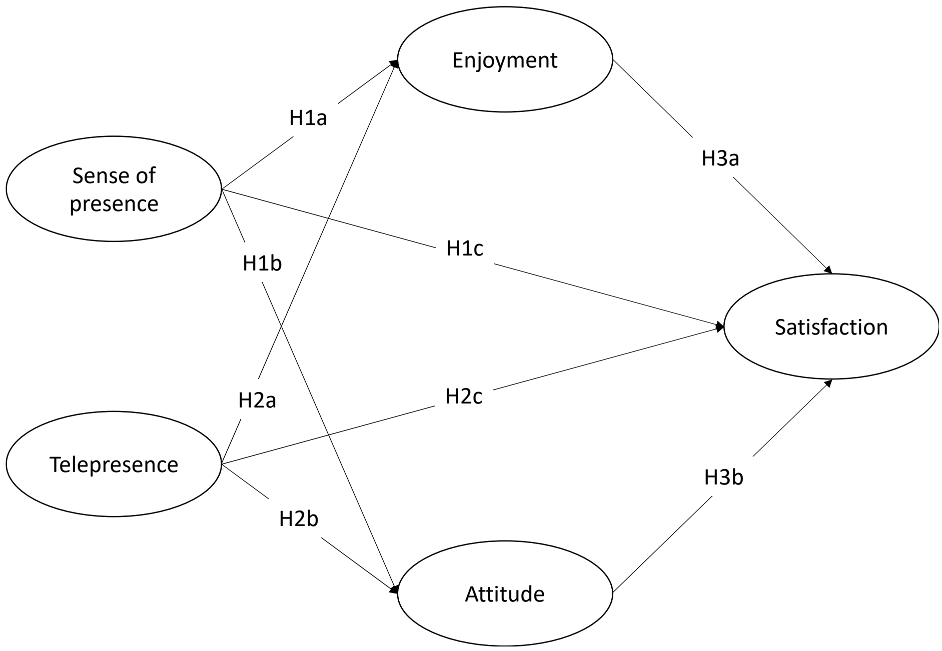

Figure 1. Research model

The conceptual framework in Figure 1 demonstrates the relationships hypothesized to exist among the study's key constructs. The model proposes that both sense of presence and telepresence play crucial roles in shaping users' enjoyment and attitude toward virtual tours (H1a–H2b), as these psychological dimensions reflect capture the feeling of being immersed and connected to the virtual environment. Furthermore, it is posited that enjoyment and attitude directly influence users' satisfaction with the virtual tourism experience (H3a–H3b), while enjoyment also mediates the relationship between presence-related factors and satisfaction (H1c–H2c). Overall, this framework integrates emotional (enjoyment), perceptual (presence), and evaluative (attitude, satisfaction) components to explain how immersive technologies can enhance user satisfaction in virtual tourism, particularly within the context of Indonesia's post-pandemic tourism revitalization.

Research methodology

This research utilized a quantitative, cross-sectional design to empirically examine the links among sense of presence, telepresence, enjoyment, attitude, and satisfaction within virtual tourism. The design was informed based on an extensive review of literature concerning VR and tourism experiences. (Yang et al., 2021; Tussyadiah et al., 2018; Kim et al., 2020), ensuring theoretical alignment with established constructs. All constructs (Sense of Presence, Telepresence, Enjoyment, Attitude, Satisfaction) were assessed with multi-item reflective indicators. This scaling approach is consistent with best practices in consumer research and facilitates variance capture while maintaining respondent ease (Hair et al., 2019). All items were adapted and linguistically validated through a translation–back translation procedure, ensuring conceptual equivalence for Indonesian respondents. This procedure followed translation protocol to maintain measurement integrity across languages (Nurhayati et al., 2025). A pilot test involving Indonesian speakers was conducted to confirm content clarity, and minor adjustments were made to wording to improve comprehension and cultural fit. Respondents provided verbal informed consent before participation, which received ethical approval from the Ethics Committee at Telkom University's School of Communication and Business, in accordance with the Declaration of Helsinki. The study also employed a non-probability, purposive sampling method, targeting individuals who previously engaged with VR-based tourism applications or virtual destination visits (e.g., 360° virtual tours, immersive travel apps). This sampling strategy aligns with earlier VR tourism research, which often focuses on experienced or technology-aware users to ensure meaningful responses regarding presence and telepresence (Tussyadiah et al., 2018; Yang et al., 2021). Participants were recruited through online platforms and university networks to ensure diversity in age and background, reflecting the demographically active segment of VR users in Indonesia. The sample size was determined following Hair et al. (2019), who recommend at least 10 respondents per indicator for PLS-SEM analysis, ensuring statistical adequacy for model estimation. The collected data were analyzed using PLS-SEM with SmartPLS software. This method was selected because it is well-suited for exploratory models, small-to-medium sample sizes, and complex mediation, as suggested by Hair et al. (2021). Tested hypothesized paths between constructs (H1–H5) using bootstrapping (5,000 resamples). The mediation effects of attitude and enjoyment were examined to capture indirect relationships between immersive experience (SP, TP) and satisfaction. Model fit indicators such as R^2, f^2, and Q^2 values were also reported to assess explanatory power and predictive relevance. A comprehensive review of previous research on virtual tourism and its associated variables, like sense of presence and telepresence, was performed (Yang et al., 2021). Then, we incorporate consumer behavior variables such as enjoyment (Suhartanto et al., 2021; Angelino et al., 2022); attitude (Ajzen, 2001; Uhm et al., 2019); and satisfaction (Melo et al., 2022). From there, we apply several research instruments. The items in the study were designed to be rated on a five-point Likert scale, from 1 (strongly disagree) to 5 (strongly agree). Additionally, because Indonesian speakers were expected to reply, the final questionnaire was translated into Indonesian, as the participants were expected to be Indonesian speakers. Participants gave verbal informed consent prior to joining the study, a procedure that was approved by the ethics committee of the authors' institutions. The ethics committee authorized the study's adherence to the Declaration of Helsinki. For reader clarity, the definitions of the constructs used in this study are presented in Table 1, specifying the elements we assessed.

Table 1: Variables measurement

Variables	Measurement	Literature
Sense of presence	During the virtual tour, I felt as if I were in a tourist destination. During the virtual tour, the destination seemed real to me.	Yang et al. (2021)
Telepresence	When I recall the virtual tour, the image of the destination tourist attraction sticks in my imagination. I imagine I am at the destination tourist attraction during the virtual tour.	Yang et al. (2021) Angelino et al. (2022)
Enjoyment	I enjoy the virtual tour experience. The virtual tour experience that I participated in was inspiring. The virtual tour experience is delightful for me. The virtual tour experience that I participated in made me satisfied. During the virtual tour, I felt like I was in another place. During the virtual tour, I felt that I was in a real tourist destination. I had the opportunity to interact with the guide during the virtual tour. I have the opportunity to interact with other participants during the virtual tour.	Suhartanto et al. (2021). Brom et al. (2017) Yang et al. (2021)
Attitude	After joining the virtual tour, I wanted to find out more about the destination. After joining the virtual tour, I want to visit the destination directly. After joining the virtual tour, I got to know the destination better. After joining the virtual tour, I got a new perception about the destination.	Ajzen (2001). Uhm et al. (2019)
Satisfaction	I am satisfied with the authentic experience of the virtual tour. I am satisfied with the unique experience of the virtual tour I will continue to participate in other virtual tours in the future because I feel that virtual tours fit my needs. After joining the virtual tour, I plan to join the virtual tour again. I intend/plan to join the virtual tour again to pass the time. I will recommend my family and friends to join the virtual tour.	Melo et al. (2022)

The participants in this research were adults who had previously experienced virtual tour from different parts of Indonesia and were over the age of 17. Following the recommendation of Hair et al. (2010) which suggests a sample size 5 to 10 times greater than the total number of indicators. 16 indicators are used in this study for various goods or indicators. Data collection for the inquiry included questionnaires. 320 individuals were approached using social media to participate in the poll (including Line, Instagram, and WhatsApp). The PLS-SEM approach is used to evaluate survey questionnaire data, and SmartPLS version 4 software is employed. This study is eligible for using PLS-SEM because the current model's complexity includes two variables as mediators, which features two mediators among its five variables. (Hair et al., 2019). The section that follows will go into data analysis and how to interpret the results.

The advantages of PLS-SEM include greater flexibility and trustworthy statistical methods (Hair et al., 2016). the PLS-SEM analysis is performed in a two-stage process: first, assessing the measurement model, and second, assessing the structural model. (Sarstedt et al., 2016). The PLS-SEM analysis process is shown in Table 1, along with basic instructions for each unit of analysis.

Table 2: Threshold values of PLS-SEM

Step of Analysis	Analysis Unit	Basic Threshold	Reference
Measurement model evaluation	Indicator reliability: Indicator loadings	≥0.70	Hair et al. (2019)
	Internal consistency reliability: Composite reliability	0.70-0.90	
	Convergent validity: average variance extracted (AVE)	≥0.50	
	Discriminant validity: HTMT	<0.85	
Structural model evaluation	p-value	p<0.05	
	R2 value	0.75, 0.50. 0.25 (substantial, moderate, weak)	

A total of 350 survey responses were gathered. An outlier assessment procedure was then conducted, which led to the classification of 320 data items as valid for analysis. a summary of these responders is presented in Table 3.

Table 3: Respondents' demographic

Profile	Criteria	Frequency	Percentage
Gender	Men	131	40.9%
	Women	189	59.1%
Age	17-25 years old	93	29.1%
	26-35 years old	113	35.3%
	36-45 years old	61	19.1%
	46-55 years old	35	10.9%
	Older than 56 years old	18	5.6%
Occupation	Students	98	30.6%
	Entrepreneurs	71	22.2%
	Civil servants	49	15.3%
	Others	102	31.9%
Ever participated in a virtual tour?	Yes	186	58.1%
	No	134	41.9%

Evaluation of the model

The data is analysed to ascertain the link between each variable and produce the study's findings once the respondent profile has been analysed. However, before these relationships can be determined, the data must first meet the required validity and reliability standards for the measurement model. During the evaluation of the measurement model, each concept's validity and reliability were assessed, as shown in Table 3. The core of construction reliability is the indicator loading value, which reflects the indicator reliability value and the composite reliability value. It displays structure's overall reliability and internal consistency.

Table 4: Result of measurement model

Variables	Indicator/Items	Reliability Test			Validity Test	
		Indicator Loadings	Cronbach's Alpha	Composite Reliability	Convergent Validity (AVE)	Discriminant Validity (HTMT)
Sense of presence	SP1	0.793	0.872	0.907	0.663	Valid
	SP2	0.883				
Telepresence	TP1	0.851	0.831	0.829	0.673	Valid
	TP2	0.800				
Enjoyment	E1	0.781	0.818	0.880	0.647	Valid
	E2	0.812				
Attitude	AT1	0.774				
	AT2	0.783	0.731	0.818	0.533	Valid
	AT3	0.766				
	AT4	0.579				
Satisfaction	S1	0.809	0.723	0.843	0.642	Valid
	S2	0.837				
	S3	0.821				
	S4	0.782				
	S5	0.783				

With the exception of AT4 (0.579), all loading indicators for each construction in table 3 meet the predicted value of larger than 0.7. Hair et al.'s (2019) research, indicators with loadings below the 0.70 minimum threshold can still be retained for analysis, provided that the construct's composite reliability is acceptable. According to Table 3, each structure's Composite Reliability value is larger than the minimal threshold value of 0.70, at 0.814 for the AT, 0.804 for the E, 0.730 for the SP, 0.801 for the S, and 0.752 for the TP (Hair et al., 2019). In other words, it is commonly known that study constructs are reliable. To respond to concerns about construct validity, an emphasis is also placed on assessing convergent and discriminant validity. The AVE (Average Variance Extract) score shows the convergent validity value as AVE values of 0.553 (AT), 0.647 (E), 0.663 (SP), 0.642 (S). This means that all constructs met the 0.50 minimum threshold for convergent validity, as suggested by (Hair et al., 2019). Similarly, discriminant validity is assessed using the Heterotrait-Monotrait correlation ratio (HTMT), which must be less than 0.85 for each association (Hair et al., 2019; Henseler et al., 2016). As shown in Table 4, it is possible to conclude that the HTMT value is widely accepted, indicating a high degree of discriminant validity. As a result, all data can be determined to be in agreement with the measurement model criteria. As a result, it is regarded as valid and credible.

Table 5*: Heterotrait-Monotrait (HTMT) correlation ratio*

	Attitude	Enjoyment	Sense of presence	Satisfaction	Telepresence
Attitude	0.814				
Enjoyment	0.455	0.804			
Sense of presence	0.395	0.339	0.730		
Satisfaction	0.587	0.384	0.400	0.801	
Telepresence	0.030	0.715	0.565	0.453	0.752

Structural model evaluation

A series of reliability and validity tests were conducted to assess the measurement model, adhering to established PLS-SEM guidelines. (Hair et al., 2019; Henseler et al., 2016). This process ensures that the reflective indicators consistently and accurately represent their corresponding latent constructs. All indicators loadings surpassed the recommended threshold 0.70, confirming adequate indicator reliability, except for item AT4 (0.579) under the Attitude construct. Despite this slightly lower value, the indicator was retained due to its theoretical relevance and because the CR of the construct remained above the acceptable threshold. Hair et al. (2019) note that items with loadings between 0.40 to 0.70 may be preserved if they contribute to content validity and the overall CR and AVE remain satisfactory. Both CA and CR were used to assess internal consistency. All constructs showed acceptable reliability, with CA values from 0.723 to 0.872 (all > 0.70). Likewise, all CR values were well above the 0.70 minimum, ranging from 0.818 to 0.907. According to Hair et al. (2019), CR is a more accurate measure than CA in PLS-SEM because it accounts for the varying loadings of indicators. Thus, the high CR values confirm that the constructs exhibit strong internal consistency and minimal measurement error. The Average Variance Extracted was used to assess convergent validity. AVE measures the variance a construct captures compared to measurement error. Table 4 shows all AVE values were above the 0.50 threshold, ranging from 0.533 (Attitude) to 0.673 (Telepresence).These results indicate that more than 50% of the variance in the observed indicators is explained by their respective constructs, supporting convergent validity. In other words, all indicators within a construct share a sufficient level of common variance, confirming that they capture the same underlying theoretical dimension. As recomended by Henseler et al. (2016). The Heterotrait-Monotrait (HTMT) ratio was used to assess discriminant validity. This criterion is met when the ratio between constructs is below 0.85. Based on Table 5, data confirm that each construct is empirically distinct, as all HTMT values were well under the 0.85 cutoff, with the highest value being 0.715 and the lowest 0.030. This result confirms that the constructs measure conceptually unique phenomena — for instance, telepresence and sense of presence are sufficiently distinct dimensions of immersion, while attitude and enjoyment capture different psychological responses to VR tourism experiences. Integrating the results of reliability and validity analyses, the measurement model fulfills the key quality criteria recommended for reflective constructs in PLS-SEM. These findings collectively demonstrate that the measurement model exhibits robust psychometric properties, validating the use of these constructs for subsequent structural model analysis. The results confirm that the instruments effectively capture the latent dimensions of presence, telepresence, enjoyment, attitude, and satisfaction in virtual reality tourism contexts.

Table 6**: Summary of relationship testing (Direct effects)**

Hypothesis	Relationship	Path Coefficient	t-values	p-Values	Significance
H1a	Sense of presence → Enjoyment	0.200	1.993	0.047	Yes
H1b	Sense of presence → Attitude	0.339	3.689	0.811	No
H1c	Sense of present → satisfaction	0.205	1.984	0.048	Yes
H2a	Telepresence → Enjoyment	0.069	1.671	0.095	No
H2b	Telepresence → Attitude	0.164	2.087	0.077	No
H2c	Telepresence → Satisfaction	0.349	3.659	0.030	Yes
H3a	Enjoyment → Satisfaction	0.235	1.384	0.057	No
H3b	Attitude → Satisfaction	0.079	1.651	0.065	No

Table 6 shows the direct effects with the explanations mentioned beforehand. In addition, table 7 shows the mediating effect of attitudes, showing the indirect effect of SP→A→S and SP→E→S. The significance value of the study is obtained by the t-values of hypothesis 4 a and 4b are greater than and the path coefficient values are positive at 0.219 and 0.154 which indicate the effects of sense of presence to satisfaction through attitude and sense of presence to satisfaction through enjoyment positive but not significant. The same happen with hypotheses 5a and 5b, with positive and significant results but the effects of telepresence on satisfaction through either attitude or enjoyment are positive but not significant.

Tabel 7: Summary of relationship testing (Indirect effects)

Hypotheses	Path	Coefficient	t-values	p-Values	Significance
H4a	Sense of presence→ Attitude→ Satisfaction	0.219	3.707	0.000	Yes
H4b	Sense of presence→ Enjoyment→ Satisfaction	0.154	3.258	0.001	Yes
H5a	Telepresence→ Attitude→ Satisfaction	0.206	4.759	0.000	Yes
H5b	Telepresence→ Enjoyment→ Satisfaction	0.222	4.404	0.000	Yes

Discussion

This study's results offer empirical support for the factors influencing tourist satisfaction in VR, highlighting attitude and enjoyment as mediators that shape tourist satisfaction in virtual reality (VR) experiences, emphasizing the mediating roles of attitude and enjoyment. The measurement analysis model confirmed that all constructs met the criteria for reliability and validity, indicating that the indicators used were appropriate for representing their respective latent variables. Despite one item (AT4) loading slightly below the 0.70 threshold, the CR and AVE values exceeded the minimum required levels (Hair et al., 2019), validating the overall construct quality. From the structural model analysis, sense of presence (SP) and telepresence (TP) emerged as important antecedents of user experience within VR-based tourism. The results show that SP significantly affects enjoyment (H1a) and satisfaction (H1c). This suggests that a tourist's level of psychological immersion in VR boosts their emotional engagement and total satisfaction. This finding is consistent with prior research, which indicating that a strong sense of presence fosters higher hedonic value and experiential satisfaction in virtual tourism (Tussyadiah et al., 2018; Kim et al., 2020). However, SP did not significantly influence attitude (H1b), implying that while users may feel immersed, this emotional involvement does not automatically translate into favorable cognitive evaluations or behavioral intentions. This finding indicates a potential gap between affective and attitudinal responses in VR tourism, possibly moderated by individual differences in technology readiness or prior VR experience. In contrast, telepresence significantly influenced satisfaction (H2c) but not enjoyment or attitude (H2a, H2b). This implies that the technological quality of VR - such as vividness, realism, and interactivity - directly improves satisfaction, even if it does not strongly affect users' emotional enjoyment or cognitive attitude formation. In other words, technological immersion may enhance perceived value through realism rather than through affective engagement. This finding complements prior literature that distinguishes between emotional and perceptual immersion in determining satisfaction (Cummings & Bailenson, 2016). Regarding downstream effects, enjoyment and attitude did not exhibit direct significant relationships with satisfaction (H3a, H3b), suggesting that in virtual tourism contexts, satisfaction may stem more directly from sensory and immersive experiences (SP and TP) than from affective or cognitive evaluations alone. Nonetheless, when examining indirect effects, both variables play significant mediating roles. The mediation analysis revealed that attitude and enjoyment significantly mediated the relationships between SP and satisfaction (H4a, H4b) as well as between TP and satisfaction (H5a, H5b). These findings indicate that while enjoyment and attitude may not independently predict satisfaction, they serve as critical emotional and cognitive pathways through which immersion (presence and telepresence) enhances tourists' overall satisfaction. This highlights the importance of designing VR tourism content that stimulates both affective enjoyment and positive attitudes toward the experience. In practice, destination managers and developers should focus on integrating sensory realism with narrative and interactive components that evoke emotion and foster meaningful user engagement. By doing so, VR tourism can move beyond novelty toward deeper experiential satisfaction and destination connection. This aligns with prior work distinguishing emotional immersion from perceptual realism: audiences may rate an experience as high quality because it looks realistic (telepresence), but realism alone does not guarantee greater enjoyment unless the experience also triggers emotional engagement (Cummings & Bailenson, 2016). Several explanations from prior research can account for the weak direct effects of attitude and enjoyment on satisfaction in our model. First, measurement and construct overlap: when upstream constructs (SP and TP) capture much of the variance relevant to satisfaction, downstream predictors may appear non-significant in the presence of those stronger antecedents (Hayes, 2013; Hair et al., 2019). Second, individual differences likely moderate these relationships. Research on technology acceptance and readiness (Davis et al., 1992; Parasuraman, 2000) suggests that prior exposure to VR, technology readiness, or involvement can influence whether affective responses (enjoyment) translate into evaluative judgments (attitude → satisfaction). Third, situational factors—such as content type (passive 360° video vs. interactive VR tour), narrative quality, or task goals—can determine whether affective enjoyment maps to satisfaction (Guttentag, 2010; Cummings & Bailenson, 2016). Overall, these findings advance the understanding of virtual reality's psychological mechanisms in shaping tourist experiences. The study confirms the multidimensional nature of satisfaction formation in VR tourism—driven by a combination of immersive presence, emotional enjoyment, and attitudinal appraisal. It contributes to both theory and practice by elucidating how virtual environments can simulate authentic tourism experiences capable of evoking satisfaction comparable to, or even exceeding, physical travel encounters.

Conclusion

This study examines whether virtual reality (VR) could be used as an alternative in Indonesian tourism. This study explores how VR can act as a substitute for real travel during times of external restrictions, examining how factors like presence, enjoyment, telepresence, and attitude collectively influence user satisfaction. The findings indicate that sense of presence positively impacts enjoyment. Conversely, telepresence was found to have a positive effect on pleasure. Most notable conclusion of the study is the positive and substantial association between sense of presence and contentment, indicating that when using VR to travel during COVID-19 outbreak, a person's sense of presence increases their degree of happiness. Furthermore, the study show no significant association between attitude and sense of presence, emphasising the need to investigate additional unrecognised influential factors. According to this study, a person's sensation of presence has little effect on their attitude, probably because using VR to replicate travel leads to a less exciting and fulfilling experience than comfort. Taken together, the results support an integrated view that combines presence theory with consumer evaluation frameworks. Presence and telepresence serve as stimulus conditions (akin to "system and content qualities"), enjoyment represents the affective response, and attitude captures the cognitive appraisal that jointly mediate the pathway to satisfaction—a conceptualization consistent with stimulus-organism-response (SOR) frameworks applied in immersive media studies. From a managerial perspective, literature on VR design emphasizes that both technological fidelity and content design matter (Cummings & Bailenson, 2016; Guttentag, 2010). Your findings reinforce this: telepresence (technical realism) raises satisfaction directly, but sense of presence (psychological immersion) is crucial for enjoyment—so optimal VR tourism products should combine high-quality visuals and interactivity with compelling narratives and emotional triggers. For research, the results highlight the need to test moderators identified in previous studies (e.g., prior VR experience, technology readiness, involvement) and to consider alternative operationalizations of attitude and enjoyment to reduce measurement overlap.

Consistent with broader VR research, caution is warranted in generalizing the results across content types and populations (Cummings & Bailenson, 2016; Tussyadiah et al., 2018). Future studies should utilize longitudinal designs or field experiments to capture how novelty effects decay (Guttentag, 2010) and how repeated exposure alters the attitudinal and hedonic pathways to satisfaction. In addition, refining the attitudinal measurement (given AT4's low loading) and incorporating moderators from the technology acceptance and media psychology literature (Davis et al., 1992; Parasuraman, 2000) will deepen theoretical insights. By tying our empirical patterns to established theoretical constructs—presence/telepresence distinctions, SOR frameworks, and TAM-like moderators—this reanalysis situates the study squarely within extant VR and tourism literature. The study both corroborates earlier findings (presence enhances enjoyment; technical realism increases perceived quality) and adds nuance by demonstrating that enjoyment and attitude function as mediators even when their direct predictive power on satisfaction is limited. This nuanced mediation insight is a valuable contribution for researchers and practitioners aiming to design VR tourism experiences that reliably produce satisfaction. The findings of this study show how virtual reality technology can replace travel. For example, customers may be forced to change their trip or activity due to political or environmental turmoil. Marketers must know the possibility of developing virtual reality content and previewing it for intended usage. The difficulty is to organise events that incorporate technology, even if they serve as a substitute for actual travel, while maintaining the attractiveness of travel and creating a spirit of adventure.

Acknowledgments
The authors thank Telkom University and Atma Jaya Catholic University of Indonesia for supporting this study.

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