International Review of Management and Marketing

ISSN: 2146-4405

available at http: www.econjournals.com

International Review of Management and Marketing, 2025, 15(1), 9-16.

Exploring the Mediating Role of User Engagement in the Relationship Between Immersive Experiences and User Satisfaction in Virtual Reality Gaming

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Received: 16 August 2024 **Accepted:** 09 November 2024 **DOI:** https://doi.org/10.32479/irmm.17343

ABSTRACT

This study aims to investigate the influence of virtual reality (VR) on immersive experiences, user satisfaction, and engagement, focusing on the emotional and cognitive dimensions that enhance the overall gaming experience. Conducted at VR Land Carthage in Tunisia (https://tunis.carthageland.com/fr/vr-land/), a platform offering immersive VR gaming, the research utilized both online and offline surveys, yielding 254 valid responses. Data were analyzed using Smart Partial Least Squares (PLS) 3, facilitating a comprehensive examination of the relationships among immersive experiences, user engagement, and satisfaction in VR gaming. The findings indicate a strong positive relationship between immersive VR experiences and user satisfaction, with user engagement acting as a mediator. Immersion significantly enhances the gaming experience; players emotionally connected to the game report higher satisfaction and increased likelihood of return. The study highlights the importance of interactive elements in fostering deep engagement. Limitations include a sample size constrained by time and accessibility, potentially affecting the generalizability of the findings beyond the Tunisian context. Practically, the research underscores the need for developers to enhance immersion through interactive features, such as social connectivity and adaptive storytelling, to boost player involvement and satisfaction, ultimately contributing to retention and success in the competitive VR gaming market. This research addresses a gap in empirical studies on user engagement and satisfaction in specific gaming environments, offering valuable insights for developers and researchers in understanding how immersive experiences drive engagement in VR gaming.

Keywords: Virtual Reality, Immersive Experiences, User Satisfaction, User Engagement, VR Gaming, Gaming Technology
JEL Classifications: O32, L86, M31

1. INTRODUCTION

Virtual reality (VR) is revolutionizing the video game industry, transforming how players interact with digital worlds (Ball, 2022; Castronova, 2007; Mario et al., 2008). As investment in VR technologies increases, the industry is shifting towards more immersive and interactive experiences that deeply engage users. Platforms like VR Land Carthage in Tunisia exemplify this trend, providing opportunities for users to immerse themselves in highly interactive and visually stunning virtual environments (LaValle, 2023). This research focuses on how VR affects user satisfaction and engagement by examining the cognitive and emotional factors that contribute to a successful gaming experience.

The growing use of immersive technologies in gaming has created new opportunities for developers to captivate audiences (Bennett et al., 2021; Bennett and Murphy, 2020; Kaur and Behki, 2024). Immersion, facilitated by 360-degree visuals and interactive elements, enhances emotional and cognitive connections to the game, making the experience more fulfilling (Calleja, 2011; Cheng et al., 2022; Feng, 2018). Understanding these dynamics is critical for developers seeking to deliver games that attract and retain

users. However, despite global interest in VR gaming, empirical data from emerging markets like Tunisia remains limited. This study aims to address this gap by analyzing user engagement and satisfaction in VR gaming at VR Land Carthage.

By collecting and analyzing data from 254 participants, this research will provide critical insights into the role of VR in enhancing the gaming experience and offer practical recommendations for developers looking to design more engaging and satisfying gaming environments. The findings will contribute to the growing body of literature on VR gaming, particularly in the context of localized innovations.

2. LITERATURE REVIEW

2.1. Immersive Experience (IE)

The concept of "immersion" is complex and multifaceted within the realm of video games. Achieving true immersion necessitates careful design and development, alongside mental readiness and active engagement from the user (Wang, 2023; Zhang, 2024). Various definitions describe this captivating experience of consciousness displacement, with "immersion" and "presence" as central ideas (Geniusas, 2022). While previous research has attempted to distinguish between these terms, they can be understood as either a proactive design function of the multimedia system—defined as "the extent to which a virtual environment immerses the user's perceptual system"—or as a reactive psychological response experienced by users during their interactions with the system.

From the system's perspective, immersion correlates with the richness of technologically mediated sensory experiences that enable a detachment from reality. Slater and Wilbur describe immersion as the extent to which a system provides users with an illusion of reality, encompassing several dimensions (Blackman, 2019; Chen et al., 2024; de Vasconcelos, 2021): (1) Inclusivity, where all attentional resources are fully engaged in the virtual world (Lovaglio, 2024); (2) Vastness, where the virtual environment accommodates multiple sensory modalities (Garner and Garner, 2018); (3) Surrounding, indicating a panoramic virtual space rather than a restricted field of view (Willemsen et al., 2009); (4) Vividness, ensuring high fidelity of stimuli (Al-Jundi and Tanbour, 2022); and (5) Matching, where sensory modalities are consistent, creating a coherent experience akin to real life (Biocca et al., 2001).

From the user's perspective, immersion triggers a series of psychological changes across attentional, emotional, cognitive, sensory, and memory dimensions (Agrawal et al., 2019; Alsina-Jurnet and Gutiérrez-Maldonado, 2010; Mancuso et al., 2023; Weber et al., 2021) characterize presence as a perceptual state that demands direct attention, resulting from the interaction between sensory stimuli, environmental cues, and personal predispositions. Consequently, the experience of presence depends on the level of attention users devote while navigating the physical space.

In summary, immersion is a multidimensional phenomenon shaped by the interplay of sensory data and cognitive processes, where attention plays a critical role (Nilsson et al., 2016). Presence in a mediated environment is enhanced when it is immersive and perceptually engaging, facilitating the formation of coherent mental representations (Pianzola et al., 2021). The more attentional resources users allocate to the mediated environment, the stronger their sense of presence becomes. (Agrawal et al., 2019; Agreval et al., 2019) define immersion as a psychological state characterized by the feeling of being enveloped or engaged in an environment that offers a continuous stream of varied sensory experiences.

Further research suggests that immersion can also be viewed as a mental simulation generated by immersive cues provided by the system, establishing a connection between system characteristics and user experiences (Calleja, 2011; Nilsson et al., 2016; Shin, 2019) defines immersion as a "response to a mental model of an environment that forms in the individual's mind based on a combination of external and internal cues." Users create mental representations through physical simulations and situated actions, facilitating grounded cognition and learning.

Additionally, some studies conceptualize immersion as "perspective-taking" (Ho and Ng, 2022; Schulz et al., 2019), whether spatial or emotional. Spatial perspective-taking involves "embodiment," referring to the sensorimotor ability to adopt the viewpoint of a virtual character. Emotional perspective-taking pertains to empathy, involving cognitive and emotional identification with that character. Both embodiment and empathy are fundamental forms of immersion in a virtual environment. This perspective-taking suggests that the attentional resources drawn to the virtual space by immersive stimuli activate multiple physiological and psychological processes simultaneously.

Despite the diversity of these definitions, there is a consensus that immersion represents "the enjoyable experience of being transported to a richly simulated place" (Johnson and Levine, 2008) and "the sensation of being surrounded by a completely different reality that captures all of our attention and perceptual apparatus" (Sadowski and Stanney, 2002). In conclusion, if we cannot precisely define a concept, we cannot measure it, understand it, or further develop it. The fundamental understanding of immersion is that it is an optimal mental state when users interact with a virtual system, where various physiological and psychological processes converge to create the transcendent experience of being present in a virtual space. Thus, we conclude that immersion inherently involves the concept of "embodiment."

Our concise definition of immersion in a virtual environment, framed within the context of Quality of Experience (QoE) assessment, is as follows:

Immersion in a virtual environment is a technology-mediated illusion that, through a mimetic system providing stimuli and cues, envelops an individual's senses and aligns their attention with a synthetic yet perceptually authentic reality, adopting the visuo-spatial and emotional perspectives of virtual agents, depending on one's imaginative capabilities and mental predispositions (Voordijk and Vahdatikhaki, 2022).

While the term "immersion" is commonly used in the video game industry, it faces definitional challenges akin to those encountered with engagement (Aeschbach et al., 2022; Goh et al., 2023). Some scholars define immersion as the sensation of being completely enveloped in a fictional gaming world (Qin et al., 2010), while others see it as being engaged in a gaming experience while still retaining some awareness of the real world (Brockmyer et al., 2009). Furthermore, many researchers tend to use immersion interchangeably with engagement (e.g., [Cairns et al., 2014; Kaplan□Rakowski and Gruber, 2024]). To deepen the understanding of immersion, (Ermi and Mäyrä, 2005) introduced the SCI paradigm, informed by observations of children during gameplay and interviews with both children and their parents. In this framework, immersion is categorized into three primary types: Sensory, challenge-based, and imaginative immersion (Agrawal et al., 2019).

As technology advances, gaming experiences have become richer and more engaging, largely due to immersive elements that captivate players. These experiences offer a genuine sense of presence in virtual environments, where design features such as responsiveness, interactivity, and user control heighten engagement (Shin, 2019). Unlike traditional gaming, where interactions may be limited, immersive gaming facilitates deep emotional and cognitive involvement, often eliciting responses similar to those in real-life scenarios (Lau and Agius, 2021; Lavoie et al., 2021).

Augmented reality (AR) has also emerged as an essential tool in creating immersive gaming experiences, enhancing gameplay by overlaying digital elements on the physical environment (Kaitane et al., 2024; Von Itzstein et al., 2024). AR enables players to engage with virtual objects in real-world settings, adding depth to the gaming narrative and increasing immersion (Shin et al., 2024). The use of AR enhances interaction, allowing players to feel as if they are part of the story (Arghashi and Yuksel, 2022). Technologies that integrate real-time data further enhance immersion, making the game world feel more dynamic and responsive to player actions (Calleja, 2011; Shin, 2019).

The role of immersive technologies in gaming is crucial for delivering memorable experiences. As (Scholz and Smith, 2016) argue, AR applications have significant potential to increase user engagement, making them a vital feature in modern gaming. The rise of AR-capable devices, such as smartphones, has opened exciting new possibilities for gameplay, reflecting a shift in how users interact with games and their surroundings (NETO, 2024).

2.2. User Engagement (UE) in VR Gaming

User engagement in virtual reality (VR) gaming refers to the emotional, cognitive, and behavioral responses players experience when interacting with immersive virtual worlds (Caldas et al., 2024). In the competitive gaming market, capturing and maintaining players' attention is crucial for developers aiming to create memorable and engaging experiences (Macklin and Sharp, 2016). VR gaming enhances user engagement by offering unprecedented levels of interactivity and immersion (Moreira et al., 2022). Unlike traditional games, where interaction is confined to a screen, VR allows players to actively participate in the game through natural movements, head tracking, and real-time feedback, leading to deeper emotional and cognitive involvement (Calleja, 2011).

VR transforms gaming by creating a sense of presence, allowing players to feel physically inside the virtual environment (Tamborini and Skalski, 2012). This immersive experience, combined with high levels of interactivity, greatly enhances user engagement, making gaming more memorable and enjoyable (Cairns et al., 2014). Rather than passively observing, VR players explore, interact with, and manipulate virtual worlds, effectively erasing the boundary between the real and the virtual. This heightened engagement not only increases player satisfaction but also encourages a greater likelihood of returning to the game (Wang, 2023).

As with AR, user engagement in VR gaming plays a central role in driving overall satisfaction and player retention (Zhang, 2024). The immersive and interactive nature of VR fulfills both practical and emotional needs, providing a personalized and dynamic experience for players (Papagiannakis et al., 2024). Ultimately, this contributes to higher levels of user satisfaction and loyalty, making immersive technologies indispensable in the evolving landscape of gaming (Shamim et al., 2024).

2.3. User Satisfaction (US)

User satisfaction in gaming is a crucial factor that significantly influences player retention and enjoyment (Zhang, 2024). It encompasses various elements, including gameplay mechanics, narrative depth, visual quality, and the social dynamics present within the game environment (Tao et al., 2021). Research indicates that players derive substantial satisfaction from immersive experiences that engage them both emotionally and cognitively (Shin, 2019). For example, games with rich storytelling and well-developed characters foster deeper connections, thereby enhancing overall satisfaction.

Additionally, the sense of achievement and progression is vital; players often seek challenges that align with their skill levels. This balance between challenge and competence can facilitate a state of flow—a concept described by (Csikszentmihalyi et al., 2014) as a deeply rewarding psychological experience. Moreover, user interface design and responsive gameplay are critical in shaping satisfaction. A well-designed interface can minimize frustration and improve usability, allowing players to focus on gameplay rather than struggling with controls (Gui and Zhao, 2024).

Furthermore, social interactions within multiplayer games can significantly enhance user satisfaction. Players often value teamwork, competition, and community engagement, leading to lasting friendships and a sense of belonging (Kim et al., 2022). Understanding these multifaceted aspects of user satisfaction is essential for game developers aiming to create compelling and enjoyable experiences that resonate with players, ultimately fostering loyalty and encouraging continued engagement in their gaming worlds.

3. THEORETICAL FRAMEWORK

Immersive experiences play a crucial role in enhancing overall user satisfaction in virtual reality (VR) gaming (Shelstad et al., 2017). These experiences, characterized by engaging multiple sensory modalities, create a rich foundation for user interaction within VR environments (Zhang and Song, 2022). Such immersive elements increase the perceived value of gameplay, resulting in heightened pleasure and satisfaction among users (Shin et al., 2024; Tao et al., 2021).

User interaction is a vital component that triggers active participation in user-content engagement. This interaction fosters a continuous connection between the mind, body, and computer-mediated environment, thereby deepening satisfaction derived from immersive experiences (Riva et al., 2014). For instance, VR gaming content allows players to engage in interactive experiences that significantly enhance their sense of immersion.

Not only does user engagement stimulate participation, but it also facilitates the creation of immersive experiences, which in turn bolster user satisfaction (Shin, 2019; Tao et al., 2021). Therefore, we propose that user engagement mediates the relationship between immersive experiences and overall user satisfaction in VR gaming.

Based on this theoretical framework, we propose the following hypotheses:

H1: Immersive experience positively affects user engagement.
H2: User engagement positively affects user satisfaction.
H3: Immersive experience has a positive effect on user satisfaction via user engagement (mediation).

Through these hypotheses, we aim to explore how immersive experiences and user engagement contribute to overall user satisfaction in the context of VR gaming (Figure 1). This investigation will clarify the mechanisms through which these elements interact, providing valuable insights for developers seeking to enhance player experiences.

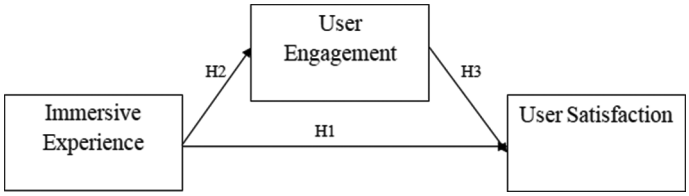
4. METHODOLOGY

4.1. Sample and Data Collection

This study focused on participants from VR Land Carthage in Tunisia, a leading platform for immersive virtual reality gaming experiences. A mixed-method approach was employed, incorporating both online and offline surveys.

A total of 254 valid responses were collected, ensuring diverse representation of VR gamers across different demographics. The survey instrument was designed to capture key variables related to immersive experiences, user engagement, and overall satisfaction.

Figure 1: Research model



Data were gathered using a convenience sampling method through structured questionnaires distributed to visitors at VR Land Tunisia between June 12 and July 15, 2024. Participants were screened to confirm their use of VR technology at the venue. Out of 154 collected questionnaires, 12 were excluded due to incomplete responses.

In addition to in-person surveys, online questionnaires were disseminated via various social media platforms, including Facebook, WhatsApp, Twitter, and Instagram. To ensure that online respondents had also experienced VR gaming at VR Land Tunisia, 112 valid online responses were included. Thus, the study utilized a total of 254 valid questionnaire responses.

The research is quantitative, with data collected through structured questionnaires divided into two sections. The first section captures demographic information of the participants, while the second includes:

- Five items to measure immersive experience (Cheng and Tsai, 2020).
- Four items to assess user engagement (Ardito et al., 2018).
- Four items to evaluate user satisfaction (Phan et al., 2016).

All statements were rated on a five-point Likert scale, ranging from "strongly disagree" (1) to "strongly agree" (5). This structured approach enabled a comprehensive analysis of the relationships among immersive experiences, user engagement, and user satisfaction in VR gaming.

4.2. Data Analysis

The model was tested using Smart PLS 3 (PLS-SEM), which allows researchers to predict complex models with multiple structures and indicator variables without imposing distribution assumptions on the data (Hair et al., 2011). This method is particularly effective for small sample sizes and does not require normality assumptions (Hair et al., 2019). Additionally, it employs resampling methods that provide robustness in analyzing indirect effects, surpassing classical tests such as the Sobel test.

Data analysis in Smart PLS occurs in two stages: The measurement model and the structural model (Hair et al., 2017). Reliability coefficients were calculated using Cronbach's Alpha (CA) and rho_A values. Composite reliability (CR) assessed internal consistency, while factor loadings and Average Variance Extracted (AVE) values were determined to evaluate convergent validity. Discriminant validity was examined using the Fornell-Larcker criteria and the Heterotrait-Monotrait Ratio (HTMT) tests.

In evaluating the structural model, several analyses were conducted, including multicollinearity analysis (Variance Inflation Factor - VIF), determination coefficient (R^2), effect size (f^2), predictive relevance (Q^2), and path analyses. This comprehensive approach ensured a thorough understanding of the relationships among immersive experiences, user engagement, and user satisfaction in VR gaming.

5. RESULTS

5.1. Participant Profiles

The demographics of the participants are summarized in Table 1. The demographics of the participants reveal a predominantly male (76.4%), young (76.3% aged 10-25), and student-focused sample, with a significant portion holding secondary (48%) or bachelor's degrees (38.2%). This profile suggests that the findings may reflect the perspectives of younger individuals, particularly those engaged in virtual environment. Given that the study is situated within the context of VR gaming in Tunisia, these demographics highlight the potential for VR experiences to engage a youthful audience, which could influence game design and marketing strategies. The majority low to moderate income levels (over 61% earning <1000 dt) may also indicate limited access to advanced gaming technologies, suggesting a need for affordable VR solutions to enhance accessibility for this demographic.

5.2. Measurement Model

This section describes the methodology used to test the proposed structural model using Partial Least Squares Structural Equation Modeling (PLS-SEM) with Smart PLS 3.3.3. The bootstrapping technique was applied to evaluate the hypotheses, ensuring robust results.

5.2.1. Reliability and validity assessment

The reliability of the model was confirmed through the calculation of Cronbach's Alpha (CA), Composite Reliability (CR), and rho_A, all of which exceeded the threshold of 0.70, indicating satisfactory internal consistency (Fornell and Larcker, 1981; Hair et al., 2019).

Convergent Validity was assessed through factor loadings and Average Variance Extracted (AVE), with all values exceeding the 0.50 threshold, demonstrating adequate convergent validity (Hair et al., 2019; Kaiser, 1974).

Discriminant validity was established by comparing the square root of the AVE values with the correlation coefficients among variables. The results showed that the square root AVE values were significantly higher than the correlation coefficients, fulfilling the Fornell and Larcker criteria (1981) (Table 2). Furthermore, the Heterotrait-Monotrait Ratio (HTMT) values remained below the 0.9 threshold, reinforcing the discriminant validity (Henseler et al., 2009) (Table 3).

5.2.2. Model evaluation

This study followed the two-step approach of Anderson and Gerbing to verify and test the model. The reliability and validity of the model were examined through PLS-SEM model evaluation. In the measurement model presented, both composite reliability and Cronbach's alpha for each construct were above 0.70, consistent with recommendations from (Hair Jr. et al., 2020).

All item loadings were >0.70, and the AVE values exceeded 0.50, indicating high-quality convergent validity. Results confirms that discriminant validity was assessed according to the Fornell–Larcker criterion, with all correlations lower than the square root of AVE, thus demonstrating proper discriminant validity.

Table 1: Sample composition of the quantitative study

Criterion	Category	Workforce	Percentage
Type	Male	194	76.4
	Woman	60	23.6
	Total	254	100
Age	10-15 years	88	34.6
	16-25 years old	106	41.7
	Over 25 years old	60	23.6
	Total	254	100
School level	Secondary	122	48
	Bachelor's	97	38.2
	Masters/engineer	33	13
	PhD	2	0.8
	Total	254	100
Socio-professional category	Student	212	83.5
	Employee	6	2.4
	Unemployed	36	14.2
	Total	254	100%
Income	<500dt	74	29.1
	500-1000 dt	82	32.3
	1000-1500 dt	53	20.9
	More than 1500 dt	45	17.7
	Total	254	100

Table 2: Structural model results

Hypothesis	Paths	B	t-value	f^2	Results
H1	IE→US	0.608	17.945***	0.983	confirmed
H2	IE→UE	0.790	19.269***	0.578	confirmed
H3	UE→US	0.690	16.255***	0.907	confirmed

***P<0.01, **P<0.05, IE: R2=0.696, Q2=0.489; US: R2=0.666, Q2=0.298; UE: R2=0.375, Q2=0.315

Table 3: Discriminant validity (Fornell–Larcker criterion)

Construct	IE	US	UE
IE	0.966	0.854	0.662
US	0.680	0.762	0.685
UE	0.865	0.818	0.864

The structural model results (Table 3) provide compelling insights into the relationships among immersive experiences (IE), user engagement (UE), and user satisfaction (US). Hypothesis H1, which posits that immersive experiences lead to user satisfaction, shows a strong path coefficient of 0.608 and a highly significant t-value of 17.945 (***P < 0.01). This indicates that immersive experiences considerably enhance user satisfaction, with a large effect size ($f^2 = 0.983$), suggesting a profound impact.

Hypothesis H2, which examines the relationship between immersive experiences and user engagement, reveals an even stronger path coefficient of 0.790, with a t-value of 19.269 (***P < 0.01). This confirms that immersive experiences significantly boost user engagement, with an effect size of 0.578, indicating a substantial effect.

Lastly, Hypothesis H3, which assesses the link between user engagement and user satisfaction, presents a path coefficient of 0.690 and a t-value of 16.255 (***P < 0.01). This further confirms

that higher levels of user engagement contribute to increased user satisfaction, supported by a large effect size of 0.907.

Overall, the R^2 values suggest that the model explains a substantial amount of variance in the dependent variables, with IE ($R^2 = 0.696$) and US ($R^2 = 0.666$) demonstrating strong explanatory power, while UE ($R^2 = 0.375$) indicates room for further exploration. The Q^2 values also reflect the model's predictive relevance, reinforcing the importance of immersive experiences and user engagement in enhancing user satisfaction in VR gaming.

6. DISCUSSION AND CONCLUSION

This research investigates the intricate relationships between immersive experiences, user engagement, and overall user satisfaction in virtual reality (VR) gaming. By employing a mixed-method approach and utilizing Partial Least Squares Structural Equation Modeling (PLS-SEM), the study provides compelling empirical evidence that user engagement mediates the relationship between immersive experiences and user satisfaction.

The findings indicate that immersive experiences significantly enhance user satisfaction, primarily through heightened user engagement. This emphasizes the critical role of sensory engagement in the VR gaming environment, suggesting that developers should prioritize creating rich, interactive experiences that capture users' attention and encourage active participation. The results confirm that immersion not only elevates satisfaction but also fosters deeper engagement, thereby reinforcing the overall gaming experience.

While this study contributes valuable insights into user interaction dynamics in VR, it also recognizes certain limitations. The reliance on convenience sampling from a single VR platform may affect the generalizability of the findings. Additionally, the subjective nature of self-reported measures introduces potential biases. Future research should explore these relationships across diverse contexts and populations, potentially incorporating more objective metrics to enhance the validity of the findings.

In conclusion, this study underscores the significance of immersive experiences and user engagement in shaping user satisfaction within VR gaming. By elucidating these relationships, it provides practical guidance for developers aiming to enhance user experiences, ultimately contributing to the growth and sustainability of the VR gaming industry. This research lays a solid foundation for future investigations that can further explore the factors influencing user satisfaction in immersive environments, paving the way for innovations that enhance user engagement in VR gaming.

6.1. Theoretical Implications

The findings from this study significantly advance the theoretical understanding of user engagement and immersive experiences in virtual reality (VR) gaming. By demonstrating that user engagement mediates the relationship between immersive experiences and user satisfaction, this research introduces a nuanced perspective to existing theories of user interaction in digital environments. Theoretical frameworks focused on user experience can now integrate the role of engagement as a crucial intermediary factor, offering a more comprehensive understanding of how immersive technologies influence user satisfaction.

Furthermore, the positive effects of immersive experiences on both user satisfaction and engagement underscore the critical importance of sensory engagement in enhancing user experiences. This supports the argument that VR developers should prioritize the creation of rich, immersive environments that stimulate multiple senses, thereby fostering deeper user involvement and satisfaction.

The study also emphasizes the dynamic interplay between immersion and engagement, suggesting that future research should delve deeper into this relationship to refine and expand theoretical models in the field. By aligning these findings with the proposed research model, scholars can better understand the pathways through which immersive experiences translate into user satisfaction, ultimately contributing to the development of more effective VR applications and enhancing the overall user experience.

6.2. Practical Applications

From a practical perspective, the insights gained from this study can guide developers and designers in the VR gaming industry. By recognizing the mediating role of user engagement, developers can focus on creating interactive content that not only enhances immersion but also fosters active participation. This could involve designing gameplay mechanics that encourage users to interact with the environment in meaningful ways, ultimately leading to greater satisfaction.

Additionally, the findings suggest that investing in high-quality immersive experiences can yield substantial returns in terms of user satisfaction. Developers should strive to create environments that captivate users' attention and encourage ongoing engagement, as this will likely enhance user loyalty and promote positive word-of-mouth, which is crucial in a competitive market.

6.3. Limitations and Future Research

Despite the contributions of this study, several limitations warrant consideration. First, the research employed a convenience sampling method, which may limit the generalizability of the findings. Participants were primarily drawn from a single VR platform in Tunisia, which may not represent the broader VR gaming audience. Future studies should consider diverse geographical locations and demographics to enhance the external validity of the results.

Second, the reliance on self-reported measures for assessing user engagement and satisfaction may introduce bias. Participants' perceptions can be influenced by various factors, including social desirability and recall bias. Future research should incorporate more objective measures or observational methods to validate the findings.

Lastly, while this study focused on the relationships among immersive experiences, user engagement, and user satisfaction,

further research could explore additional variables that may influence these relationships, such as individual differences in user preferences or prior experience with VR. Longitudinal studies could also provide insights into how user satisfaction evolves over time with repeated exposure to immersive experiences.

In conclusion, this study provides valuable insights into the theoretical and practical implications of immersive experiences and user engagement in VR gaming. By highlighting the importance of these factors, it paves the way for future research that can further explore and refine our understanding of user interactions in immersive digital environments.

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