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Virtual Reality's impact on Virtual World Brand Experience, Virtual World Brand Authenticity, and Purchase Intention: The Moderating Role of Technology Anxiety

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Abstract

This study investigates the psychological and experiential mechanisms through which virtual reality (VR) features influence consumer purchase intention in an emerging market. Grounded in the Stimulus-Organism-Response (S-O-R) framework and flow theory, the research proposes an integrated model linking technical affordances (diagnosticity, telepresence) to brand outcomes via playfulness and virtual brand experience. Data collected from 553 Vietnamese consumers were analyzed using PLS-SEM. The results indicate that telepresence, perceived diagnosticity, and playfulness explain 50.5% of the variance in virtual world brand experience. While virtual brand experience and authenticity significantly predict purchase intention, the effect sizes are moderate (R2 = 20.8%), suggesting the influence of unmeasured external factors. Notably, technology anxiety acts as a moderator but yields counterintuitive findings: it strengthens the relationship between virtual brand authenticity and purchase intention, suggesting that anxious consumers rely more heavily on authenticity cues to mitigate uncertainty. The study contributes to the immersive marketing literature by clarifying the role of diagnostic utility and authenticity. However, limitations regarding the cross-sectional design and the specific market context (Vietnam) are acknowledged.

1. Introduction

In contemporary consumer marketing, the rapid advancement of immersive technologies has significantly reshaped how brands engage with their audiences. Among these technologies, Virtual Reality (VR) stands out as a tool that creates simulated environments where users can interact, explore, and engage with branded content in ways that traditional online media cannot replicate. Unlike broader constructs such as the metaverse or virtual worlds, which refer to overarching simulated environments, VR specifically denotes technology that facilitates high-immersion experiences through hardware and software systems (Cowan & Ketron, 2019). These immersive experiences have the potential to influence consumer perceptions and behavior by generating a sense of “presence” - a psychological state in which virtual stimuli are processed as if they were real (Zeng et al, 2019; Meuter et al, 2020).

Despite growing interest, extant literature remains fragmented regarding how VR-mediated experiences affect deeper psychological constructs such as brand authenticity, defined as consumers’ perceptions that a brand is genuine, sincere, and aligned with its values (Zeng et al., 2023). Empirical research suggests that VR-based brand experiences can enhance consumer engagement and satisfaction by providing sensory richness and interaction opportunities that bridge the gap between digital and physical contexts (Zeng et al., 2023). Moreover, brand experience research indicates that immersive brand stimuli can develop stronger consumer-brand relationships, which in turn can elevate purchase intention. However, studies specifically investigating the mechanisms linking VR experiences to brand authenticity and subsequent purchase intentions are scarce.

One reason for the theoretical gap is that most existing studies focus on isolated aspects of VR impacts, such as presence, vividness, or engagement, without integrating multiple psychological pathways into a

single model (e.g., telepresence, perceived diagnosticity, and playfulness). Telepresence - the sensation of being physically present in a virtual environment has been shown to influence consumer involvement and responses in immersive contexts (Navarro et al., 2019). Perceived diagnosticity, referring to how well a mediated experience helps consumers evaluate products, and playfulness, capturing the enjoyment derived from interaction, are also important emotional and informational antecedents to engagement but have received less integrated empirical scrutiny in VR marketing contexts.

Furthermore, consumer reactions to immersive technology are not uniform. Technology Anxiety, defined as the apprehension or fear experienced when encountering new technological systems (Meuter et al., 2003), may negatively moderate the positive effects of VR brand experiences on cognitive and emotional outcomes. Research on technology anxiety in the context of self-service technologies illustrates that higher anxiety can inhibit usage and satisfaction, suggesting similar inhibitory effects might occur in immersive VR contexts.

To address these gaps, this study proposes and tests a comprehensive model of VR marketing effects that integrates multiple cognitive and affective mediators - telepresence, perceived diagnosticity, and playfulness - in explaining how Virtual Reality influences Virtual World Brand Experience and Virtual World Brand Authenticity, and ultimately, Purchase Intention. Additionally, this research investigates the moderating role of Technology Anxiety, hypothesizing that anxiety may weaken the positive influence of immersive experiences on authenticity perceptions and purchase outcomes. By incorporating these dimensions, the study offers a more holistic theoretical framework for understanding how VR enhances brand authenticity and drives consumer purchase intention in increasingly digital consumer environments.

2. Literature review

2.1. Virtual reality

While early definitions characterized Virtual Reality (VR) strictly through technological hardware such as head-mounted displays (HMDs) and sensory feedback systems (Steuer, 1992), contemporary marketing literature reconceptualizes VR as an experiential platform defined by immersion and interactivity (Flavián et al., 2019; Wedel et al., 2020). Unlike augmented reality (AR), which overlays digital content onto the physical world, VR completely supplants the user’s physical reality with a computer-generated environment, creating a distinct "closed-loop" experience (Heller et al., 2019). However, treating VR merely as a technological tool overlooks its psychological impact on brand perception. Recent studies argue that VR's effectiveness is not inherent in the hardware but lies in its ability to generate high-fidelity sensory inputs that mimic direct product experience (Xi & Hamari, 2021). Despite its potential, empirical findings remain fragmented: while some scholars posit that VR enhances product understanding through vividness (Pizzi et al., 2019), others warn that excessive technological complexity can induce cognitive overload, potentially diminishing the brand experience (Roettl & Terlutter, 2018). This study,

therefore, moves beyond the binary view of VR usage to examine how specific VR-induced psychological states (telepresence, diagnosticity, playfulness) drive brand outcomes.

2.2. Telepresence

Traditionally, telepresence was defined as the sensation of 'being there' in a mediated environment (Steuer, 1992). However, in the context of the emerging metaverse and immersive retailing, Xi and Hamari (2021) reconceptualize telepresence not merely as a spatial sensation but as a multidimensional construct driven by immersion and interactivity. Unlike traditional web interfaces, modern VR induces a state of 'embodied presence,' where the user feels physical ownership of their avatar within the branded space (Flavián et al., 2019). Recent empirical evidence suggests that high-fidelity VR telepresence significantly reduces the psychological distance between the consumer and the product, a mechanism critical for evaluating virtual goods (Algharabat et al., 2018).

2.3. Perceived diagnosticity

Perceived diagnosticity refers to the consumer's belief that a website provides sufficient information to assess product quality (Jiang & Benbasat, 2004). While early e-commerce relied on text and images, Petit et al. (2019) argue that VR revolutionizes diagnosticity through 'digital sensory enablement.' By allowing users to virtually manipulate products (e.g., rotate, zoom, or simulate usage), VR mitigates the 'touch-and-feel' gap inherent in online shopping (Heller et al., 2019). This enhanced spatial understanding creates a 'virtual trial' experience, which Alzayat and Lee (2021) found to offer diagnosticity levels comparable to physical inspection, thereby reducing uncertainty in purchase decisions.

2.4. Playfulness

Playfulness represents the intrinsic enjoyment and cognitive spontaneity derived from interacting with technology. While foundational models positioned playfulness as a determinant of system usage (Moon & Kim, 2001), contemporary VR literature views it as a core component of the 'hedonic' user experience (Kang et al., 2020). In immersive brand spaces, playfulness is triggered by gamified interactions and vivid simulations, which sustain user attention and foster a state of 'flow' (McLean & Wilson, 2019). Unlike static web browsing, the playful nature of VR encourages exploratory behavior, which Papagiannidis et al. (2017) suggest can transfer positive affect directly to the brand, enhancing perceived authenticity.

2.5. Virtual world brand experience

Virtual World Brand Experience refers to the sensations, thoughts, cognitions, and behavioral responses elicited by brand-related stimuli in three-dimensional, computer-generated environments, where consumers interact through avatars and immersive simulations. Unlike traditional brand encounters, which are limited to physical or digital touchpoints such as advertisements or websites, the advent of virtual worlds allows consumers to engage directly with brands, creating a participatory, sensory-rich experience (Brakus et al., 2009). In these virtual spaces, customers connect with brands in dynamic, simulated settings that replicate real-world interactions, enabling exploration, customization, and co-creation of brand meanings (Li et al., 2002; Suh & Chang, 2006). Such environments foster deeper

sensory immersion and emotional attachment by allowing consumers to directly interact with virtual objects and avatars that closely resemble real-world consumption experiences (Choi & Kim, 2023; Brown et al., 2024). These interactions have been shown to influence product knowledge, attitudes, and purchase intention positively (Li et al., 2002; Suh & Chang, 2006). As the technology continues to evolve, studies have highlighted how virtual brand experiences can bridge the gap between traditional and immersive marketing, enhancing both brand authenticity and consumer engagement (Choi & Kim, 2023).

2.6. Virtual world brand authenticity

Virtual world brand authenticity refers to consumers' perceptions of a brand as authentic, trustworthy, and consistent with its real-world identity in a virtual environment. In AR/VR platforms, brands are represented not only by visual features but also through the perceived realism and emotional integrity of their virtual presence (Choi & Kim, 2023). This concept extends traditional brand authenticity theories (Beverland, 2006; Morhart et al., 2015), emphasizing that authenticity is co-created through interactive experiences and technological mediation.

Studies show that consumers perceive a brand as authentic when its virtual representation aligns with its core principles, fostering trust in the brand's virtual presence (Gabisch, 2011). Self-image congruence and perceived diagnosticity are key mechanisms in this process. First, consumers assess authenticity based on how well the brand aligns with their values (Sirgy et al., 1997). Second, when virtual experiences aid in evaluating a brand's attributes, they strengthen perceptions of its credibility (Jiang & Benbasat, 2005). Recent studies also highlight that consistency across virtual and physical brand touchpoints enhances perceived authenticity (Choi & Kim, 2023), which is critical for maintaining trust and consumer loyalty in immersive environments.

2.7. Purchase intention

Purchase intention refers to an individual's readiness or decision to purchase a product or service in the future (Spears & Singh, 2004). It is a critical outcome in consumer behavior research, linking customer assessments, attitudes, and satisfaction to actual purchasing behavior. According to marketing theory, purchase intention is influenced by both cognitive factors (e.g., perceived quality, usefulness, and trust) and affective elements (e.g., emotional connection and enjoyment) (Yao & Huang, 2017). Recent studies emphasize the role of emotional attachment and perceived social influence in shaping purchase intentions, especially in digital and immersive commerce environments (Cohen & Peres, 2021; Verhagen et al., 2020).

Consumers' purchase intentions are significantly influenced by their overall product attitude, shaped by perceptions of product quality, brand image, and past experiences (Kotler, 2008; McCarthy & Perreault, 1990). A positive product attitude increases the likelihood of purchase, serving as a bridge between marketing efforts and consumer behavior (Tek, 1999). Moreover, purchase intention is a key component of behavioral intention, which reflects a customer's tendency to continue or discontinue an action based on satisfaction and perceived value (Anderson et al., 1994; Zeithaml et al., 1996). Recent studies

highlight that trust and perceived value play critical roles in shaping purchase intentions in e-commerce and immersive shopping contexts (Kang et al., 2021; Goh et al., 2020).

2.8. Technology anxiety

Technology anxiety is defined as an individual's feeling of uncertainty, fear, or discomfort when considering or using new technology (Meuter et al., 2003; Venkatesh et al., 2014). It is a psychological barrier that affects users' perceptions, attitudes, and behavioral intentions toward adopting new technologies. Individuals with high levels of technology anxiety often view digital systems as complex or intimidating, leading to avoidance behaviors and lower engagement with innovative tools (Li & Xu, 2020). Empirical research has shown that technology anxiety negatively impacts consumers' perceptions of new technologies, including augmented and virtual reality (AR/VR) applications. Users who are apprehensive about interacting with these technologies tend to exhibit lower trust, perceive the systems as harder to use, and demonstrate less intention to adopt these technologies (Rosen et al., 2022; Yoon & Kim, 2021). Consequently, technology anxiety has been identified as a moderating factor that weakens the positive effects of immersive experiences on outcomes such as engagement, satisfaction, and purchase intention (Shao et al., 2022). Anxious consumers are less likely to embrace virtual experiences unless the technology is perceived as user-friendly and accessible.

3. Hypothesis development

3.1. Virtual reality and user perceptions

Virtual Reality (VR) technology has emerged as a powerful tool that enhances immersive experiences by creating an illusion of physical presence in a mediated environment. The concept of telepresence, defined as the extent to which users feel as if they are “present” in a remote or simulated space (Steuer, 1992), is central to understanding user experience in VR. The high level of interactivity and sensory realism offered by VR allows users to perceive a sense of “being there” within the environment (Riva & Gamberini, 2003). When users engage with VR systems that present realistic stimuli and provide responsive feedback, their perceptual and cognitive processes are more likely to elicit a sense of telepresence (Schöne, 2023).

Beyond telepresence, VR can also enhance perceived diagnosticity, which refers to the degree to which consumers believe that a system or medium helps them make accurate judgments or decisions (Jiang & Benbasat, 2004). The immersive and interactive nature of VR enables users to gather more concrete and vivid information about products, experiences, or simulated contexts, thus improving the perceived accuracy and reliability of their evaluations (Negi et al., 2024). When users interact with VR environments that provide multisensory, dynamic feedback, they tend to perceive these experiences as more informative and diagnostic than those in traditional media.

In addition, the experiential affordances of VR can stimulate users’ perceived playfulness, which reflects the extent to which they find the interaction enjoyable, engaging, and intrinsically motivating (Webster &

Martocchio, 1992). The high level of sensory immersion, novelty, and freedom of interaction provided by VR environments enhances users' curiosity and enjoyment, encouraging exploratory and playful behavior (Reid, 2004). Previous studies have shown that VR-based interactions promote higher levels of enjoyment and engagement than conventional digital interfaces (Kouijzer et al., 2023). Thus, it is reasonable to expect that the use of VR will increase users' perceived playfulness. Hence, the following hypothesis is proposed:

H1: Virtual reality positively affects telepresence.

H2: Virtual reality positively affects perceived diagnosticity.

H3: Virtual reality positively affects playfulness.

3.2. Effects of telepresence

Telepresence refers to the extent to which individuals feel as if they are physically present in a mediated environment rather than in their immediate physical surroundings (Steuer, 1992). Within virtual brand environments, a higher sense of telepresence allows users to engage deeply with brand-related stimuli, leading to more immersive and memorable experiences (Javornik, 2016). When users experience a sense of "being there," they are more likely to develop emotional and cognitive connections with the virtual world, thus enhancing their overall brand experience (Yim et al., 2017).

Moreover, telepresence facilitates the perception of authenticity in virtual worlds by reducing the psychological distance between consumers and the brand environment. The feeling of being virtually "present" increases users' belief in the reality of the experience and the credibility of the brand's representation. Studies in 3D virtual environments have shown that greater interactivity and control over virtual products can enhance the perception of product and brand authenticity by making the experience feel more tangible and credible (Pizzi, 2020). Consequently, telepresence can strengthen both experiential and authenticity-related brand perceptions. Therefore, we propose the following hypothesis:

H4: Telepresence positively affects virtual world brand experience.

H5: Telepresence positively affects virtual world brand authenticity.

3.3. Effects of perceived diagnosticity

Perceived diagnosticity refers to the degree to which consumers perceive online information as helpful in evaluating products and making purchase decisions (Jiang & Benbasat, 2007). In virtual brand environments, diagnostic information enhances users' confidence and understanding of the brand, contributing to richer and more informative experiences (Li et al., 2022). When consumers find the virtual information useful, they are more likely to engage cognitively and emotionally, leading to a stronger brand experience (Kim et al., 2020).

Additionally, perceived diagnosticity contributes to brand authenticity by signaling transparency and reliability. When virtual platforms provide diagnostic cues such as realistic visuals, detailed product information, or interactive content, users perceive the brand as more genuine and trustworthy (Choi & Kim, 2019). Therefore, perceived diagnosticity is likely to enhance both the experiential and authenticity dimensions of virtual brand engagement. Hence, the following hypothesis is proposed:

H6: Perceived diagnosticity positively affects virtual world brand experience.

H7: Perceived diagnosticity positively affects virtual world brand authenticity.

3.4. Effects of Playfulness

Playfulness reflects the extent to which individuals perceive interactions as enjoyable, entertaining, and intrinsically motivating (Webster & Martocchio, 1992). In virtual brand environments, playfulness encourages users to explore, experiment, and emotionally connect with the brand, thereby enhancing their experiential engagement (Hsu & Lu, 2004). Engaging features such as gamification, interactivity, and creative design stimulate curiosity and enjoyment, leading to more positive virtual world brand experiences (Lee et al., 2010).

Furthermore, playful interactions foster a sense of authenticity by humanizing brand encounters and promoting genuine emotional connections (Holbrook & Hirschman, 1982). When users perceive their engagement with a brand's virtual world as fun, expressive, and self-reflective, they are more likely to view the brand as sincere and authentic (Romero et al., 2025). Thus, playfulness can be viewed as a critical driver of both experiential quality and perceived authenticity in virtual environments.

H8: Playfulness positively affects virtual world brand experience.

H9: Playfulness positively affects virtual world brand authenticity.

3.5. Brand experience, authenticity, and purchase intention

Recent advances in immersive technology have transformed traditional brand interactions, allowing consumers to experience brands in virtual worlds through interactive, sensory-rich environments. These virtual-world brand experiences elicit emotional, cognitive, and behavioral engagement, closely mirroring real-world consumption experiences (Kim, Kim, & Park, 2023). When consumers perceive these virtual encounters as realistic, coherent, and personally meaningful, they are more likely to perceive the brand as authentic and credible, even within a synthetic space (Choi & Kim, 2022). This sense of authenticity emerges from the alignment between a brand's virtual representation and its core identity, which fosters consumer trust and strengthens brand relationships (Park, Kim, & Ko, 2021).

Moreover, immersive experiences in virtual environments can directly enhance purchase intentions by evoking enjoyment, emotional attachment, and perceived value. Studies have demonstrated that virtual brand experiences increase consumer engagement, stimulate affective responses, and translate these emotional responses into favorable brand attitudes and stronger purchase intentions (Lee, Park, & Oh,

2023; Wang & Lee, 2022). In the context of the metaverse and other extended reality (XR) environments, consumers' experiential value often outweighs utilitarian factors, suggesting that virtual interactions can be powerful predictors of behavioral outcomes like purchase intention.

Brand authenticity plays a critical mediating role in converting virtual experiences into concrete purchase intentions. Authentic brands are seen as honest and consistent, which helps reduce psychological risk and enhances consumers' confidence in their purchase decisions (Jang, Kim, & Kim, 2024; Morales & Lim, 2023). When consumers perceive a brand's presence in virtual spaces as genuine and trustworthy, they are more inclined to form lasting connections and exhibit a higher likelihood of purchasing. Thus, virtual world brand experience and brand authenticity joint action act as essential antecedents of consumer purchase intention in immersive digital contexts.

H10: Virtual world brand experience positively affects virtual world brand authenticity.

H11: Virtual world brand experience positively affects purchase intention.

H12: Virtual world brand authenticity positively affects purchase intention.

3.6. Moderating role of technology anxiety

Technology anxiety refers to an individual's emotional discomfort, fear, or apprehension when using advanced digital systems or immersive technologies (Alalwan, 2022; Hwang & Lee, 2022). In virtual reality (VR) and metaverse-based brand environments, consumers with high levels of technology anxiety often view these platforms as complex, unpredictable, or mentally taxing. Such feelings of uncertainty hinder their ability to engage fully with virtual experiences, ultimately reducing their intention to purchase through these immersive channels (Li, Kim, & Park, 2022).

Technology anxiety influences how consumers process and respond to immersive experiences. Consumers with low technology anxiety are more likely to appreciate the interactive, sensory, and emotional elements of virtual brand environments, which enhances the relationship between virtual world brand experience and purchase intention. On the other hand, users with higher levels of technology anxiety may struggle with system navigation or performance issues, which weakens the experiential effects on behavioral intentions (Gupta & Dogra, 2023). Additionally, the positive impact of brand authenticity on purchase intention may depend on the consumer's comfort with technology. Anxious users, uncertain about their ability to interact effectively, may question the brand's credibility or consistency in virtual spaces (Hsu & Lin, 2021).

H13a: Technology anxiety moderates the relationship between virtual world brand experience and purchase intention.

H13b: Technology anxiety moderates the relationship between virtual world brand authenticity and purchase intention.

H13c: Technology anxiety negatively affects purchase intention.

3.7. The model framework

Building upon the Unified Theory of Acceptance and Use of Technology 2 (UTAUT2), the Stimulus-Organism-Response (S-O-R) model, and Flow Theory, this study proposes an integrated conceptual framework to explain how virtual reality (VR) marketing shapes consumer experience, perceived authenticity, and purchase intention.

In this model, virtual reality (VR) serves as the stimulus, influencing consumers' internal experiential states: telepresence, perceived diagnosticity, and playfulness. These psychological and emotional responses (the "organism") jointly enhance two critical brand-related outcomes: virtual world brand experience (VBE) and virtual world brand authenticity (VBA). These brand constructs, in turn, act as mediators that transform immersive experiences into behavioral outcomes, specifically purchase intention (the "response").

Furthermore, technology anxiety is introduced as a moderating variable, moderating the relationships between virtual world brand experience (VBE) and purchase intention and between virtual world brand authenticity (VBA) and purchase intention. Technology anxiety may weaken the positive effects of brand experience and authenticity on purchase intention, particularly among consumers who experience higher levels of anxiety when engaging with immersive technologies.

The conceptual model thus integrates cognitive (diagnosticity), affective (playfulness), and perceptual (telepresence) dimensions to illustrate how immersive technology fosters consumer trust, brand authenticity, and purchase intention in virtual commerce contexts. This framework highlights how both experiential engagement and emotional involvement in virtual environments can lead to stronger brand connections and purchasing behavior (Fig. 1).

4. Methods

4.1 Research design

This study adopted a quantitative, cross-sectional research design to examine how Virtual Reality (VR) marketing influences consumer experience, perceived authenticity, and purchase intention. Specifically, the research investigates the relationships among telepresence, perceived diagnosticity, playfulness, virtual world brand experience, virtual world brand authenticity, technology anxiety, and purchase intention. A structured questionnaire survey was employed to collect self-reported data from individuals who had previously experienced VR-based marketing content. The cross-sectional survey approach is commonly used in consumer behavior research to examine relationships among psychological constructs in technology-mediated environments. However, because respondents were asked to recall their past VR experiences rather than being exposed to a controlled VR environment, the design may introduce recall bias and variability across different VR platforms. This limitation is acknowledged and addressed in the discussion section.

Despite these limitations, a survey-based design is appropriate for examining consumer perceptions and behavioral intentions across a relatively large sample, particularly in emerging markets where controlled VR experimental settings remain limited.

4.2 Sampling method and participants

Due to the absence of a sampling frame for VR users in Vietnam, this study adopted non-probability sampling, combining convenience and snowball techniques. Participants were recruited through social media platforms such as Facebook, Instagram, and LinkedIn. Eligible respondents were individuals who had interacted with VR marketing content (e.g., virtual product demonstrations, immersive brand experiences, or virtual store environments) within the past year. A total of 600 responses were collected, and after data screening, 553 valid responses remained for analysis.

Most respondents were young, urban, and highly educated, with 81.2% under 30 years old. While this group represents early adopters of immersive technologies, the sample is not fully representative of the Vietnamese population; therefore, the findings should be interpreted with caution regarding generalizability. A power analysis following Hair et al. (2022) indicates that the final sample size provides sufficient statistical power for PLS-SEM analysis.

4.3. Measurement development

Measurement items were adapted from previously validated studies and measured using a five-point Likert scale (1 = strongly disagree to 5 = strongly agree). Minor wording adjustments were made to fit the VR marketing context.

Because the original scales were developed in English, a translation and back-translation procedure was conducted to ensure linguistic equivalence in Vietnamese. A pilot test with a small group of respondents familiar with VR content was also conducted to confirm the clarity of questionnaire items.

4.4. Data collection procedure

Data were collected through an online survey using Google Forms over a period of approximately three weeks. Respondents were informed of the academic purpose of the study and assured of anonymity and confidentiality. To improve data quality, responses with incomplete answers, unusually short completion times, or repetitive patterns were removed. Measures were also taken to limit multiple submissions from the same account. Participation was voluntary, and informed consent was obtained before respondents proceeded with the survey.

4.5 Data analysis

The data were analyzed using SPSS 26.0 and SmartPLS 4.0. SPSS was used for descriptive statistics and preliminary reliability analysis, while PLS-SEM was applied to test the structural relationships among constructs. PLS-SEM was selected due to its suitability for complex models with multiple mediating and moderating relationships and its ability to handle non-normal data distributions. Reliability was assessed using Cronbach's alpha and Composite Reliability (CR), while Average Variance Extracted (AVE) and the

Fornell–Larcker criterion were used to evaluate validity. Bootstrapping with 5,000 resamples was conducted to test path significance, and effect sizes (f^2) were reported to assess the magnitude of relationships between constructs.

5. Research results

5.1. Demographic statistics

Following the data cleaning process, 553 valid responses were retained for analysis. Table 1 summarizes the demographic characteristics of the respondents. Among participants, 35.4% were male and 66.4% were female. This distribution reflects the prevailing demographic profile of online fashion and lifestyle shoppers in Vietnam, who are predominantly female.

Most respondents resided in two key economic hubs: Ho Chi Minh City (29.3%) and Hanoi (21.2%). The majority were aged between 23 and 30 years old (50.5%), followed by the 16–22 age group (30.7%). In terms of occupation, office workers comprised 30.9% of the sample, followed by business professionals (24.4%), technical experts (15.2%), students (14.6%), and others (14.8%). Regarding education, 41.2% held a university degree. Concerning income, 33.8% reported earning between 7 and 15 million VND monthly, while 47.3% earned above 15 million VND. More than half of the respondents reported engaging in virtual shopping or immersive activities (ranging from mobile-based 360-degree views to VR headsets) for 2–4 hours per day.

To address potential Common Method Bias (CMB) in self-reported survey data, we applied both the traditional Harman's single-factor test and the full collinearity assessment approach (Kock, 2015). Harman's test showed that the first factor accounted for 37.128% of the total variance, below the 50% threshold, indicating that no single factor dominates the variance.

Table 1
Characteristics of respondents

Criteria	Respondents	Rate
Gender	**553**	**100%**
Male	196	35.4%
Female	357	64.6%
Age	**553**	**100%**
16–22	170	30.7%
23–30	279	50.5%
31–40	90	16.3%
> 40	14	2.5%
Location	**553**	**100%**
HCM	162	29.3%
HN	117	21.2%
Hue	54	9.8%
ĐN	108	19.5%
Can Tho	112	20.3%
Job	**553**	**100%**
Student	81	14.6%
Officer	171	30.9%
Technical Professional	84	15.2%
Business	135	24.4%
Other	82	14.8%
Academic level	**553**	**100%**
High school	115	20.8%
College	115	20.8%
Undergraduate	228	41.2%
Postgraduate	60	10.8%
Income	**553**	**100%**
(Source: Created by authors)		

Criteria	Respondents	Rate
Gender	**553**	**100%**
< 7M	69	12.5%
7-<15M	187	33.8%
15-<25M	162	29.3%
>=25M	100	18.1%
Frequency	**553**	**100%**
< 2hrs	122	22.1%
2-4hrs	338	61.1%
> 4hrs	93	16.8%
(Source: Created by authors)		

5.2. Measurement model assessment

The measurement model was evaluated using SmartPLS 4 following Hair et al. (2019). Reflective indicator loadings exceeded the 0.7 threshold (Table 2), ensuring item reliability. Construct reliability was established with Cronbach's alpha ≥ 0.7 (DeVellis, 2012) and Composite Reliability (CR) > 0.7 (Hair et al., 2013). Convergent validity was confirmed as Average Variance Extracted (AVE) values exceeded 0.5 (Hock & Ringle, 2010). Discriminant validity was assessed using the Heterotrait-Monotrait ratio (HTMT); all values remained below the conservative threshold of 0.90 (Henseler et al., 2015), confirming that the constructs are empirically distinct (Table 3).

Table 2
Construct reliability and convergent validity results

(Source: Created by authors)

Likert scale constructs	Loadings	Cronbach's alpha	CR	AVE
PD		**0.818**	**0.892**	**0.733**
PD1	0.849			
PD2	0.867			
PD3	0.852			
PF		**0.903**	**0.932**	**0.774**
PF1	0.891			
PF2	0.895			
PF3	0.874			
PF4	0.860			
PI		**0.949**	**0.967**	**0.908**
PI1	0.955			
PI2	0.950			
PI3	0.952			
Pract1	1			
TA		**0.887**	**0.922**	**0.747**
TA1	0.817			
TA2	0.902			
TA3	0.893			
TA4	0.844			
TLP		**0.868**	**0.919**	**0.791**
TLP1	0.907			
TLP2	0.885			
TLP3	0.875			
VBA		**0.876**	**0.924**	**0.801**
(Source: Created by authors)				

Likert scale constructs	Loadings	Cronbach's alpha	CR	AVE
PD		**0.818**	**0.892**	**0.733**
VBA1	0.890			
VBA2	0.888			
VBA3	0.907			
VBE		**0.922**	**0.950**	**0.865**
VBE1	0.918			
VBE2	0.928			
VBE3	0.944			
(Source: Created by authors)				

Table 3
The results of the HTMT ratio of correlations

(Source: Author's own)

PD	PD	PF	PI	Pract1	TA	TLP	VBA	VBE
PF	0.681							
PI	0.440	0.312						
Pract1	0.447	0.514	0.407					
TA	0.189	0.065	0.321	0.130				
TLP	0.493	0.570	0.195	0.412	0.265			
VBA	0.710	0.582	0.260	0.444	0.201	0.473		
VBE	0.589	0.757	0.283	0.485	0.041	0.504	0.565	
(Source: Created by authors)								

5.3. Structural model assessment

The structural model was evaluated using the Partial Least Squares Structural Equation Modeling (PLS-SEM) approach, with bootstrapping performed on 5,000 subsamples to ensure the robustness of estimates. Regarding collinearity diagnostics, all of the variance inflation factor (VIF) values fall below the recommended threshold of 3, indicating no critical multicollinearity concerns, following the guidelines proposed by Hair et al. (2019). The model explains 50.5% of the variance in virtual world brand experience (VBE) and 44.6% in virtual world brand authenticity (VBA). However, the R^2 for

Purchase Intention (PI) was 20.8%. While moderate, this indicates that purchase decisions in VR contexts are complex and likely influenced by omitted variables such as price sensitivity or product need, beyond the measured experiential factors.

Path analysis (Table 4) supported most hypotheses. Practical experience (Pract1) showed strong positive associations with telepresence ($\beta = 0.383$, $p < 0.001$), perceived diagnosticity ($\beta = 0.405$, $p < 0.001$), and playfulness ($\beta = 0.489$, $p < 0.001$). These "organism" states subsequently predicted VBE and VBA. Specifically, playfulness was the strongest predictor of VBE ($\beta = 0.549$), highlighting the hedonic nature of the VR experience.

However, the direct effect of VBA on PI, while significant, was small ($\beta = 0.093$, $p = 0.044$), suggesting that authenticity acts largely as a hygiene factor rather than a sole driver of purchase. Figure 2 visualizes these paths, with dashed lines indicating non-significant relationships.

Table 4
Results of the hypothesis test

(Source: Created by authors.)

Hypothesis	Original sample (O)	P values	Results
H1: Pract1 = > TLP	0.383	0.000	Supported
H2: Pract1 = > PD	0.405	0.000	Supported
H3: Pract1 = > PF	0.489	0.000	Supported
H4: TLP = > VBE	0.119	0.000	Supported
H5: TLP = > VBA	0.084	0.047	Supported
H6: PD = > VBE	0.140	0.001	Supported
H7: PD = > VBA	0.388	0.000	Supported
H8: PF = > VBE	0.549	0.000	Supported
H9: PF = > VBA	0.102	0.048	Supported
H10: VBE = > VBA	0.200	0.000	Supported
H11: VBE = > PI	0.233	0.000	Supported
H12: VBA = > PI	0.093	0.044	Supported
H13a: TA x VBE = > VBA	**-0.056**	**0.110**	**Unsupported**
H13b: TA x VBE = > PI	0.142	0.002	Supported
H13c: TA x VBA = > PI	0.085	0.039	Supported
(Source: Created by authors)			

5.4. Mediating Effects

Bootstrapping results confirmed significant mediating pathways. Playfulness exerted a robust indirect effect on PI (β = 0.148, p < 0.001) and VBA (β = 0.110, p < 0.001). Similarly, perceived diagnosticity indirectly influenced PI through VBA (β = 0.071, p < 0.05). These findings suggest that the "Stimulus" (VR features) translates into "Response" (Purchase Intention) largely through the "Organism" states of enjoyment and information processing, validating the S-O-R logic in this context.

5.5. Moderation Effects

The moderation analysis yielded nuanced findings regarding Technology Anxiety (TA). H13a was unsupported (β= − 0.056, p = 0.110), indicating TA does not dampen the impact of brand experience on purchase intention. However, contrary to the original expectation that anxiety would weaken relationships, H13b and H13c were supported with positive coefficients (β = 0.142, p = 0.002; β = 0.085, p = 0.039). This implies that Technology Anxiety strengthens the relationship between Virtual Brand Authenticity and Purchase Intention.

Interpretation

This counterintuitive finding suggests a risk-mitigation mechanism. Consumers with higher technology anxiety may feel uncertain about the virtual environment. Consequently, they rely more heavily on cues of Brand Authenticity to judge trustworthiness before forming purchase intentions. For anxious users, authenticity serves as a critical reassurance anchor; thus, when authenticity is perceived as high, its conversion to purchase intention is stronger than for non-anxious users who might be more comfortable navigating the tech regardless of authenticity cues. Conversely, the inclusion of perceived diagnosticity as a moderator (if applicable in your specific new text, otherwise stick to TA) highlights that informational utility can reinforce emotional engagement.

6. Discussion

The purpose of this study was to investigate how virtual reality (VR) marketing influences consumer experience, perceived brand authenticity, and purchase intention. The findings demonstrate that immersive VR environments stimulate key psychological responses—telepresence, perceived diagnosticity, and playfulness which subsequently shape consumers' perceptions of brand experience and authenticity. These results suggest that VR marketing operates not merely as a technological interface but as an experiential stimulus that influences both cognitive evaluations and emotional engagement with brands.

Consistent with prior research, the findings indicate that VR environments significantly enhance telepresence, perceived diagnosticity, and playfulness. Previous studies have shown that immersive technologies create vivid and interactive environments that increase users' sense of presence and engagement (Yim et al., 2017; Flavián et al., 2019). The present study extends this literature by showing

that these three experiential dimensions play complementary roles in shaping consumer perceptions. Telepresence primarily strengthens the psychological feeling of “being present” in the virtual environment, while perceived diagnosticity enhances the informational value of the experience by helping consumers evaluate product attributes more effectively. Together, these elements suggest that VR marketing can simultaneously support both experiential immersion and cognitive evaluation during the consumer decision-making process.

Among the examined constructs, playfulness emerged as the strongest predictor of virtual brand experience. This finding provides an important insight into how consumers interact with immersive technologies. Unlike traditional online environments, VR experiences encourage exploration, interaction, and voluntary engagement. When users perceive the environment as enjoyable and entertaining, they are more likely to spend time interacting with the virtual setting, which intensifies immersion and emotional involvement with the brand. In this sense, playfulness functions as a motivational mechanism that encourages deeper participation in the virtual experience. This finding aligns with experiential marketing theory, which emphasizes that emotional engagement and enjoyment can significantly enhance the memorability and impact of brand experiences.

The results also reveal that telepresence, perceived diagnosticity, and playfulness positively influence both virtual brand experience and perceived brand authenticity. This suggests that authenticity in VR marketing may emerge through interactive experiences rather than solely through brand communication. When consumers experience an immersive environment that is both enjoyable and informative, they may interpret the brand as more transparent and credible. This finding supports the view that authenticity is not only a brand attribute communicated by firms but also a perception constructed through consumers’ experiential interactions with the brand (Napoli et al., 2014).

Furthermore, the findings demonstrate that both virtual brand experience and perceived brand authenticity significantly influence purchase intention. Consumers who experience vivid and meaningful interactions with a brand in a virtual environment are more likely to perceive the brand as authentic, which subsequently increases their willingness to purchase. This indicates that the value of VR marketing extends beyond immediate engagement. Immersive experiences can shape deeper psychological perceptions about the brand that ultimately influence consumer decision-making.

The moderating role of technology anxiety showed partial effects in the relationship between brand perceptions and purchase intention. While not all moderating relationships were significant, the findings suggest that consumers who feel more comfortable with technology are more likely to translate positive VR experiences into purchasing behavior. Conversely, higher levels of technology anxiety may reduce consumers’ confidence in relying on VR-based information when making decisions. This result is consistent with prior research indicating that consumers’ technological readiness can influence their responses to technology-mediated services (Meuter et al., 2003).

From a theoretical perspective, this study contributes to the Stimulus-Organism-Response (S-O-R) framework by clarifying how immersive technological stimuli influence consumer behavior through both

cognitive and affective mechanisms. Specifically, the findings highlight the distinct roles of telepresence (immersion), perceived diagnosticity (cognitive evaluation), and playfulness (emotional engagement) in shaping consumers' psychological responses within VR environments. By integrating these constructs into a unified framework, the study provides a more nuanced explanation of how immersive marketing technologies influence brand-related perceptions and behavioral intentions.

Importantly, the study also highlights the dominant role of playfulness in driving virtual brand experiences, suggesting that emotional engagement may play a particularly critical role in immersive digital environments. While informational value remains important, the findings indicate that the experiential enjoyment of VR interactions can significantly amplify consumers' connection with brands. This insight contributes to the growing literature on immersive marketing by emphasizing that the effectiveness of VR campaigns depends not only on technological sophistication but also on the emotional and experiential quality of the interaction.

Overall, these findings suggest that successful VR marketing strategies should balance informational usefulness with enjoyable and engaging experiences. By creating immersive environments that combine entertainment, interaction, and credible product information, brands can strengthen both consumer trust and behavioral intentions.

7. Conclusion

7.1. Theoretical and managerial implications

This study advances our understanding of consumer behavior in virtual environments by integrating UTAUT2, the S-O-R framework, and flow theory. The findings show that virtual world brand experience (VBE) and brand authenticity (VBA) mediate the impact of immersive experiences on purchase intention, demonstrating that virtual experiences are not just for entertainment but play a key role in reinforcing brand trust and driving purchase behavior. The inclusion of technology anxiety as a moderating variable reveals that consumers with higher anxiety levels have weaker links between immersive experiences and purchase intentions. In contrast, those with lower anxiety exhibit stronger engagement. This highlights the influence of psychological traits on digital marketing outcomes, particularly in immersive settings. The study also extends brand authenticity theory into the metaverse, showing that authenticity remains critical to trust and purchase motivation in virtual spaces.

From a managerial perspective, the study offers practical insights for brands using VR, AR, or metaverse marketing. Marketers should design immersive, interactive, and personalized experiences that foster emotional engagement and enhance brand connections. Maintaining brand authenticity across all touchpoints is essential for building consumer trust. Additionally, addressing technology anxiety through clear guidance and user-friendly designs will improve consumer engagement, especially among those less comfortable with technology. Tailoring experiences based on technological readiness will help brands maximize engagement and conversion rates in immersive commerce.

7.2. Limitations and future research

This study, while contributing significantly to the understanding of consumer behavior in immersive marketing, has several limitations. First, the data were collected exclusively from consumers in Vietnam, limiting the generalizability of the findings to other cultural or economic contexts. Future research should consider cross-cultural and multi-market studies to explore how cultural values, digital infrastructure, and familiarity with immersive technologies affect responses to virtual brand experiences. Second, the study used a cross-sectional design, which restricts causal inference. Future studies could adopt longitudinal or experimental designs to track dynamic changes in experience, authenticity, and purchase intention over time. Third, while technology anxiety was explored as a moderating variable, other psychological factors such as privacy concerns, perceived enjoyment, and digital literacy could also influence consumer behavior in virtual environments. Incorporating these factors could offer a deeper understanding of consumer diversity in immersive settings. Lastly, the study primarily focused on brand-driven virtual experiences. Future research might examine user-generated or co-created virtual experiences to explore alternative insights into authenticity and brand engagement. Addressing these limitations will enhance theoretical frameworks and inform more inclusive and effective marketing strategies in immersive commerce.

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Declarations

Competing interests

The authors declare no competing interests.

Declarations interests statement

The authors declare no conflict of interest.

Ethical approval

Ethics approval for the research was granted by Ho Chi Minh Banking University and Publication Ethics Committee on 2.03.2025, under decision number HREC84. All procedures involving human participants followed the ethical standards of the institutional and national research committees and aligned with the 1964 Helsinki Declaration and its amendments.

Consent to participate

We provided detailed information to the participants about the purpose, scope and expectations of the study before they participated in the study. We explained the aims of the study, the information

requested from the participants, the data collection process and the method of using the data in a clear and understandable language. Before the research survey questionnaire, the participants received a consent form between March 2, 2025 and March 1, 2026, having read and understood the research's purpose. We informed the participants that participation in the study was completely voluntary and that they had the right to withdraw from the study at any stage. We obtained written informed consent forms from the participants. These forms indicate that the participants accepted the terms of the study and approved the use of their data for the purposes of the study.

Consent for publication

Not applicable.

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Author Contribution

Conception and design, Thi Thanh Hang Hoang, Van Dat Tran; methodology, Thi Thanh Hang Hoang, Hoang Uyen Nhi; analysis and interpretation of the data, Van Dat Tran; validation, Van Dat Tran; data collection, Thi Thanh Hang Hoang, Hoang Uyen Nhi Doan; writing—original draft preparation; Van Dat Tran: writing—review and editing, Van Dat Tran. All authors have read and agreed to the published version of the manuscript.

Data Availability

All data available on the https://doi.org/10.5281/zenodo.19379546

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Figures

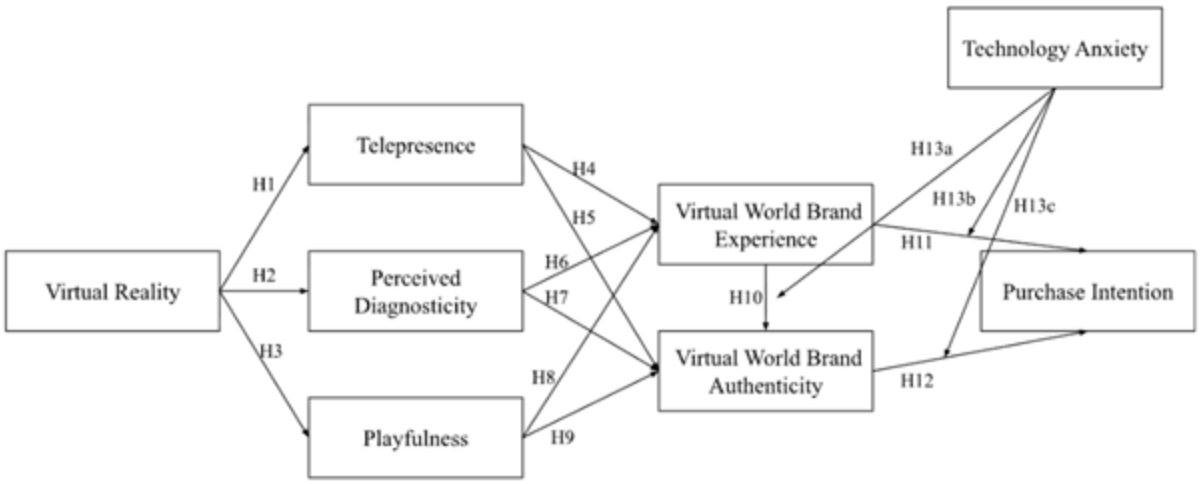


Figure 1

Proposed model framework

(Source: Created by authors)

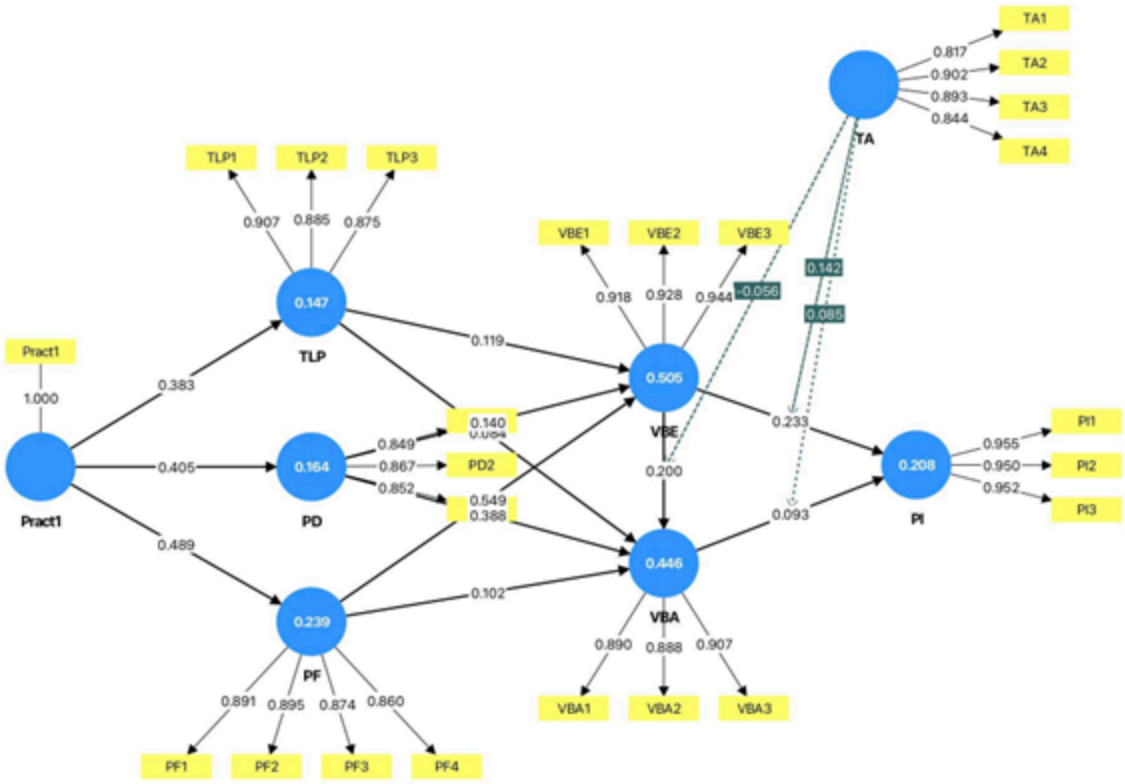


Figure 2

The path coefficients of the research model.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- DATASET.xls
- Questionaire.docx