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A Comparative Analysis of Satisfaction and Sustainable Participation in Actual Leisure Sports and Virtual Reality Leisure Sports

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Abstract: The advanced technology of virtual reality (VR) has brought about significant changes in our society, and leisure sports are no exception. The purpose of this study was to assess how leisure satisfaction with leisure sports and degree of sustainable participation affect men and women in actual sports and virtual reality (VR) sports. Exploratory factor analysis was applied to confirm scale validity and reliability, and multivariate analysis of variance and multiple regression were conducted for comparative analysis and linear relationships between variances. The results showed that while men typically participate in 'masculine' sports and women in 'feminine' sports, both genders equally enjoy the same types of VR sports. In terms of gender differences, female VR sport participants placed importance on educational leisure satisfaction and the intent of sustainable participation. Interestingly, there were no significant differences in the physical, psychological, or social leisure satisfaction factors, indicating no differences in satisfaction between performing actual sports and those in the VR environment. In addition, all factors except relaxation factor, had a positive impact on intent of sustainable participation. This study implied that VR sports offer an opportunity for people to be together, regardless of gender, and that it is becoming a part of healthy leisure sports culture.

Keywords: sustainable participation; leisure satisfaction; VR sports; gender differences; leisure

1. Introduction

The term 'virtual reality' first came into use at a time when computer programmer Jaron Lanier was developing helmets and glove interfaces for virtual reality. Virtual reality (VR) refers to technology that allows an individual to experience a realistic environment or situation within a virtual space [1]. A great advantage of this technology is that it triggers interest and entertainment regarding new domains that were not previously experienced in the real world through simulation [2,3]. This VR technology is being implemented in various fields today, particularly in the sports industry [4–6].

VR sports system use advanced technology to integrate motion feedback platforms with actual sports to provide users with the feeling of actual exercise in virtual reality and are expected to offer the considerable benefit of actual exercise effects through immersion [7]. Hence, it is popular among athletes in training or rehabilitation to improve their performance, as well as in school gym lessons and leisure [4]. Since the VR leisure sports industry affords anyone the opportunity to participate, it is becoming more widely used among the middle-aged and elderly in addition to young adults in their 20s or 30s.

Female sport participation has continuously increased over the last two generations, but there are still differences compared to male participation [8]. However, the traditional concepts of 'masculinity' and 'femininity' were imposed on men and women long ago [9,10], and these skewed perceptions regarding gender-created social and cultural biases may have kept women from participating in sports activities or punished them for it [11–13]. In other words, mistaken viewpoints regarding gender were a considerable obstacle hindering gender equality in the sport industry [14,15].

This phenomenon is exacerbated in Asian cultures with patriarchal cultures that expound Confucian ideals. Hence, this study will analyze the empirical differences in leisure satisfaction and intent of sustainable participation among participants of actual sports and participants of VR sports, which has recently been gaining wide popularity among men and women alike in Korea. This study will go one step beyond the assumptions that advanced devices will be useful to mankind in the fourth industrial revolution (4IR) by providing valuable data by verifying whether there are significant effects on its use based on gender.

2. Literature Review

VR systems using cutting-edge technologies were first introduced to American and European sport scenes at the beginning of the 1990s [16]. Typical sports where VR systems were applied include American football, archery, tennis, shooting, and golf, and VR systems were widely used for simulation trainings and mental training to enhance elite athletes' competing performance [16]. Although VR was first created to assist elite athletes with training, the application of VR is currently expanding to the area of leisure sports widely enjoyed by the public because VR provides a leisure environment that is free of various constraints faced in actual leisure sports [17]. VR golf, enjoyed by many as one kind of leisure sport, has been widely commercialized in the Korean VR sports market. VR continues to expand its scope to other sports such as baseball, soccer, and shooting. It is estimated that about 200,000 people enjoy VR golf on a daily basis in Korea [18]. Furthermore, the size of the VR golf market has become larger than the actual golf market [19]. A study reported that, surprisingly, an estimated 4 million people enjoy VR golf only instead of playing actual golf [19]. Multiple VR theme parks have recently been created, offering a wide array of enjoyable VR leisure sports. In sum, the VR-based leisure industry is consolidating its base as a sector of the leisure industry in its own right.

Leisure activities refer to non-work activities that can be freely selected and participated in by individuals [20]. They help today's busy individuals get away from their daily routine, reduce stress, and feel refreshed [21]. Leisure activities cover a range of activities: cultural activities such as music or art collecting and cooking; recreational activities such as watching TV, internet surfing, and drinking tea; and physical activities such as soccer, golf, tennis, bowling, swimming, and skiing. Among the leisure activities listed, leisure sports involving physical activity in particular offer a variety of benefits. However, for a variety of reasons, people may either participate in or refrain from participating in leisure sports, which play an extremely important role in the lives of individuals [22]. Earlier studies have reported that participating in leisure sports can lead to a physically healthy life [23] and may even have a significant impact on psychological well-being [24–26]. Furthermore, they provide an opportunity to share hobbies with other people and form efficient social interactions [27]. The experiences gained through leisure sports—which offer various positive physical, psychological, and social impacts—have been regarded as important pre-requisites that determine an individual's leisure satisfaction [28].

Satisfaction is an emotion experienced in countless aspects of human life, including social activities, interpersonal relationships, income, jobs, and leisure activities [29–31]. Specifically, leisure satisfaction depends on the extent to which one's desires are satisfied compared to one's expectations when an individual participates in leisure activity [32]. Many studies have reported leisure satisfaction as an important factor that increases a person's happiness and quality of life [33,34]; therefore, we can understand how important successful leisure activities are. In order to measure leisure satisfaction, Ragheb and Tate [28] developed the Leisure Satisfaction Scale (LSS), which includes six

factors: (a) psychological; (b) educational; (c) social; (d) relaxation; (e) physiological; and (f) aesthetic. Satisfaction is based on the difference between consumers' initial expectations and post-participation experience [35]. In this context, efforts are made to assess the extent to which leisure sports participation fulfills people's expectations so as to lead them to achieve a better life.

In general, high satisfaction with leisure sports is known to have a more positive impact on sustainable participation activities than other factors (e.g., participation motivation, service quality, perceived value, and so on) [36,37]. More specifically, positive emotions such as pleasure and fun deriving from participation in leisure sports enable participants to feel satisfaction [38,39]. A large number of existing studies have reported that they further lead to sustainable participation [38,39]. Considering the fact that finding new participants is six times more difficult than maintaining existing participants [40], research on satisfaction among existing leisure sports participants is necessary [41]. However, research has shown surprising results, in that 50% of people who first tried leisure sports do not continue their participation and quit within six months [42]. Moreover, after the consumers' determination of continuance (favorable behavioral intention), their psychological decisions would recur due to repeating leisure participation. Backman and Crompton [43] stated that the repeated decision-making process between discontinuance and confirmation for each leisure participation indicates the unpredictability of a given individual's leisure participation. Therefore, research on leisure satisfaction and intent of sustainable participation among leisure participants must be conducted from various perspectives. Considering the fact that continuous participation in leisure sports beyond a one-shot participation increases the quality of life, this makes a study of sustainable participation ever more important. Additionally, it is crucial to pay close attention to the aforementioned unpredictability of an individual's decision-making process for leisure participation, particularly in the new genres of leisure activity such as VR leisure sports treated in this study.

VR leisure sports offer great advantages not only to normal individuals, but also to those who have difficulties in participating in actual leisure sports due to a variety of constraints [17]. For this reason, VR leisure has started to gain wide popularity among people from a range of social backgrounds. However, most studies have been limited to virtual reality-related technologies like digital camera-based sensors or computer-based simulators [44]. Narrowing down this issue to the area of sports, physical activity programs using VR are highly useful for people with disabilities who find it difficult to participate in actual sports, and existing studies report that VR sports motivate them and induce their sustainable participation [45]. Recently published studies have also investigated VR golf from a marketing perspective [46,47]. These instances suggest that the VR environment can be largely applicable to sports; however, only little investigation has been made of this issue [48,49]. Therefore, this study established the following research questions for empirical testing.

Research Significance and Research Questions

As suggested in the above literature review, the VR leisure sports market continues to expand, but only a few existing studies have investigated the subject from a marketing perspective. In this context, this study attempted to investigate differences in the sports enjoyed by each gender among the participants of actual leisure sports and VR leisure sports. Furthermore, it aimed to demonstrate leisure satisfaction and intent of sustainable participation in participants of the two types of sports according to gender and to empirically demonstrate causality between these two important variables. The results of this study are expected to have a considerable impact across all leisure sports if a new leisure environment using VR can provide favorable leisure satisfaction and encourage the intent of sustainable participation, by going beyond the limits of reality. Moreover, examining differences in leisure sports behavior between men and women will increase our understanding of why women show a low participation rate in leisure industries. The findings can serve as basic data for projects that will largely help those who are unable to participate in actual leisure sports for various reasons.

Research question 1: What are differences in sports enjoyed by participants of actual leisure sports and VR leisure sports by gender?

Research question 2: What are the gender differences in leisure satisfaction and intent of further participation in actual sports and VR sports?

Research question 3: What leisure satisfaction factors drive the intent of further participation in actual sports and VR sports?

3. Materials and Methods

3.1. Participants

To assess the leisure satisfaction and intent of sustainable participation of people who enjoy leisure sports, including VR sports, this study contacted associates from seven VR sports theme parks located in South Korea and five community sports centers that are operated by the cities. Thereafter, the researchers conducted a survey from early February 2018 for about two weeks in 11 of these places, excluding 1 community sports center. These facilities were selected for the study because they had facilities for a variety of leisure sports, including baseball, basketball, soccer, golf, badminton, table tennis, yoga, swimming, and pilates, which made it easy to contact the participants of a variety of leisure sports.

First, study participants were given thorough information on the study's background, purpose, and duration (10 to 15 min) with a verbal consent form. It was announced that the questionnaire survey would be treated anonymously and would not be used for any other purpose outside the study. Participants were also informed that there would be no disadvantage for not participating in the study, and that they could quit answering the questionnaire at any time. Therefore, participants took part in the study voluntarily after giving consent. The questionnaire was self-administered. Specifically, study participants were asked whether they had any experience participating in VR sports or actual sports. Depending on the answer, each participant received a survey on the leisure sports they have experience practicing. A total of four groups were formed: (a) men who partake in actual sports; (b) women who participate in actual sports; (c) men who participate in VR sports; and (d) women who participate in VR sports. All respondents voluntarily answered the survey regarding leisure satisfaction and intent of sustainable participation. Out of 700 surveys that were distributed, 636 copies were collected. After excluding 22 incomplete surveys, a total of 614 surveys were used as data for this study. Of these, 326 were completed by men (53.1%) and 288 by women (46.9%); there were 314 participants who enjoyed actual sports (51.1%), and 300 participants who enjoyed VR sports (48.9%).

3.2. Measures

To measure the leisure satisfaction of participants in actual sports and VR sports, this study used the short version of the LSS first developed by Beard and Regheb [20] and recently redesigned by Kaya [43]. Earlier research showed acceptable scale reliability, with values of Cronbach's α ranging from 0.74 to 0.80. This scale included six factors: (a) psychological (e.g., "My leisure activity gives me self-confidence."); (b) educational (e.g., "My leisure activity provides opportunities to try new things."); (c) social (e.g., "My leisure activity has helped me develop close relationships with others."), (d) relaxation (e.g., "My leisure activity helps me reduce stress."); (e) physiological (e.g., "My leisure activity helps me to stay physical healthy."); and (f) aesthetic (e.g., "The place where I engage in my leisure activity is fresh and clean."); there were a total of 19 questions with 3 questions for each factor, except for educational satisfaction, which had 4 questions. Each question was measured on a five-point Likert scale (1 = 'strongly disagree' to 5 = 'strongly agree').

To measure intent of sustainable participation, this study utilized the scale created by Lee [50], showing excellent reliability ($\alpha = 0.88$). The instrument included one factor with four items dedicated to it (e.g., "I will continue to participate in this leisure activity.", "I would like to take part in this leisure activity continuously.", "This leisure activity is better than that I had expected.", and "It is possible for me to participate in this leisure activity later."). This scale was also measured on a five-point Likert scale (1 = 'strongly disagree' to 5 = 'strongly agree').

3.3. Data Analysis

Exploratory factor analysis (EFA) was performed in order to verify the validity of the research data. More precisely, principal component analysis (PCA) was used as the factor extraction method and the varimax method was used for factor rotation. In addition, Cronbach's alpha was calculated to verify the internal consistency of the questions. After this process, a multivariate analysis of variance (MANOVA) was conducted to compare and analyze the differences in leisure satisfaction and intent of sustainable participation according to gender and leisure environment (i.e., actual leisure and VR leisure sports). Last, the correlation and cause-and-effect relationships of variables were verified through correlation analysis and multiple regression analysis.

4. Results

4.1. Descriptive Statistics

Gender differences were analyzed regarding questions that asked the type of leisure sport the respondent enjoys with respect to actual sports. Over 95% of the participants in the sports of soccer (male = 42; female = 1), baseball (male = 39; female = 2), and basketball (male = 21; female = 1) were men, while there were significantly more women participants in yoga (male = 2; female = 52), pilates (male = 1; female = 33), and swimming (male = 8; female = 21). There was equal participation across men and women for golf (male = 20; female = 14), table tennis (male = 14; female = 10), and badminton (male = 10; female = 13).

Among VR sports, most of the participants enjoyed baseball (male = 61; female = 52), soccer (male = 49; female = 28), golf (male = 42; female = 45), and other sports (male = 9; female = 14), without any striking gender differences across sports types. Last, the four groups that were designed to fit the purpose of the study were (a) men who participate in actual sports (n = 165, 26.9%); (b) women who participate in actual sports (n = 149, 24.3%); (c) men who participate in VR sports (n = 161, 26.2%), and (d) women who participate in VR sports (n = 139, 22.6%) (Table 1).

Table 1. Frequency of distributions for variables.

Gender	**Male** n **= 326 (53.1%)**		**Female** n **= 288 (46.9%)**	
Sports	**Actual Sports** n **= 314 (51.1%)**		**VR Sports** n **= 300 (48.9%)**	
	Male	**Female**	**Male**	**Female**
Soccer	42	1	49	28
Baseball	39	2	61	52
Basketball	21	1	4	5
Golf	20	14	42	45
Table Tennis	14	10	2	3
Badminton	10	13	3	6
Yoga	2	52	-	-
Pilates	1	33	-	-
Swimming	8	21	-	-
etc.	8	2	-	-

4.2. Scale Validity and Reliability

Exploratory factor analysis using the PCA with Varimax on leisure satisfaction (19 items) and intent of sustainable participation (4 items) was conducted. The Kaiser–Meyer–Olkin (KMO) measure verified the adequacy of the sample for the analysis, KMO = 0.726, exceeding the standard criterion (0.70) [51]. Barlett's test of sphericity (χ^2 = 7259.130, df = 253, $p < 0.000$) was statistically significant. Seven extracted factors had eigenvalues greater than 1 and factor structure coefficients greater than 0.40. The factors accounted for 75.724% of the total variance.

All Cronbach's alphas showed acceptable internal consistency for reliability based on the 0.70 cutoff [52]: (a) physical (α = 0.799); (b) educational (α = 0.896); (c) social (α = 0.765); (d) relaxation (α = 0.839); (e) psychological (α = 0.847); (f) aesthetic (α = 0.874); and (g) intent for sustainable participation (α = 0.908) (Table 2).

Table 2. Factor structure matrix for variables.

	Factors						
Items	**Sustainable Participation**	**Educational**	**Aesthetic**	**Psychological**	**Relaxation**	**Physical**	**Social**
SP1	**0.911**	0.054	0.041	0.064	−0.003	0.026	0.079
SP4	**0.871**	0.018	0.058	0.070	0.045	0.070	0.065
SP3	**0.870**	0.077	0.020	0.081	−0.024	0.022	0.020
SP2	**0.855**	0.024	0.022	0.092	−0.007	0.078	0.065
E4	0.052	**0.896**	−0.024	0.024	0.010	0.012	0.016
E1	0.028	**0.872**	−0.041	0.020	−0.006	−0.016	0.017
E3	0.029	**0.870**	0.025	0.017	0.019	−0.018	−0.038
E2	0.057	**0.848**	0.012	−0.054	−0.028	0.042	−0.021
A1	0.027	−0.017	**0.932**	0.009	0.013	0.020	0.009
A2	0.043	0.049	**0.872**	−0.042	−0.031	0.018	0.022
A3	0.057	−0.059	**0.872**	0.027	−0.034	0.033	0.002
PS1	0.089	0.005	−0.002	**0.927**	0.007	0.018	0.037
PS2	0.107	0.007	−0.011	**0.859**	0.015	0.021	0.066
PS3	0.008	−0.008	0.006	**0.817**	−0.015	0.073	0.035
R1	0.011	0.023	−0.029	−0.013	**0.892**	−0.008	0.030
R3	0.004	0.005	−0.001	0.014	**0.880**	0.041	0.005
R2	−0.006	−0.031	−0.023	0.004	**0.836**	0.031	−0.009
PH1	0.053	0.002	0.014	0.042	0.032	**0.902**	0.030
PH3	0.014	0.068	0.044	0.055	−0.021	**0.849**	0.035
PH2	0.099	−0.047	0.011	0.016	0.051	**0.765**	0.036
S1	0.060	0.019	0.051	0.021	0.029	0.060	**0.859**
S3	0.107	0.065	0.018	0.079	−0.027	−0.019	**0.827**
S2	0.030	−0.102	−0.034	0.034	0.022	0.057	**0.771**
E−value	3.145	3.079	2.406	2.308	2.281	2.153	2.045
Variance (%)	13.676	13.386	10.460	10.033	9.916	9.361	8.893
α	0.908	0.896	0.874	0.847	0.839	0.799	0.765

SP = sustainable participation, E = educational, A = aesthetic, PS = psychological, R = relaxation, PH = physical, S = social; Factor structure coefficients of 0.40 or higher are in bold.

4.3. Multivariate Analysis of Variance

The multivariate analysis showed statistically significant differences by gender and leisure environment on leisure satisfaction and intent of sustainable participation (Wilks' lambda = 0.826, F (21, 1734.912) = 5.684, p = 0.00, partial η^2 = 0.062). Based on the adjusted alpha level using the Bonferroni correction (p = 0.05/7 = 0.007), univariate tests for (a) educational; (b) aesthetic; and (c) intent of sustainable participation were statistically significant. However, the rest of the tests were not statistically significant: (a) physical; (b) social; (c) relaxation; and (d) psychological as shown in Table 3.

The follow-up Tukey post hoc analyses revealed significant differences between female participants in educational leisure satisfaction and intent of sustainable participation, unlike the differences in the leisure sports environment. In other words, women who took part in VR leisure sports showed more leisure satisfaction and intent of sustainable participation from an educational perspective than did women who enjoyed actual leisure sports. For aesthetic leisure satisfaction, there were greater differences between leisure environments than between genders. In other words, participants of VR leisure sports were found to experience higher leisure satisfaction from an aesthetic perspective than participants of actual leisure sports. Table 4 shows more detailed average values.

Table 3. Results of MANOVA: differences in leisure satisfaction and intent for sustainable participation between four groups based on leisure environment and gender.

Source	DV	*df*	*F*	*p*	η^2
Leisure Satisfaction	Educational	3	8.702	0.000 ***	0.041
	Social	3	0.835	0.475	0.004
	Aesthetic	3	12.142	0.000 ***	0.056
	Relaxation	3	2.163	0.091	0.011
	Physical	3	1.796	0.147	0.009
	Psychological	3	0.864	0.460	0.004
	Intent for sustainable participation	3	12.327	0.000 ***	0.057

*** $p < 0.001$.

Table 4. Mean scores for leisure satisfaction and intent for sustainable participation among groups.

	Educational	Social	Aesthetic	Relaxation	Physical	Psychological	Sustainable Participation
Group 1	2.94	3.69	2.69	3.31	3.33	3.52	2.79
Group 2	2.74	3.77	2.79	3.03	3.57	3.36	2.79
Group 3	2.88	3.70	**3.19**	3.10	3.54	3.38	2.60
Group 4	**3.32**	3.60	**3.38**	3.08	3.44	3.37	3.33

Group 1 = men in actual sport; Group 2 = women in actual sport; Group 3 = men in VR sport; Group 4 = women in VR sport. Statistically significant higher mean scores between groups in bold.

4.4. Multiple Regression

The results of the multiple regression analysis had an explanatory power with the following result: $F = 8.795$, $p = 0.000$, $R^2 = 0.080$. In more detail, psychological ($t = 4.330$, $p = 0.000$), social ($t = 3.125$, $p = 0.002$), educational ($t = 2.414$, $p = 0.016$), physical ($t = 2.392$, $p = 0.017$), and aesthetic ($t = 2.062$, $p = 0.040$) factors from leisure satisfaction increased intent for sustainable participation, whereas relaxation, $t = 0.109$, $p = 0.913$, was not statistically significant (Table 5).

Table 5. Results of multiple regression.

Model	B	SE	β	*t*	*p*
(constant)	0.772	0.323		2.392	0.017
Educational	0.102	0.042	0.094	2.414	0.016 *
Social	0.157	0.050	0.123	3.125	0.002 **
Aesthetic	0.075	0.037	0.081	2.062	0.040 *
Relaxation	0.004	0.040	0.004	0.109	0.913
Physical	0.101	0.042	0.094	2.392	0.017 *
Psychological	0.182	0.042	0.170	4.330	0.000 ***

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

5. Discussion

There were significant results from the participants in this study in response to the question "What kind of leisure sports do you enjoy?". There were significant gender differences between the two different leisure sports environments (i.e., actual leisure and VR leisure sports). Specifically, in the actual sports context, men participated more in 'masculine' leisure sports such as baseball, basketball, and soccer; while women enjoyed more 'feminine' leisure sports such as yoga, swimming, and pilates. However, in the VR leisure sports context, both men and women enjoyed soccer, basketball, golf, and other sports without gender differences.

Although there has been a drastic increase in female participation in the sports industry [8], it cannot be denied that the industry is still dominated by men [11–13]. In this context, Bryson [53]

argued that there are differences in athletic performance between men and women because 'physical superiority' is emphasized in sports; hence, there are not enough sports that both genders can enjoy together. However, because VR leisure sports emphasizes a 'structure that allows people to play together' rather than 'physical superiority' as in actual leisure sports, they are now becoming 'participatory sports' rather than 'spectator sports' for women. As mentioned above, there is low female participation in the sports industry [54], but the appearance of VR leisure sports holds major implications in offering women a chance to participate in a variety of leisure sports with the help of advanced technology.

5.1. Significant Differences

In this study, VR leisure sports participants show greater satisfaction with aesthetic factors than actual sports participants. The cleanliness [55], beauty and spatial structure [56,57], and appropriate spatial arrangement [56] of a sports facility have been reported as very important factors for consumers. In this context, VR leisure sports involve an integrated cultural play-space that integrates advanced technology, a clean appearance, facilities, and structures in which people immerse themselves in the leisure activity. These can be understood satisfying participants' emotional aspects.

In terms of gender differences, female participants of VR leisure sports held a high perception of educational leisure satisfaction and intent of sustainable participation. With respect to this, Coakley [8] argued that there are not enough opportunities, such as sports programs or facilities, for women to achieve gender equality in the sports field. This implies that female participants, who were previously neglected in the leisure sports field, acquire game information or knowledge regarding a new type of game by gaining a chance to participate in VR leisure sports. In addition, the fact that women showed a relatively high intent of sustainable participation indicates the potential of VR leisure sports. The implication that technical advancements have allowed more people to participate in leisure sports is a meaningful result of this study.

5.2. Non-Significant Differences

In this study, there were no statistically significant differences among physical, psychological, or social factors in the leisure satisfaction of either actual leisure sports participants or VR leisure sports participants. This result is significant in showing that for the three factors with the highest average values across all factors, the satisfaction that is gained from doing actual leisure sports is no different from the satisfaction experienced in the VR environment. In other words, leisure sports are known to offer participants physical [23], psychological [24], and social benefits [25]; these benefits can also be offered through VR leisure sports. These results imply that leisure activities through VR can offer sufficient satisfaction and various benefits to people and demonstrate the potential of VR sports.

Last, this study on the leisure satisfaction of participants of leisure sports showed that all factors, except for relaxation, have a positive impact on intent of sustainable participation. Preceding studies have also reported that satisfaction with leisure is an important variable for increasing sustainable participation [36,37], and this study holds significance in that it proved this fact once again.

5.3. Practical Implications of This Study

One great advantage of VR leisure sports is that they do not depend on equipment, weather, or place because they are about experiencing an environment or situation of actual leisure sports in a virtual manner [17]. On the other hand, even though VR leisure sports do offer some indubitable advantages, it is a fact that a minority doubts whether VR leisure sports would be able to replace actual leisure sports [46]. This study demonstrated that VR leisure sports provide an opportunity to socialize with others regardless of gender, along with the aforementioned existing benefits. What is more important is that no significant difference was observed in physical, psychological, and social factors between actual leisure sports and VR leisure sports. This finding indicates that as there is no significant difference between actual leisure sports and VR leisure sports, it effectively refutes the

prejudice that VR sports are simply a game, and instead suggests that they can develop into a healthy leisure sports culture. These results may serve as a useful reference for busy workers, women, elderly people, and people with disabilities who are greatly constrained in participating in actual leisure sports for practical reasons. Finally, though VR sports are the main subject of this study, there has been only very little investigation of this issue because the popularity of and interest in VR sports has only just started to rise. The findings of this study, therefore, will offer useful data as a first step for further research.

6. Conclusions

In this study, men tended to participate in 'masculine' sports while women tended to participate in 'feminine' sports in terms of actual sports. However, VR leisure sports that have appeared through technological advancements in the 4IR era offer opportunities that are not only free of the restrictions of equipment, weather, or location restrictions, but offer a chance for both genders to play together [17]. Furthermore, a comparison between actual leisure sports and VR leisure sports, there were no significant differences in the physical, psychological, or social factors that are the sub-factors of leisure satisfaction. This shows that participants do not see these environments as different from each other and that VR leisure sports transcend the perception of a mere game to become part of a healthy leisure sports culture. Based on these results, future studies must analyze the impact of VR leisure sports on seniors, who are another vulnerable group of leisure sports participants. Moreover, a method that can improve the generalizability must be considered through various sampling methods.

This study has several limitations identified during the overall process of study. First, this study was conducted in Korea, where advanced technology-based VR leisure sports have been widely commercialized. Therefore, the study results are not generally applicable to other regions that do not have a similar environment. Second, the kinds of sports available in VR leisure sports are not as varied as actual leisure sports. It is thus hard to simply compare and analyze these two different types of sports. Finally, it cannot be ruled out that the leisure satisfaction in study participants might have come from satisfying their curiosity about such a new form of leisure environment. A longitudinal research approach may be necessary to examine changes that occur in the same subject over the course of time. It is recommended that future studies cover diverse samples from varied regions over a longer term.

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