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Structural relationship between perceived value, subject norms, consumer satisfaction, and intention to continue using virtual reality for sports viewing

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ABSTRACT

This study investigates the factors that influence sports audiences' sustained use of virtual reality (VR) during the COVID-19 pandemic. A survey was conducted among sports viewers in the Southwest region, and data were analyzed using correlation and structural equation modeling. The results indicate that perceived value significantly enhances subjective norms and consumer satisfaction, both of which positively impact the intention to continue using VR for sports viewing. These findings provide crucial insights into how perceived value, subjective norms, and consumer satisfaction drive the continued adoption of VR in sports, offering strategic implications for enhancing audience engagement within the industry.

Contribution/ Originality: This study is the first to empirically explore sustained VR use in sports viewing, providing new insights into consumer behavior.

1. INTRODUCTION

Digital transformation is actively applying VR technology in fields like shopping, products, and education [1]. A study estimates the global VR industry's value to be $11.64 billion in 2021, with a projected growth to $227.35 billion by 2029 [2]. Such rapid growth has made virtual reality technology a development trend in sports viewing, providing new opportunities for sports marketing [3]. These emerging technologies can enable consumers to watch sports games on a wider geographical scale. For example, they can watch sports games at home and have an immersive viewing experience [4]. In addition, researchers have found that virtual reality technology can not only improve the viewing experience of sports events, but also significantly affect consumers' loyalty, motivation, and behavioral intentions towards virtual reality services [5-7].

An urgent task facing sports marketers today is to adopt emerging technologies. These technologies are changing the way consumers participate in and watch sports, creating a host of challenges for sports organizations. While consumers can now more easily watch games at home, they also increasingly demand a better viewing experience. Therefore, the sports industry must keep up with these changes, provide better services, and satisfy audiences [8, 9].

Regarding these challenges, some researchers believe virtual reality can provide a unique perspective and enhance the experience of watching live sports events without geographical restrictions. However, some

researchers believe that the scope of sports VR content is still limited compared to traditional broadcast options. Even traditional viewers may resist the adoption of VR to watch sports programs [10]. In this regard, they are considering potential threats to the sustainability of VR sports, and the experience model of watching sports games through VR is not well understood.

Additionally, VR spectator sports events could be a potential business opportunity. If consumers continue to participate, there will be continued market demand, which can attract more investors and partners and promote the development and growth of the industry [11]. Consumers' intention to continue participating in VR spectator sports activities is significant to industry development, user experience, and market competition [12, 13]. Therefore, understanding and studying consumers' motivations and intentions for continued participation is crucial to promoting the development and growth of virtual reality spectator sports activities.

Previous research has pointed out the complex interrelationships between perceived value, subjective norms, consumer satisfaction, and behavioral intentions [14, 15]. For example, under the Technology Acceptance Model (TAM) framework, perceived value and subjective norms are essential factors affecting individual behavioral intentions [16]. Additionally, consumer satisfaction is a significant variable influencing individual behavioral intentions; specifically, consumers' satisfaction with virtual reality affects their behavioral intentions [17]. However, previous research has often failed to investigate why people intend to use VR in spectator sports.

This study, addressing this issue, modified the Technology Acceptance Model (TAM) to suit its purpose [18]. Expressly, the variable subjective norms, a construct from the Theory of Planned Behavior (TPB), were also incorporated [19]. As illustrated in Figure 1, this study constructed a structural equation model named the "Sports Audience Virtual Reality Watching Experience Model" to explore the subjective impact of perceived value when using virtual reality to watch games in the context of sports audiences, as well as the influence of norms and consumer satisfaction, and the impact of subjective norms and consumer satisfaction on behavioral intentions. This study aims to empirically examine consumers' attitudes and behaviors towards virtual reality sports viewing and gain a deeper understanding of the potential impact of virtual reality on the sports viewing experience. Sports marketers can gain valuable insights from this study, highlighting the significance of enhancing user experience and satisfaction to encourage the continuous application.

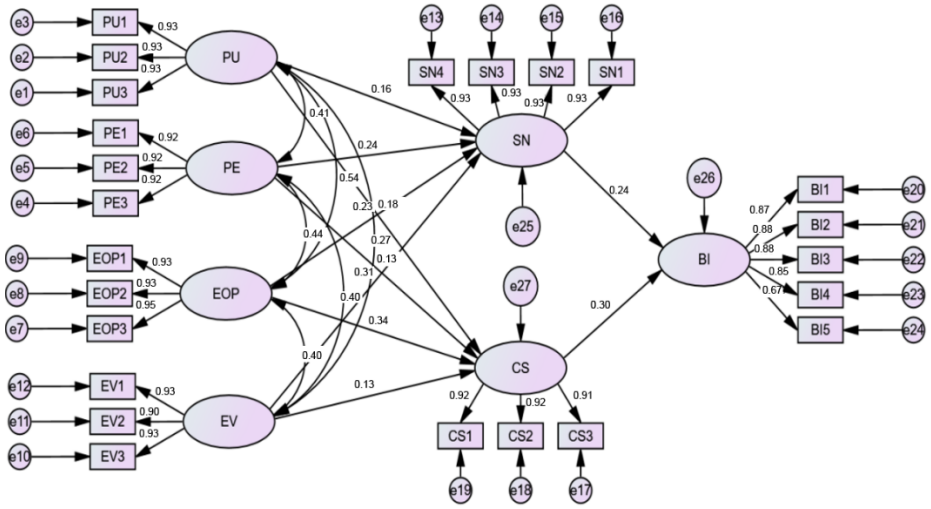

Figure 1. Sports audience virtual reality watching experience model.

This study examines the performance of sports consumers in southwest China when using virtual reality to watch sports events, aiming to investigate the various influencing factors on consumer behavior. The objective is to provide a more detailed analysis of the structural relationships between these variables, which will help reveal consumers' decision-making mechanisms regarding virtual reality spectator sports and subsequently offer more

targeted strategic suggestions for sports marketers and related practitioners. Through an in-depth understanding of these relationships, the results of this study can better comprehend consumer needs and preferences, optimize product and service design, enhance consumer satisfaction, and promote the sustainable development of virtual reality audience sports.

2. THEORETICAL BACKGROUND AND HYPOTHESIS SETTING

2.1. Perceived Value and Subjective Norms

Perceived value is defined as the value or attractiveness of a product or service in the minds of consumers [20]. However, over time, its definition has changed. 2011 recognized the complexity and multidimensionality of perceived value [21]. Therefore, perceived value is a key factor that can significantly influence consumers' purchasing decisions and overall perception [22, 23]. It not only affects consumers' immediate behavior, but also has a profound impact on their future intentions [24].

Some researchers believe that the complexity and multidimensionality of perceived value arise from the combination of various types of value perceived by customers [25, 26]. Among these, four key dimensions stand out: perceived usefulness, enjoyment, ease of use, and price value [10, 27]. Perceived usefulness is defined as "the extent to which a person believes that a particular system will enhance their job performance [28, 29]." Conversely, perceived ease of use refers to "the degree to which a person believes that using a specific system requires minimal effort [30]. The term "perceived enjoyment" describes the experience of using a technology as somewhat enjoyable, taking into account any potential performance consequence [31]. Eventually, economic value refers to consumers' evaluation of the efficiency and quality perceived by a product or service [32].

Perceived value plays an important role in interpreting subjective norms. Subjective norms refer to the tendency of individuals to exhibit behavioral intentions consistent with the expectations and pressures of others when they perceive them [33]. Some researchers believe that perceived value directly affects consumers' subjective norms, thereby influencing their behavioral intentions. When they believe a technology has high value, they are more likely to continue using it and recommend it to others [34, 35]. In addition, high perceived value will enhance consumers' sense of identification and belonging to technology. This feeling can prompt consumers to exhibit more positive attitudes and behaviors when using technology [36]. Furthermore, it will also increase social recognition. Consumer will experience a stronger sense of social recognition when they widely recognize a technology as having high value [37, 38]. This recognition comes not only from personal experience but also from the evaluation and recognition of the technology by others, which further enhances the influence of subjective norms [39].

Therefore, this paper believes that when consumers perceive the high value of watching sports events in VR, they are more susceptible to social expectations and norms. Thus, perceived value can not only enhance personal experience but also increase recognition and compliance with social norms. This shows that improving the perceived value of VR technology can effectively promote consumers' acceptance of and intention to use it [40]. Based on this, this paper proposes the following hypothesis.H1. Perceived value has a positive impact on subjective norms.

$H_{1\text{-}1}$: Perceived usefulness has a positive impact on subjective norms.

$H_{1\text{-}2}$: Perceived enjoyment has a positive impact on subjective norms.

$H_{1\text{-}3}$: Perceived ease of use has a positive impact on subjective norms.

$H_{1\text{-}4}$: Economic value has a positive impact on subjective norms.

2.2. Perceived Value and Consumer Satisfaction

People often view satisfaction as a multifaceted concept that stems from evaluating the results received against the fulfillment of expectations, purchase decisions, or desires [41]. In other words, consumers decide to continue or stop purchasing based on consumer satisfaction after purchase [42].

Many researchers have conducted extensive studies on consumer satisfaction, and these efforts clarify the consumer decision-making process [43-45]. Their findings pointed out that perceived value has a direct impact on consumer satisfaction. When consumers believe that a product or service has a higher perceived value, they tend to be more satisfied [46-48]. Therefore, by studying the relationship between perceived value and consumer satisfaction, we can gain insights into how individuals perceive the value of watching sports events in virtual reality and convert it into satisfaction with the experience. If users perceive a VR experience to be highly useful and valuable, they are likely to be more satisfied with their knowledge and hold a more positive attitude [49, 50]. Therefore, this article makes the following assumptions:

H_2: Perceived value has a positive impact on consumer satisfaction.

$H_{2\text{-}1}$: Product usefulness has a positive impact on consumer satisfaction.

$H_{2\text{-}2}$: Perceived enjoyment has a positive impact on consumer satisfaction.

$H_{2\text{-}3}$: Product ease of use has a positive impact on consumer satisfaction.

$H_{2\text{-}4}$: Economic value has a positive impact on consumer satisfaction.

2.3. Subjective Norms and Behavioral Intentions

Behavioral intention refers to a person's tendency or intention towards a specific behavior. It reflects an individual's desires and decisions in a particular situation and indicates the actions an individual may take to achieve a specific goal [51]. Research on behavioral intentions continues to explore its determinants and effects in various domains, such as health behaviors and technology adoption [52]. Additionally, there is growing interest in how digital and social media environments influence behavioral intentions, particularly in marketing and consumer behavior [53, 54].

Multiple studies have yielded contradictory findings regarding the relationship between subjective norms and behavioral intentions. Previous research has indicated that subjective norms may not have a significant impact on behavioral intention, as suggested by findings in studies [55, 56]. However, some studies show that subjective norms play a crucial role in explaining behavioral intentions. First, studies found that subjective norms positively impact behavioral intentions using virtual reality technology to learn [57, 58]. Second, for users who watch sports events in virtual reality, this sense of identity may come from interactions with peers and social media [59]. In addition, the support and encouragement of social circles can significantly influence consumers' decisions. For example, in using smart glasses and wearable AR devices, subjective norms significantly impact behavioral intentions [60-62]. This influence comes from the words and deeds of relevant social group members, whose words and deeds will influence the user's decision and enhance the user's status in the group [11]. These studies show that the influence of subjective norms on behavioral intentions in specific situations is crucial.

By studying the relationship between subjective norms and behavioral intentions, we can better understand the social pressure and expectations that users face when watching sports events in virtual reality and the impact of these factors on their behavior. Therefore, this paper proposes the following hypothesis:

H_3: Subject norms have a positive impact on behavioral intentions.

2.4. Consumer Satisfaction and Behavioral Intentions

Previous researchers found that satisfaction is the most critical factor affecting customers' behavioral intentions compared to other factors [63]. Suppose individuals are satisfied with the VR experience. In that case, they may be more likely to show behavioral intention to continue using it and be willing to choose VR technology to watch sports events again [64]. On the other hand, if individuals are less satisfied, it may affect their future behavioral intentions or even cause them to stop using the technology [65, 66]. Research frequently investigates how customer satisfaction affects various forms of consumer behavior. Enhancing customer satisfaction encourages customers to return to the store, suggest it to others, and extend their stay [67].

Recent research has explored this relationship in contexts such as virtual reality, sporting events, and consumer services, highlighting how satisfaction affects subsequent consumer behavior [68, 69].

Therefore, studying the relationship between consumer satisfaction and behavioral intention can help to deeply understand the impact of individuals' experiences when using virtual reality to watch sports events on their future behavior to improve the user experience of virtual reality technology and promote its sustainability. Use provides essential reference and guidance [64]. Therefore, this article puts forward the following hypotheses:

H_5: Consumer satisfaction has a positive impact on behavioral intentions.

3. RESEARCH METHOD

3.1. Participants

This study used Structural Equation Modeling (SEM) to investigate the impact of VR on sports viewing. Compared with previous studies, this study selected a population with sports viewing experience in southwestern China as the research object, rather than the general consumer group. To explore the impact of virtual reality on sports viewing, we collected samples from people in Southwest China who are interested in or have experience with VR. The questionnaire was distributed online through Questionnaire Star and WeChat. A total of 330 questionnaires were distributed, and 300 questionnaires were collected. Of these, after excluding 28 incomplete questionnaires and ten questionnaires that had never used virtual reality, 262 questionnaires were used in this study. Table 1 presents the demographic characteristics of the sample below.

Table 1. Demographic characteristics (N=262).

Variable	Option	Frequency	Percent
Gender	Man	106	40.50%
	Woman	156	59.50%
Age	Under the age of 20	18	6.90%
	20~29 years old	159	60.70%
	30~39 years old	52	19.80%
	40~49 years old	25	9.50%
	Over 50 years old	8	3.10%
Education	Below high school graduation	19	7.30%
	Tertiary institutions	37	14.10%
	University	128	48.90%
	Graduate student or above	78	29.80%
Amount spent	0 USD	59	22.50%
	US$100 to US$ 300	130	49.60%
	US$300 to US$ 500	52	19.80%
	Over 600 USD	21	8.00%

3.2. Measurement Tools

This study analyzed items from questionnaires measuring perceived value factors, subjective norms, consumer satisfaction, behavioral intentions, and demographic characteristics of the subjects. All questions in the survey were measured using a 5-point Likert scale for all items except for demographic factors.

The project on perceived value factors was measured using the tools used and revised to make it more suitable for this study [6]. There are 12 items of perceived value factors: 3 items of perceived usefulness, three items of entertainment experience, three items of perceived ease of use, and three items of price value.

The questionnaire utilized in the study was revised to better suit this research's aims. Subjective norm was assessed as a single factor comprising 4 items [5, 7]. Regarding the use of consumer satisfaction items, the instruments employed underwent revisions and supplementation to improve their suitability for this study [8]. Consumer satisfaction was a single factor, as measured using 3 items. Finally, the instruments utilized for measuring the behavioral intention factors [5] were revised for this study. Behavioral intention was assessed as a single factor comprising 5 items.

3.3. Validity and Reliability of the Measurement Tool

An expert group of full-time teachers and doctoral students specializing in sports management projects prepared the questionnaire, evaluated it to ensure it adequately covered the concepts to measure, and ensured each item was appropriate for this study.

Table 2 presents the results of the model fit test. After analyzing the demographic characteristics, confirmatory factor analysis (CFA) was conducted for each factor. The model fit indices were $\chi^2 = 289.756$ (df = 231.005, $p < 0.001$), $\chi^2/df = 1.254$, CFI = 0.991, TLI = 0.989, and RMSEA = 0.031, all of which met the established criteria.

To clarify, the Comparative Fit Index (CFI) assesses how well the model fits the data compared to a baseline model, with values close to 1 indicating a good fit. The Tucker-Lewis Index (TLI) is another fit index that adjusts for model complexity, with higher values also indicating a better fit. The Root Mean Square Error of Approximation (RMSEA) measures the model's fit per degree of freedom, with lower values indicating a better fit, typically less than 0.05.

Additionally, the Composite Reliability (CR) values and Average Variance Extracted (AVE) for each dimension exceeded 0.70 and 0.50, respectively. This indicates that the scales used to measure the variables in this study demonstrated adequate convergent and discriminant validity.

Table 2. Results of confirmatory factor analysis and reliability analysis (N=262).

Variable		Esti.	S.E.	C.R.	CR	AVE	α
Product usefulness	Using VR to watch sports events experience gave me the same feeling at a relatively lower price than in real life	1	0.038	26.293	0.949	0.860	0.948
	Using VR to watch sports events experience helps my life, for instance relieving stress	0.971	0.036	26.662			
	Using VR to watch sports events can help improve the quality of watching games	1.003					
Perceived enjoyment	Using VR to watch the game can feel content both mentally and physically	1.007	0.041	24.818	0.942	0.845	0.942
	Using VR to watch sports events is fun	0.978	0.040	24.544			
	Using VR to watch sports events makes me feel happy	1					
Ease of use a product	VR equipment is easy to use	1.002	0.034	29.712	0.955	0.877	0.956
	Learning to use VR equipment is easy	0.963	0.033	28.987			
	Interaction with VR devices is clear and easy to understand	1					
Economical value	VR equipment offers high value for money	1.001	0.039	25.663	0.942	0.845	0.942
	VR equipment is a good product for the price	0.965	0.040	24.195			
	VR equipment would be economical	1					
Subjective norm	I feel envy toward people who own a VR device	1.059	0.039	27.519	0.962	0.865	0.962
	Someone important to me thinks I should use VR to watch sports events	1.056	0.038	28.111			
	Someone I respect wants me to use VR to watch sports events	1.056	0.037	28.186			
	My friends support me using VR devices to watch sports events	1					
Consumer satisfaction	I am happy with my decision to use VR to watch sports events	0.981	0.041	23.755	0.940	0.839	0.940
	I'm so glad I decided to use VR to watch sports events	0.988	0.041	23.926			
	I believe I did the right thing when I decided to use VR to watch sports events	1					
Behavioral intentions	I will use a VR device in the future	1.191	0.095	12.545	0.919	0.695	0.915
	Using a VR device in the future is important to me	1.243	0.098	12.696			
	The likelihood that I will use the service of this device again is high	1.247	0.098	12.712			
	The likelihood that I would advise this device's services to a friend is high	1.193	0.096	12.407			
	If I had to do it over again, I would do the similar select	1					

In addition, Cronbach's A-coefficients are both above 0.7, the threshold for reliability assessment, certifying that the items all exceed the limits of good internal consistency reliability.

3.4. Data Analysis

This study used SPSS 23.0 (IBM, Armonk, NY, USA) and AMOS 26.0 (IBM, Armonk, New York, USA) for statistical analysis of the collected data, and conducted confirmatory factor analysis to test the effectiveness of the measurement tools.

4. RESULTS

4.1. Correlations Results

Table 3 shows the correlations between the variables in this study. The results show that all correlations are significantly positive with p values below 0.01. No multicollinearity issues were found, and the correlation coefficients between all variables were below 0.90.

Table 3. Correlation analysis between study variables (N=262).

Variable	PU	PE	EOP	EV	SN	CS	BI
PU	1(0.859)						
PE	0.388**	1(0.845)					
EOP	0.508**	0.411**	1(0.876)				
EV	0.254**	0.378**	0.372**	1(0.844)			
SN	0.435**	0.499**	0.513**	0.506**	1(0.864)		
CS	0.418**	0.376**	0.509**	0.339**	0.436**	1(0.838)	
BI	0.488**	0.418**	0.365**	0.309**	0.331**	0.381**	1(0.692)

Note: **p<0.01, () =AVE.

4.2. Hypothesis Testing

Table 4 presents the results of the hypothesis testing. The structural model demonstrated a satisfactory goodness of fit, with the following indices: $\chi^2 = 334.113$ (df = 236, $p < .001$), $\chi^2/df = 1.416$, TLI = .982, CFI = .985, and RMSEA = .040. These values indicate that the model fits well, and there are no issues with the hypothesis testing.

Table 4. Results of structural equation modeling (N=262).

Hypothesis test	Estimate		S.E.	C.R.	P
	B	*β*			
H1-1 Perceived usefulness → Subjective norms	0.154	0.155	0.059	2.606	**
H1-2 Perceived enjoyment →Subjective norms	0.242	0.239	0.059	4.091	***
H1-3 Perceived ease of use →Subjective norms	0.210	0.231	0.057	3.715	***
H1-4 Economic value → Subjective norms	0.305	0.307	0.055	5.508	***
H2-1 Perceived usefulness → Consumer satisfaction	0.173	0.178	0.065	2.669	**
H2-2 Perceived enjoyment →Consumer satisfaction	0.132	0.132	0.065	2.042	*
H2-3 Perceived ease of use →Consumer satisfaction	0.303	0.339	0.063	4.838	***
H2-4 Economic value →Consumer satisfaction	0.126	0.129	0.060	2.096	*
H3 Subjective norms →Behavioral intentions	0.172	0.245	0.046	3.719	***
H4 Consumer satisfaction →Behavioral intentions	0.217	0.303	0.048	4.516	***

Note: *p<0.05. **p<0.01. ***p<0.001

The findings validate Hypothesis 1-1, indicating that perceived usefulness significantly enhances subjective norms ($\beta = .155$, $p < .01$). Similarly, Hypotheses 1-2 through 1-4 are confirmed, showing that perceived enjoyment ($\beta = .239$, $p < .001$), perceived ease of use ($\beta = .231$, $p < .001$), and economic value ($\beta = .307$, $p < .001$) all positively influence subjective norms.

Hypotheses 2-1 through 2-4 are also supported, with results demonstrating that perceived usefulness (β = .178, p < .01), perceived enjoyment (β = .132, p < .1), perceived ease of use (β = .339, p < .001), and economic value (β = .129, p < .1) positively affect consumer satisfaction.

Hypothesis 3 is confirmed, showing a significant positive relationship between subjective norms and behavioral intentions (β = .245, p < .001). Lastly, Hypothesis 4 is supported, indicating that consumer satisfaction significantly impacts both behavioral intentions and the intention to use (β = .303, p < .001).

5. DISCUSSION

This study utilizes individuals who have engaged in sports viewing and consumption as research subjects to investigate the behavioral intention factor that motivate modern sports consumers to persist in using virtual reality for sports events. Based on previous research on virtual reality usage intention based on the TAM model, this study identified perceived value, subjective norms, and consumer satisfaction as key factors that may affect the continued use of virtual reality and quantified the correlation of these factors. In the light of the research findings, the following discussion is addressed.

First, there was a positive correlation between perceived value and subjective norms. This is consistent with previous research findings that perceived value positively impacts subjective norms [70-72]. The impact of perceived enjoyment and price value was relatively small. The effects of perceived enjoyment and price value were relatively small. The research results suggest that virtual reality providers should prioritize products usefulness and ease of use in their product design to enhance consumers' subjective norms. Therefore, when choosing virtual reality products, sports marketers should consider their usefulness and ease of use, improve consumers' usage efficiency, and provide consumers with an effortless operation process [73].

Secondly, perceived value had a positive impact on consumer satisfaction. This discovery is consistent with previous research findings [74-76]. They believe that when viewers use virtual reality to watch, higher perceived usefulness, enjoyment, ease of use, and price value will lead to higher consumer satisfaction. Therefore, sports marketers need to allow consumers to experience an experience different from traditional viewing and more convenient, fun and cost-effective [77].

Third, subjective norms had a positive impact on behavioral intentions to continue using VR viewing. Some previous studies have confirmed the positive relationship between subjective norms and behavioral intentions [78-80]. Therefore, sports marketers need to make consumers aware of the advantages of this experience when their perceived value increases, take the initiative to share it with others, and gain approval from others. This will help increase consumers' behavioral intention to continue using virtual reality to watch sports events.

Fourth, consumer satisfaction has had a positive impact on behavioral intentions to continue using virtual reality viewing. This finding is accordant with previous research showing that consumers with higher satisfaction levels have higher continuation intentions [81-83]. When consumers meet their expectations while using VR to watch sports events, their behavioral intentions for continued use also increase. This result highlights the importance of improving user experience and satisfaction with VR devices to promote users continued use of VR technology [84]. This means that manufacturers and developers can improve user satisfaction by continuously improving device functions and performance, thereby increasing user loyalty and continued usage and promoting the widespread application and development of virtual reality technology.

6. CONCLUSION

6.1. Implications and Limitations

This significant study quantifies the drivers of spectator use of VR to view sporting events and demonstrates that intrinsic motivation to use VR has a substantive and statistically significant impact. Implementing this innovative technology improves the collective experience of watching sporting events, providing viewers with a

more authentic, exciting, and attractive sports viewing experience. Sports marketers can implement participation in sports viewing by uploading some videos online. By providing consumers with an insider's perspective of major sporting events, marketers can engage a wider audience.

However, this study faces limitations in integrating its findings. First, due to practical constraints, the research focused solely on specific sports consumers in Southwest China, potentially resulting in limited findings. Additionally, by focusing solely on sports consumers in Southwest China, the results may be influenced by a specific cultural context. Lastly, the study's methodology presents inherent limitations. The research utilized only questionnaire surveys and structural equation modeling, omitting more comprehensive data-gathering methods such as in-depth interviews or field observations. Thus, while this study offers valuable insights into the potential impact of virtual reality technology on sports viewing, its limitations warrant attention, and its full scope and impact will require further exploration in future research.

6.2. Future Research Suggestions

Future research could consider broadening the sample base to encompass consumers across various countries and diverse cultural backgrounds. Additionally, it can delve deeper into enhancing user experience and satisfaction by improving device functionality and performance and offering more personalized services and content, thus encouraging the sustained use of virtual reality technology.

In conclusion, while this study offers valuable insights into the potential impact of VR on sports viewing experiences, it is important to acknowledge its limitations. Future research should focus on expanding the sample base, enhancing user experience and satisfaction, and addressing cultural differences to further advance the application and development of virtual reality technology in sports viewing.

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