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**Original Article**

# Effects of service quality attributes of public sports facilities on virtual reality experience among wheelchair users

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**Abstract**
This study explores the impact of service quality attributes in public sports facilities on the virtual reality (VR) experiences of wheelchair users, focusing on how these attributes influence user satisfaction and the intention to revisit. As VR technology becomes increasingly integrated into sports facilities, it is essential to understand the specific needs and preferences of wheelchair users, a demographic often underserved in sports environments. A survey was administered to 250 wheelchair users who had experienced VR in public sports facilities. The survey examined their perceptions of tangible elements, such as facility accessibility and equipment, as well as service quality attributes, including reliability, responsiveness, and staff competence. The data were analyzed to assess the relationship between these factors and their effect on overall satisfaction and the likelihood of revisiting the facility.The results reveal that tangible aspects, particularly the accessibility and quality of the physical environment, are significant predictors of revisit intention among wheelchair users. Interestingly, while reliability and responsiveness were not directly associated with revisit intention, they played a crucial role in shaping overall satisfaction. Satisfaction, in turn, was found to be a strong mediator, significantly influencing the intention to return to the facility. These findings underscore the importance of prioritizing tangible service quality attributes, such as well-maintained and accessible facilities, to enhance the VR experience for wheelchair users. Moreover, this study suggests that while intangible service elements like reliability and responsiveness are important, their influence on revisit intention is largely indirect, mediated through user satisfaction. Thus, public sports facilities should focus on improving both the tangible and intangible aspects of service quality to better serve wheelchair users, thereby enhancing their VR experience and encouraging repeat visits.
**Keywords: Service Quality Attributes; Virtual Reality Experience; Wheelchair User Satisfaction; Revisit Intention; Facility Accessibility**

## Introduction

Public sports facilities play a crucial role in advancing physical activity and sports participation (Kung & Taylor, 2014). These facilities are designed with accessibility in mind, incorporating modified equipment and specialized programs to meet the diverse needs of the community (Borgers et al., 2016). The removal of physical and social barriers within these environments is essential, empowering all individuals to engage in sports and promoting greater societal integration (Ratten, 2010). In South Korea, where approximately 2.49 million people live with disabilities, the need for inclusive design in public sports infrastructure is underscored by the mandate for these individuals to participate in sports to maintain their health (Kang & Kang, 2019). The integration of virtual reality (VR) technology in sports represents a significant advancement, offering individuals with disabilities the opportunity to engage in a broad range of physical activities (Yalon-Chamovitz & Weiss, 2008). This technological integration not only broadens access, but also creates shared spaces where individuals, regardless of ability, can interact and bond over common experiences (Benim et al., 2021). The development of wheelchair sports, initially a post-WWII rehabilitative practice, has evolved into a competitive discipline, highlighted by the prominence of wheelchair racing in Paralympic sports, covering everything from sprints to endurance events (Laferrier et al., 2012; Fuss, 2009).

This evolution emphasizes the need for continuous innovation in public sports facilities to ensure inclusivity and adaptability to the needs of all participants. Moreover, to compete effectively with private sports facilities and achieve high standards, public sports facilities must provide high-quality services to maximize user satisfaction (Bolton & Drew, 1991; Boulding et al., 1993). Enhancing service quality is critical to increasing consumer satisfaction, as users evaluate the value they want and how they perceive the value provided by public sports facilities (Zeithaml et al., 1996). Since service quality is determined by user perceptions, it is vital to measure the services provided by public sports facilities based on user evaluations (Parasuraman et al., 1988). Parasuraman, Zeithaml, and Berry (1985) developed the SERVQUAL model, a tool for evaluating service quality across five dimensions: tangibles, reliability, assurance, responsiveness, and empathy. Tangibles refer to the physical appearance of goods; reliability indicates the provider's ability to perform tasks dependably and


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accurately; assurance reflects the provider's courtesy, trust, and competence; responsiveness measures the provider's willingness to assist; and empathy assesses the provider's understanding of and attention to consumer needs. Research using the SERVQUAL model in sports centers has shown significant interest in understanding and improving the user experience within sports management (Tsitskari et al., 2006). Tsitskari, Tsiotras, and Tsiotras (2006) adapted the SERVQUAL model to the sports industry, offering innovative insights into service quality assessment in sports services. Additionally, Ramezanian et al. (2013) provided specific insights into perceived service quality within university sports facilities, emphasizing the unique expectations of the academic sports community. Collectively, these studies highlight the dynamic interplay between service quality, consumer satisfaction, and loyalty, reinforcing the integral role of the SERVQUAL model in driving continuous improvement in the sports sector. Public sports facilities must reflect the characteristics and needs of users, including key aspects such as accessibility, safety, and convenience (Lam et al., 2005). For wheelchair users, it is crucial that facilities are accessible, with amenities like disabled toilets and showers, and that exercise equipment and spaces are designed with safety in mind (Calder et al., 2018). Addressing this gap is essential for developing inclusive service strategies that cater to the needs of all users, including those with mobility impairments, ensuring equitable access to public sports facilities and the benefits they provide. Therefore, this study examined the relationship between service quality characteristics, consumer satisfaction, and revisit intention at public sports facilities with VR sports centers, specifically targeting wheelchair users. The findings from this study are expected to contribute to identifying improvement strategies for VR sports venues, ensuring that all users, including those in wheelchairs, have a more satisfactory sports experience.

**Material and Methods**

*Research Model*

This study analyzed the effect of service quality attributes of public sports facilities, which operate virtual experience venues, on the satisfaction and intention to revisit among wheelchair users. Consumer satisfaction refers to the degree of contentment that a user feels after utilizing a service or product (Oliver, 1999). Bitner (1990) prioritized consumer satisfaction over service quality, asserting that behavioral intentions follow accordingly. Taylor and Baker (1994) concluded that consumer satisfaction affects behavioral intentions, particularly noting that the interaction between these two variables has a more significant impact. Consumer satisfaction is a critical component in the operation of sports facilities, acting as a catalyst for repeat patronage and positive word-of-mouth (Paschalidou et al., 2023). Thus, high satisfaction levels correlate strongly with increased user loyalty, shaping the facility's reputation and long-term success (Matsuoka et al., 2003). Understanding and fulfilling consumer expectations are essential for the strategic management and sustainable operation of sports facilities (Schwarz et al., 2016). Service quality attributes have the potential to influence consumer satisfaction significantly. Tsitskari et al. (2006) demonstrated that service quality dimensions within sports services are significant predictors of overall customer satisfaction, reinforcing the importance of service quality in sports facility management. In the realm of virtual golf, factors such as the responsiveness of staff, the reliability of technology, and the tangibility of the virtual environment were shown to shape consumers' perceptions of value and satisfaction, ultimately guiding their future behavioral intentions and loyalty to the service (Choi et al., 2018). Therefore, this study proposes the following hypothesis.

*H1: The service quality attributes of public sports facilities operating virtual experience sports venues shall positively affect the consumer satisfaction of wheelchair users.*

Revisit intention refers to the extent to which a user is willing to re-engage with a specific service or facility. Oliver (1997) viewed the intention to revisit as one element constituting a subdimension of consumer loyalty, defining it as the desire to continue visiting or purchasing favored products or services. Additionally, Oliver (1999) described the intention to revisit as a behavioral intention associated with loyalty, suggesting that satisfied consumers are likely to visit frequently and make numerous purchases. Furthermore, Brady and Cronin (2001) clarified that revisit intention is the likelihood of a consumer being satisfied with a provided service and using it in the future. Revisit intention reflects an overall attitude towards the experience, involving the evaluation of the overall impression of that experience, meaning that consumers intend to revisit based on their past experiences (Stylos et al., 2016). Service quality attributes are acknowledged to influence revisit intentions, as affirmed by studies highlighting the importance of tangibility, reliability, responsiveness, assurance, and empathy in shaping consumer attitudes toward future engagements with service providers (Parasuraman et al., 1988). Enhanced service quality leads to greater customer satisfaction, which in turn impacts the likelihood of consumers returning to the service significantly (Zeithaml et al., 1996). Consumer satisfaction has been shown empirically to have a positive influence on revisit intentions. Oliver (1997) demonstrated that the level of satisfaction consumers feel after a service encounter predicts their willingness to return to the service provider significantly, suggesting that satisfaction serves as a determinant of repeat patronage. Several studies have investigated the relationship between customer satisfaction and revisit intention in sports facilities. For instance, Kim and Kim (1995) found that customer satisfaction was a significant predictor of revisit intention in fitness clubs. Similarly, Theodorakis et al. (2014) confirmed that both service quality and customer satisfaction were

key determinants of customers' intentions to revisit a sports center. Additionally, in exploring the dynamics between service quality and user behavior, Heskett et al. (1994) underscored the pivotal role of consumer satisfaction, identifying it as a moderating variable that influences the impact of service quality on behavioral intentions. Therefore, this study proposes the following hypotheses.

*H2: The service quality attributes of public sports facilities operating virtual experience sports venues shall positively affect the revisit intention of wheelchair users.*
*H3: Consumer satisfaction shall positively affect the intention to revisit.*
*H4: Consumer satisfaction shall have a mediating effect in the relationship between service quality attributes and revisit intention.*

Therefore, the research model investigates the relationship between the service quality of public sports facilities and both consumer satisfaction and revisit intention among adult wheelchair users. The research model depicted in Figure 1 illustrates the hypothesized relationships between service quality attributes, consumer satisfaction, and revisit intention in the context of public sports facilities that operate virtual experience sports venues for wheelchair users. The proposed research model indicates a flow from the quality of service provided by the public sports facilities to the satisfaction of the users, which in turn influences their intention to revisit the facility. This model underscores the importance of service quality in both satisfying consumers and encouraging repeat visits, particularly in the specialized context of virtual experience sports venues for wheelchair users.

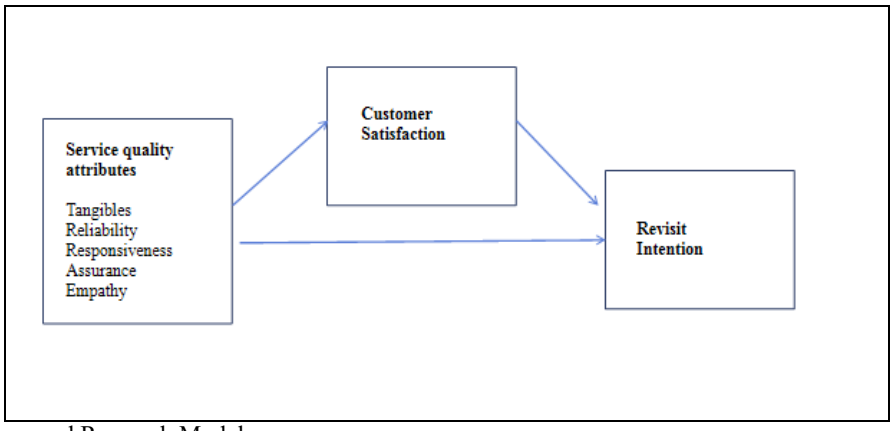


**Figure 1**. Proposed Research Model

*Research Instruments*

Table 1 details the composition and sources of research instruments used in the study, categorizing them under various variables and noting the number of items and their academic sources. Service quality attributes are divided into five subcategories: Tangibles, Reliability, Responsiveness, Assurance, and Empathy, each comprising 6 items. The sources for Tangibles include Grönroos (1984) and Parasuraman et al. (1991). Consumer satisfaction is assessed with 3 items, sourced from Cronin and Taylor (1992). Revisit intention is another variable with 3 items, for which the sources are Bitner (1990) and Maxham (2001). Additionally, the table includes Demographic characteristics as a variable with 4 items. In total, the research instruments consist of 40 items. To measure the variables, a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree) was used.

**Table 1.** Composition and sources of research instruments

| Variables | | Number of Items | Sources |
|---|---|---|---|
| Service quality attributes | Tangibles | 6 | Gronroos(1984), Parasuraman et al. [38] |
| | Reliability | 6 | |
| | Responsiveness | 6 | |
| | Assurance | 6 | |
| | Empathy | 6 | |
| Consumer satisfaction | | 3 | Cronin & Taylor [39] |
| Revisit intention | | 3 | Bitner [26], Maxham [40] |
| Demographic characteristics | | 4 | (-) |
| Total | | 40 | |

*Subjects and Data Collection*

This study was conducted over approximately two months, from February 1, 2024, to March 31, 2024, targeting 250 wheelchair users with experience in VR sports (such as racing and ball games) at five public sports facilities with VR sports centers located in the metropolitan area. Specifically, the researchers and research

assistants visited disabled individuals to explain the purpose and rationale of the research and distributed questionnaires to those who agreed voluntarily to participate in the survey. The survey method involved self-administered questionnaires, where the respondents filled in their responses and returned the forms on the spot. Additionally, this study adhered to the Declaration of Helsinki, ensuring that participants were fully informed about the research and consent was obtained through written consent forms. After excluding 15 questionnaires with inadequate responses, a total of 235 questionnaires were used for the final analysis.

*Data Analysis*

The collected data were statistically analyzed using the IBM SPSS 22.0 program (IBMCorp., Armonk, NY,USA). First, frequency analysis and descriptive statistics were conducted to understand the general characteristics of the respondents. Second, exploratory factor analysis and the calculation of Cronbach's α coefficient were performed to verify the validity and reliability of the research instruments. Third, correlation analysis was employed to explore the relationships between variables. Fourth, multiple regression analysis was utilized for hypothesis testing. Lastly, the significance level for the analysis was set at α=.05.

**Results**

*General Characteristics*

Table 2 presents the demographic characteristics of participants in the research. A disproportionate gender representation is observed, with males constituting a substantial 83.8% (197 subjects) of the sample, while females account for only 16.2% (38 subjects). The age distribution skews younger with the largest cohorts being those between 20-29 years and 30-39 years, which constitute 43.3% (102 subjects) and 36.5% (86 subjects) of the population, respectively. The groups aged 40-49 and those 50 years or older are less represented, comprising 14.8% (35 subjects) and 5.1% (12 subjects), respectively. Income brackets reveal that a majority, 51.5% (121 subjects), report earnings within the $2,000-4,000 range, 32.4% (76 subjects) earn above $4,000, and the remaining 16.1% (38 subjects) earn $2,000 or below. Duration of wheelchair use indicates 45.9% (108 subjects) have utilized a wheelchair for a decade or less, 30.6% (72 subjects) for a period between 10-20 years, and 23.4% (55 subjects) have exceeded two decades of usage.

**Table 2.** Demographic Characteristics

| Category | | Frequency | Percent |
|---|---|---|---|
| Gender | Male | 197 | 83.8 |
| | Female | 38 | 16.2 |
| Age(Year) | 20-29 | 102 | 43.3 |
| | 30-39 | 86 | 36.5 |
| | 40-49 | 35 | 14.8 |
| | ≥50 | 12 | 5.1 |
| Monthly Income (Dollars) | ≤ 2000 | 38 | 16.1 |
| | 2000-4000 | 121 | 51.5 |
| | >4000 | 76 | 32.4 |
| Wheelchair use period (Year) | ≤ 10 | 108 | 45.9 |
| | 10-20 | 72 | 30.6 |
| | >20 | 55 | 23.4 |
| Total | | 235 | 100 |

Table 3 provides descriptive statistics for various service quality categories in public sports facilities, including tangibles, reliability, responsiveness, assurance, empathy, consumer satisfaction, and revisit intention. For Tangibles, the facilities offering virtual reality sports experiences are considered modern, with a mean of 3.583, and the appropriateness of facilities has a mean of 3.527. Accessibility aspects like transportation and parking have a lower mean of 3.461, suggesting room for improvement. However, the neat appearance of employees scores higher at 3.847, with the cleanliness of places and equipment close behind at 3.806. Thus, the overall average for Tangibles is 3.647± .634. Under Reliability, with an overall mean of 3.746±.812, facilities are seen as dependable in delivering promised services, rating 3.762 for this item. Services provided within a set time are rated at 3.807, indicating timeliness. Quick problem resolution has a lower rating of 3.601, suggesting a potential area for improvement. Confidence in using the facilities is captured at 3.616, while security of personal consumer information is notably higher at 3.807. Trust in facility staff is also strong with a score of 3.822. Responsiveness has a slightly higher overall mean of 3.807± .798, reflecting the agility of staff interactions. Staff explanations of facility usage score highly at 3.881, showing good communication. Faithful responses to consumer questions and quick responses to consumer requirements are both solidly rated at 3.801 and 3.807, respectively. The ability to respond to accidents is scored at 3.846, indicating readiness to manage emergencies. Good information about future services is slightly lower at 3.652, and proactive help from employees is another strong point, scoring 3.847. In the Assurance category, public sports facilities are perceived as safe, with a mean of 3.834. The staff at these facilities are considered polite and courteous, scoring a mean of 3.841. Professionalism is indicated by a mean of 3.807 for providing professional answers to inquiries. Knowledge and experience offered by the staff are rated with a mean of 3.722, while the seriousness of staff attitudes receives a

mean of 3.761. Additionally, the cost of using public sports facilities is deemed appropriate by users, as reflected in a mean of 3.793. The overall mean for Assurance is 3.746±.578. The Empathy category, with an overall mean of 3.758±.573, assesses how public sports facilities and their employees relate to their consumers. Facilities are rated as very considerate of consumers' perspectives, scoring 3.807. The ability of employees to fully understand consumer needs is similarly high at 3.803. Taking an interest in each consumer is valued at 3.841, indicating a personalized approach to consumer care. However, the score for employees considering the interests of users is somewhat lower at 3.576. The provision of optimal service to consumers is rated at 3.807, demonstrating a commitment to quality service delivery. Lastly, the ease with which users can communicate their circumstances to employees is rated at 3.681, suggesting good two-way communication between staff and patrons. Also, the mean of consumer satisfaction is measured at 3.843±0.562, while the mean of Revisit Intention is registered at 3.561±0.614.

**Table 3.** Descriptive Statistics

| Category | Items | Mean ± Standard Deviation |
|---|---|---|
| Tangibles (3.647± .634) | Public sports facilities that provide virtual reality experience sports are modern. | 3.583± .637 |
| | Public sports facilities are equipped with appropriate facilities. | 3.527± .723 |
| | Accessibility to public sports facilities (transportation, parking, etc.) is convenient. | 3.461± .458 |
| | Employees of public sports facilities dress neatly and appear neatly. | 3.847± .629 |
| | The places and equipment of public sports facilities are clean. | 3.806± .511 |
| | There are various types and functions of virtual reality experience sports at public sports facilities. | 3.738± .739 |
| Reliability (3.746±.812) | Public sports facilities provide promised services. | 3.762± .443 |
| | Public sports facilities provide services within a set time. | 3.807± .645 |
| | Public sports facilities solve problems quickly. | 3.601± .543 |
| | Consumers can use public sports facilities with confidence. | 3.616± .726 |
| | Public sports facilities are strict about consumer personal information security. | 3.807± .734 |
| | I can trust the staff working at public sports facilities. | 3.822± .526 |
| Responsiveness (3.807± .798) | Staff at public sports facilities explain how to use them well. | 3.881± .634 |
| | Employees of public sports facilities faithfully respond to consumer questions. | 3.801± .729 |
| | Employees of public sports facilities respond quickly to consumer requirements. | 3.807± .732 |
| | Public sports facilities have the ability to quickly respond to various accidents. | 3.846± .828 |
| | Public sports facilities provide good information about future service provision plans. | 3.652± .727 |
| | Employees of public sports facilities voluntarily provide help. | 3.847± .626 |
| Assurance (3.746±.578) | I think public sports facilities are safe. | 3.834± .463 |
| | Employees at public sports facilities are polite and courteous. | 3.841± .576 |
| | Employees of public sports facilities provide professional answers to questions. | 3.807±. 629 |
| | Employees of public sports facilities provide knowledge and experience. | 3.722±. 623 |
| | The attitude of staff at public sports facilities is serious. | 3.761± .726 |
| | The cost of using public sports facilities is appropriate. | 3.793± .942 |
| Empathy (3.758±.573) | Public sports facilities are very considerate of consumers' perspectives. | 3.807± .632 |
| | Employees of public sports facilities fully understand the needs of consumers. | 3.803± .574 |
| | Public sports facilities take interest in each consumer. | 3.841± .667 |
| | Employees of public sports facilities consider the interests of users. | 3.576± .463 |
| | Public sports facilities provide optimal service to consumers. | 3.807± .618 |
| | Users of public sports facilities can easily tell employees about their circumstances. | 3.681± .713 |
| Consumer satisfaction (3.843±.562) | I am satisfied with the quality of service provided by public sports facilities. | 3.938± .726 |
| | I am satisfied with the exercise experience provided by public sports facilities. | 3.806± .733 |
| | I am overall satisfied with public sports facilities. | 3.732± .842 |
| Revisit Intention (3.561±.614) | I will continue to use public sports facilities. | 3.614± .617 |
| | I will recommend this public sports facility to others. | 3.652± .533 |
| | If I need to exercise, I will consider public sports facilities first. | 3.423± .672 |

*Analysis of Reliability and Validity*

Table 4 presents an exploratory factor analysis on participation intention, examining the relationship between various factors and their corresponding items. The analysis employs a Varimax rotation for the rotated component matrix, and five factors have been extracted. The "Tangibles" attribute includes six items (T1-T6)

that load heavily on Factor 1, with values ranging from .762 to .832, indicating that this factor is primarily associated with tangible aspects. The "Reliability" attribute is represented by six items (R1-R6), which load predominantly on Factor 2, with values from .694 to .807, suggesting that this factor captures elements related to reliability. The "Responsiveness" attribute is captured by six items (RS1-RS6) and is mostly associated with Factor 3, where the loadings range from .727 to .809, indicating a strong relation to responsiveness attributes. The "Assurance" attribute involves six items (A1-A6) with the highest loadings on Factor 4, values between .782 and .827, showing that assurance is a distinct factor. Lastly, the "Empathy" attribute comprises six items (E1-E6), which have the strongest loadings on Factor 5, ranging from .757 to .823, thus identifying empathy as a separate factor influencing participation intention. The eigenvalues for each factor range from 3.923 for Factor 1 to 1.433 for Factor 5. The percentage of variance explained by the factors ranges from 27.327% for Factor 1 to 5.487% for Factor 5, with a cumulative percentage increasing from 27.327% to 67.852% as additional factors are considered. Cronbach's alpha values for each factor indicate the reliability of the items, with Factor 4 showing the highest internal consistency at .834 and Factor 2 the lowest at .729. The Kaiser-Meyer-Olkin measure of sampling adequacy is strong at .841, indicating that the sample is suitable for the analysis. Bartlett's test of sphericity is highly significant with a value of 831.673 ($p<.001$).

**Table 4**. Exploratory factor analysis on participation intention

| Factors | Items | Rotated component matrix (Varimax) | | | | |
|---|---|---|---|---|---|---|
| | | Factor 1 | Factor 2 | Factor 3 | Factor 4 | Factor 5 |
| Tangibles | T1 | **.762** | .178 | .224 | .301 | .103 |
| | T2 | **.805** | .211 | .207 | .248 | .149 |
| | T3 | **.776** | .114 | .196 | .161 | .291 |
| | T4 | **.812** | .275 | .114 | .329 | .138 |
| | T5 | **.785** | .097 | .163 | .096 | .215 |
| | T6 | **.832** | .109 | .183 | .266 | .173 |
| Reliability | R1 | .204 | **.694** | .165 | .189 | .098 |
| | R2 | .163 | **.752** | .138 | .252 | .149 |
| | R3 | .212 | **.788** | .167 | .297 | .193 |
| | R4 | .185 | **.807** | .283 | .119 | .287 |
| | R5 | .138 | **.769** | .096 | .227 | .216 |
| | R6 | .176 | **762** | .213 | .267 | .168 |
| Responsiveness | RS1 | .283 | .245 | **.727** | .139 | .131 |
| | RS2 | .269 | .166 | **.693** | .215 | .114 |
| | RS3 | .157 | .179 | **.722** | .174 | .228 |
| | RS4 | .087 | .238 | **.764** | .099 | .114 |
| | RS5 | .194 | .135 | **.809** | .184 | .275 |
| | RS6 | .292 | .201 | **.781** | .132 | .183 |
| Assurance | A1 | .144 | .162 | .213 | **.782** | .182 |
| | A2 | .292 | .312 | .182 | **.821** | .169 |
| | A3 | .196 | .168 | .137 | **.767** | .133 |
| | A4 | .113 | .226 | .148 | **.809** | .225 |
| | A5 | .269 | .232 | .193 | **.811** | .218 |
| | A6 | .157 | .138 | .237 | **.827** | .114 |
| Empathy | E1 | .088 | .202 | .283 | .176 | **805** |
| | E2 | .243 | .163 | .097 | .134 | **.812** |
| | E3 | .285 | .224 | .211 | ,229 | **.761** |
| | E4 | .132 | .212 | .201 | .187 | **.823** |
| | E5 | .179 | .278 | .186 | .126 | **.757** |
| | E6 | .277 | .307 | .194 | .238 | **.729** |
| Eigenvalues | | 3.923 | 3.187 | 2.591 | 1.842 | 1.433 |
| % of variance | | 27.327 | 15.768 | 11.027 | 8.243 | 5.487 |
| Accumulated % | | 27.327 | 43.095 | 54.122 | 62.365 | 67.852 |
| Cronbach's α | | .757 | .729 | .806 | .834 | .812 |
| Kaiser-Meyer-Olkin test = 0.841, Bartlett's test= 831.673 ($p<.001$) | | | | | | |

Table 5 presents an exploratory factor analysis conducted on consumer satisfaction and revisit intention. The analysis employs a Varimax rotation for the rotated component matrix, revealing two factors. For consumer satisfaction (CS), which comprises three items (CS1, CS2, CS3), loadings are higher than 0.7 on Factor 1, indicating that the variables can be well represented by that factor. Revisit intention (RV), with items RI1, RI2, and RI3, shows a contrasting pattern where loadings are high on Factor 2, indicating that revisit intention is mainly related to Factor 2. The eigenvalues for Factors 1 and 2 are 3.862 and 2.738, accounting for 44.734% and 25.682% of the variance, respectively. The cumulative percentage of variance explained by the two factors is 70.416%. Cronbach's alpha values for Factor 1 and Factor 2 are .816 and .827, respectively, indicating good internal consistency for the items within each factor. The Kaiser-Meyer-Olkin measure of sampling adequacy is

.823, which is above the commonly accepted threshold of .6, suggesting that the sample is suitable for the factor analysis. Bartlett's test of sphericity has a value of 278.548, with a significance level of p<.001, indicating that the observed correlation matrix is not an identity matrix and is appropriate for factor analysis.

**Table 5**. Exploratory factor analysis on consumer satisfaction and revisit intention

| Factors | Items | Rotated component matrix (Varimax) | |
|---|---|---|---|
| | | Factor 1 | Factor 2 |
| Consumer satisfaction(CS) | CS1 | **.784** | .113 |
| | CS2 | **.822** | .148 |
| | CS3 | **.748** | .193 |
| Revisit intention (RV) | RI1 | .188 | **.767** |
| | RI2 | .367 | **.838** |
| | RI3 | .285 | **.759** |
| Eigenvalues | | 3.862 | 2.738 |
| % of variance | | 44.734 | 25.682 |
| Accumulated % | | 44.734 | 70.416 |
| Cronbach's α | | .816 | .827 |
| Kaiser-Meyer-Olkin test = 0.823, Bartlett's test= 278.548 (p<.001) | | | |

*Correlation Analysis*

Table 6 presents a correlation analysis of variables. Tangibles may have a strong positive correlation with Reliability (r = .692, p < .001), indicating that as tangible aspects of service quality improve, perceptions of reliability also tend to be higher. Responsiveness is significantly correlated with Reliability (r = .711, p < .001), suggesting that timely and efficient responses are associated with the overall reliability of services. A moderate positive correlation is observed between Assurance and Tangibles (r = .518, p < .05), while Responsiveness and Assurance are more strongly correlated (r = .654, p < .001). These results suggest that as the perception of safety and security (assurance) improves, so does the perception of the facility's responsiveness.

Empathy has a notable positive correlation with Reliability (r = .681, p < .001) and a moderate relationship with Responsiveness (r = .495, p < .01). The strongest correlation for Empathy is with Assurance (r = .678, p < .001), highlighting the importance of empathetic service as a component of consumers feeling secure and well-cared for. Consumer Satisfaction is strongly linked with Reliability (r = .753, p < .001), Responsiveness (r = .614, p < .001), and particularly Assurance (r = .814, p < .001). Finally, Revisit Intention has the strongest correlation with Tangibles (r = .802, p < .001), demonstrating that the physical aspects of the service environment are significant predictors of whether consumers intend to return. Additionally, Revisit Intention is highly correlated with Consumer Satisfaction (r = .797, p < .001), reinforcing the concept that satisfaction levels are predictive of repeat patronage.

**Table 6.** Correlation analysis of variables

| Category | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| 1.Tangibles | 1 | | | | | | |
| 2.Reliability | .692*** | 1 | | | | | |
| 3.Responsiveness | .573** | .711*** | 1 | | | | |
| 4.Assurance | .518* | .647** | .654*** | 1 | | | |
| 5. Empathy | .584** | .681*** | .495** | .678*** | 1 | | |
| 6.Consumer satisfaction | .622*** | .753*** | .614*** | .814*** | .783*** | 1 | |
| 7.Revisit intention | .802*** | .797*** | .673*** | .792*** | .748*** | .797*** | 1 |

*p<.05, **p<.01, ***p<.001

*Verification of Hypotheses*

Table 7 details the regression analysis on the effect of service quality attributes on consumer satisfaction, with their associated unstandardized (B) and standardized (β) coefficients, standard errors (SE), t-values, p-values, tolerance, and variance inflation factor (VIF) scores. The unstandardized coefficient for the constant is 1.322, which can be interpreted as the baseline level of revisit intention when all other variables are held at zero. Its standardized coefficient is 0.532, with a standard error of 2.468, and it is not statistically significant at the p < 0.05 level (p = .198). The model's goodness-of-fit measures indicate a strong fit with an $R^2$ of 0.812, which means that approximately 81.2% of the variance in revisit intention is explained by the model. The Adjusted $R^2$ of 0.761 accounts for the number of predictors in the model, still indicating a strong fit. The Durbin-Watson statistic of 1.837 suggests that there is no serious autocorrelation issue. Finally, the F-value of 16.891 with a p-value of less than .001 indicates that the model is statistically significant overall. The VIF values range from 1.482 to 1.885, which are all below the commonly used threshold of 5 or 10, suggesting that multicollinearity is not a concern in this model. The "Tangibles" attribute shows a positive relationship with revisit intention, with an unstandardized coefficient of 0.312 and a standardized coefficient of 0.352, although

this relationship is not statistically significant (p = .211). The "Reliability" attribute has an unstandardized coefficient of 0.334, but the standardized coefficient is negative (-0.396), which could suggest a coding error or a negative relationship when standardized (p = .339). "Responsiveness" attribute has a negative impact on revisit intention, with both unstandardized and standardized coefficients being negative (-0.482 and -0.469, respectively), which is not statistically significant (p = .489). Conversely, "Assurance" attribute is negatively associated with revisit intention with a coefficient of -0.482 and a standardized coefficient of -0.463, which is significant at the p < 0.01 level (p = .007). The "Empathy" attribute has a strong positive association with revisit intention, with the highest standardized coefficient in the model at 1.059 (p=.081). Therefore, Hypothesis 1 is partially accepted.

**Table 7.** Effects of service quality attributes on consumer satisfaction

| Variables | Revisit intention | | | | | | |
|---|---|---|---|---|---|---|---|
| | Unstandardized coefficient (B) | Standardized coefficient (β) | Standard error (SE) | t | *p* | Tolerance | VIF |
| (Constant) | 1.322 | | .532 | 2.468 | .198 | | |
| Tangibles | .312 | .352 | .243 | 1.302 | .211 | .823 | 1.589 |
| Reliability | .334 | -.396 | .389 | -.977 | .339 | .726 | 1.673 |
| Responsiveness | -.482 | -.469 | .457 | .712 | .489 | .747 | 1.482 |
| Assurance | -.482 | -.463 | .124 | -2.883 | .007 | .778 | 1.885 |
| Empathy | .921 | 1.059 | .502 | 1.849 | .081 | .693 | 1.668 |
| $R^2$=.812, Adjusted $R^2$= .761, Durbin-Watson=1.837, F-value=16.891, p-value<.001 | | | | | | | |

Note: VIF=Variance inflation factor

Table 8 illustrates the investigation into how various service quality attributes, specifically tangibles, reliability, responsiveness, assurance, and empathy, affect consumers' intentions to return to a service provider. The model's goodness of fit is indicated by an $R^2$ value of .817, suggesting that 81.7% of the variance in revisit intention is explained by the service quality attributes included in the model. The adjusted $R^2$ value of .779 accounts for the number of predictors in the model and indicates a high level of explanatory power. The Durbin-Watson statistic of 1.796 is close to 2, suggesting there is no significant autocorrelation in the residuals. The F-value of 16.428 with a p-value of less than .001 indicates that the model is statistically significant. The tolerance and VIF values for each variable indicate that there is no significant multicollinearity affecting the model, with all VIF values being well below the common threshold of 10. The “Tangibles” attribute show a significant positive impact on revisit intention, with a high standardized coefficient (β=.892, p=.003), indicating a strong and positive effect of tangible aspects of service quality on consumers' intention to revisit. The “Reliability” attribute, however, has a negative unstandardized coefficient (β=-.579, p=.173), suggesting a negative but not statistically significant impact on revisit intention. The “Responsiveness” attribute has a positive but not statistically significant influence on revisit intention (p=.382). The “Assurance” and “Empathy” attributes also show nonsignificant negative and positive impacts, respectively (p=.397, p=.458). Therefore, Hypothesis 2 is partially accepted, in that only Tangibles influences revisit intention significantly.

**Table 8.** Effects of service quality attributes on revisit intention

| Variables | Revisit intention | | | | | | |
|---|---|---|---|---|---|---|---|
| | Unstandardized coefficient (B) | Standardized coefficient (β) | Standard error (SE) | t | p | Tolerance | VIF |
| (Constant) | -.498 | | .782 | -.663 | .518 | | |
| Tangibles | 1.213 | .892 | .353 | 3.624 | .003 | .794 | 1.624 |
| Reliability | -.814 | -.579 | .567 | -1.431 | .173 | .736 | 1.761 |
| Responsiveness | .612 | .528 | .674 | .903 | .382 | .737 | 1.493 |
| Assurance | -.443 | -.303 | .513 | 869 | .397 | .768 | 1.784 |
| Empathy | .554 | .438 | .722 | .761 | 458 | .694 | 1.677 |
| $R^2$=.817, Adjusted $R^2$= .779, Durbin-Watson=1.796, F-value=16.428, p-value<.001 | | | | | | | |

Note: VIF=Variance inflation factor

Table 9 presents the effects of consumer satisfaction on the intention to revisit. The model's goodness of fit is reflected in the $R^2$ value of .642, indicating that approximately 64.2% of the variance in the intention to revisit is explained by consumer satisfaction. The adjusted $R^2$ value, which accounts for the number of predictors in the model, stands at .621, suggesting that consumer satisfaction is a strong predictor of revisit intention even after adjusting for the number of variables in the model. The Durbin-Watson statistic of 1.837 implies that there is no serious autocorrelation problem within the regression model, indicating that the residuals are independent of each other. Also, the tolerance value of .727 and the variance inflation factor (VIF) of 1.738 are well within acceptable limits, signifying that multicollinearity does not distort the results of the regression analysis. The analysis reveals that consumer satisfaction has a strong and positive relationship with the intention to revisit, as indicated by a significant unstandardized coefficient (B) of 1.143 and a standardized coefficient (β) of .814 (t=6.068, p<.001). Therefore, Hypothesis 3 is accepted.

**Table 9.** Effects of consumer satisfaction on revisit intention

| Variables | Revisit intention | | | | | | |
|---|---|---|---|---|---|---|---|
| | Unstandardized coefficient (B) | Standardized coefficient (β) | Standard error (SE) | t | p | Tolerance | VIF |
| (Constant) | -.498 | | .782 | -.663 | .518 | | |
| Consumer satisfaction | 1.143 | .814 | .193 | 6.068 | <.001 | .727 | 1.738 |
| $R^2$=.642, Adjusted $R^2$= .621, Durbin-Watson=1.837, F-value=36.863, p-value<.001 | | | | | | | |

Note: VIF=Variance inflation factor

Table 10 details the mediating role of consumer satisfaction in the nexus between service quality attributes and the intention to revisit. During Step 1, service quality attributes are shown to predict consumer satisfaction substantially, as indicated by an unstandardized coefficient (B) of .869 and a standardized coefficient (β) of .881. This positive relationship is strongly supported by a high t-value of 8.324, with an R-squared value of .772, demonstrating that 77.2% of the variation in consumer satisfaction can be accounted for by service quality attributes alone. The significant F-value of 69.283 at the .001 level further reinforces the model's robust fit. Advancing to Step 2, the analysis reveals that service quality attributes also have a substantial impact on revisit intention (B=1.203, β=.839, t=7.108). The R-squared value for this step is .712, suggesting that service quality attributes explain 71.2% of the variation in revisit intention. The model remains strong, evidenced by an F-value of 50.548, which is also significant at the .001 level. In Step 3, when the effects of both service quality attributes and consumer satisfaction are considered simultaneously, the influence of service quality attributes on revisit intention is still positive but insignificant (B = .382, β = .273, t=1.092, p>.05). However, consumer satisfaction emerges as a significant predictor of revisit intention (B=.864, β=.612, t= 2.484, p<.05). The R-squared value increases slightly to .718, and the F-value, though reduced to 26.087, remains significant at the .01 level. This demonstrates that consumer satisfaction serves as a complete mediator in the relationship between service quality attributes and revisit intention. Therefore, Hypothesis 4 is accepted.

**Table 10.** The mediating effect of consumer satisfaction in the relationship between service quality attributes and revisit intention

| Category | Independant Variables | Depentant Variables | *B* | *β* | *t* | $R^2$ | *F* |
|---|---|---|---|---|---|---|---|
| Step 1 | Service quality attributes | Consumer satisfaction | .869 | .881 | 8.324*** | .772 | 69.283*** |
| Step 2 | Service quality attributes | Revisit intention | 1.203 | .839 | 7.108** | .712 | 50.548*** |
| Step 3 | Service quality attributes | Revisit intention | .382 | .273 | 1.092 | .718 | 26.087** |
| | Consumer satisfaction | Revisit intention | .864 | .612 | 2.484* | | |

*p<.05,**p<.01,***p<.001

**Discussion and conclusion**

This study explored the impact of service quality in public sports facilities with VR centers on the satisfaction and revisit intentions of wheelchair users in South Korea. The research aimed to fill a gap by examining the relationship between service quality attributes, consumer satisfaction, and revisit intentions, focusing particularly on the needs of individuals with disabilities. The study utilized the SERVQUAL model, assessing five dimensions of service quality—tangibles, reliability, responsiveness, assurance, and empathy. Each attribute was measured using items validated by previous academic studies, emphasizing critical aspects for

wheelchair users, such as accessibility, safety, convenience, and staff professionalism. This study sampled 250 wheelchair users over two months, with 235 valid responses collected via self-administered questionnaires at various VR sports centers. The findings supported the hypothesis that service quality attributes positively influence consumer satisfaction (H1) and revisit intention (H2) among wheelchair users. Moreover, consumer satisfaction was found to have a positive effect on revisit intention (H3) and mediated the relationship between service quality attributes and revisit intention (H4). The regression analysis confirmed that tangible aspects of service quality influenced revisit intentions significantly. Specifically, "Tangibles" showed a significant positive impact on revisit intention, indicating that the physical elements of the sports facilities affect users' decisions to return substantially. In contrast, "Reliability," "Responsiveness," "Assurance," and "Empathy" exhibited nonsignificant relationships with revisit intention. This partial acceptance of H1 suggests that not all service quality attributes exert the same influence on satisfaction or revisit intention. Consumer satisfaction emerged as a strong predictor of revisit intention, confirming H3, and fully mediated the relationship between service quality attributes and revisit intention, supporting H4. These findings align with established theories and prior research emphasizing the pivotal role of tangible elements in shaping consumer perceptions and intentions. The positive correlation between consumer satisfaction and revisit intention found in this study corroborates the findings of Oliver (1997) and Brady and Cronin (2001), who posited that satisfaction is a key driver of loyalty behaviors, such as the intention to revisit. The findings are consistent with the service-profit chain model, highlighting satisfaction as a crucial link between service quality and consumer loyalty. The nonsignificant findings for some service quality factors may be attributed to the unique context of public sports facilities with VR sports centers catering to wheelchair users. This suggests that while tangibles are vital, other service quality attributes like empathy or responsiveness may not have a straightforward impact on revisit intention, possibly due to the specific needs and experiences of wheelchair users in VR sports environments. The results also imply that the SERVQUAL model's dimensions might require adaptation or further investigation in the context of VR sports experiences for disabled individuals. Comparing these results with other studies, it was found that integrating virtual reality (VR) with physical activities, such as FES cycling, significantly enhances physical function and user engagement in rehabilitation contexts (Duffell et al., 2019). Similarly, this study highlights the positive impact of modern, well-equipped facilities on user satisfaction and revisit intentions. Herbison et al. (2023) emphasized the importance of improving access to physical activities for people with disabilities, which aligns with our findings that tangible service quality attributes are critical for user satisfaction and return intentions. Lee et al. (2023) explored the current status of esports participation among people with disabilities in South Korea, underscoring the importance of accessibility and user experience in promoting engagement—findings that support the role of accessibility and facility quality as vital components of service quality influencing user satisfaction and revisit intentions. Furthermore, Vella et al. (2023) emphasized the mental health benefits of physical activity and the need for inclusive, well-managed sports facilities, which this study corroborates by showing that high-quality service and well-maintained facilities significantly enhance user satisfaction and encourage repeat visits. Sahoo and Choudhury (2023) discussed the broader implications of accessibility for equality and inclusion, which is crucial for public sports facilities aiming to serve all users effectively. This study underlines the importance of improving tangible aspects of service quality, such as accessibility and facility appropriateness, to significantly impact user satisfaction and loyalty, thereby promoting greater inclusion and participation among wheelchair users.

Therefore, this study confirms the significant role of service quality, particularly tangible attributes, in influencing consumer satisfaction and revisit intentions at public sports facilities with VR centers for wheelchair users. While tangible, such as the modernity of facilities and equipment, affects revisit intentions significantly, other dimensions of service quality, such as reliability and responsiveness, do not have a straightforward impact, highlighting the nuanced nature of service quality in VR sports environments. Consumer satisfaction has emerged as a robust mediator, establishing that it is not just the service quality attributes directly, but the satisfaction they engender that influences the likelihood of revisits. This aligns with established service-profit chain models, suggesting that quality leads to satisfaction, which in turn drives loyalty behaviors like revisits. The study's implications emphasize the importance of tangible improvements in public sports facilities to encourage revisits, stressing the need for a physical environment conducive to the specific needs of wheelchair users. Additionally, our findings highlight the importance of enhancing overall consumer satisfaction to foster loyalty, suggesting a complex interplay between service quality attributes and satisfaction. The limitations of this study include its specific focus on wheelchair users in South Korea, which may not represent the experiences of all individuals with disabilities or those in different cultural contexts. This study predominantly emphasizes tangible aspects of service quality, potentially overlooking subtleties of other attributes like empathy and assurance in the unique setting of VR sports. Lastly, the study's cross-sectional design does not allow for the observation of changes over time, limiting the ability to infer causality between service quality and revisit intentions. For subsequent research, it is recommended to adopt a longitudinal approach to observe the evolution of consumer satisfaction and revisit intentions over time. Additionally, expanding the scope to include diverse types of disabilities and cultural backgrounds will provide a more comprehensive understanding of service quality in public sports facilities globally. Further exploration into how non-tangible attributes of service quality impact consumer satisfaction in VR sports settings would also be valuable.

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