
Effects of Service Quality and Service Convenience on Customer Satisfaction and Loyalty in Self-Service Fitness Centers: Differences Between Staffed and Unstaffed Services

[Shan Sun](#) and [Younghwan Pan](#) *

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Article

Effects of Service Quality and Service Convenience on Customer Satisfaction and Loyalty in Self-Service Fitness Centers: Differences between Staffed and Unstaffed Services

Shan Sun and Younghwan Pan *

Department of Smart Experience Design, Graduate School of Techno Design, Kookmin University, Seoul 02707, Republic of Korea; thss18@kookmin.ac.kr

* Correspondence: peterpan@kookmin.ac.kr

Abstract: As an emerging model, self-service fitness centers are reshaping the consumer fitness experience globally. Given the crucial role of customer loyalty in the sustainable operation and management of fitness service enterprises, this study constructs a structural model incorporating service quality, service convenience, customer satisfaction, word-of-mouth intentions, and repatronage intentions. The model is designed to elucidate the factors and mechanisms impacting customer loyalty at self-service fitness centers and further investigates how these relationships are affected by service methods, either with staff or without staff. The study employs PLS-SEM to empirically analyze 552 customer questionnaires from four self-service fitness centers in first-tier cities in China. The results reveal positive correlations among the constructs in the structural model, emphasizing the important position of raising service quality standards and reducing the time and effort expended by customers in the management of customer loyalty. Concurrently, service convenience was found to play a significant driving role in customers' perceived service quality. Through the chain-mediating effect of service quality and customer satisfaction, service convenience exerts a considerable positive impact on word-of-mouth intentions and repatronage intentions. Moreover, the study reveals significant differences in these relationships when considering service methods, either with staff or without staff.

Keywords: service quality; service convenience; Satisfaction; Loyalty; Behavioral Intentions; Self-Service Fitness Center

1. Introduction

Leisure activities, such as fitness, are widely acknowledged to have positive impacts on individuals' physical and mental health, as well as their mood [1]. Fitness centers have emerged as pivotal players in this scenario, evolving into a conventional service to fulfill public fitness requirements [2]. Given the challenges of new customer acquisition and high attrition rates among existing customers in fitness center operations, customer loyalty becomes especially crucial in an intensely competitive industry environment [3]. With the rise in consumers' disposable income and further improvement in their quality of life, the propensity to participate in fitness activities and expectations for service quality at fitness centers have simultaneously increased. Hence, businesses are compelled to formulate customer-centric strategies, fulfilling customer expectations to carve a competitive advantage. Research indicates that service quality is among the primary factors influencing customer satisfaction, customer retention, and the long-term profitability of an organization [4–6]. Therefore, to foster customer loyalty and ensure sustainable operations, fitness centers must excel in service quality management [7].

Simultaneously, due to the profound impact of emerging technologies on people's lifestyles, consumers' demand for convenience has become more pronounced, especially concerning time-saving and effort reduction [8]. To meet consumers' requirements for convenience, the service industry has begun to invest more resources in improving service delivery, such as incorporating e-commerce, mobile payment, round-the-clock operation hours, data-driven recommendations, and

various applications, shifting their service strategy towards customer-centricity and convenience [9]. Research indicates that highly convenient services significantly contribute to enhancing consumers' behavioral intentions and loyalty [10].

In recent practice within the fitness service industry, the outbreak of COVID-19 has further accelerated this change. During the pandemic, the normal operation of fitness centers was heavily impacted due to strict restrictions on face-to-face service interactions, leading fitness centers to actively seek technology innovations to change service methods. Among these, technologies that enable service delivery without face-to-face interaction between customers and staff, such as self-service technologies, have been widely welcomed. In response to this change, previous studies have discussed the impact of some technologies on service management and marketing in fitness centers, such as virtual fitness classes, apps, and wearable devices [11–13]. The research results highlight the significant influence of convenience and service quality under these technology adoptions on customer satisfaction, future behavioral intentions, and willingness to continue participating in fitness activities. However, no research to date has explored the impact of self-service technology (SST) on service management in fitness services.

After the pandemic, more fitness centers began to fully adopt SST for service provision. In China, self-service fitness centers have become an important channel for promoting sports industry growth and have received strong support from government policies [14]. Empirical studies in other service industries have shown that the adoption of self-service technology not only changes the way customers and staff interact but also effectively enhances customer satisfaction and loyalty [15,16]. Self-service convenience stores, self-service gas stations, and self-service hotels have become typical applications of self-service technology. With the rapid development of the self-service fitness service model globally [3], consumers' acceptance of using technology for fitness activities is gradually increasing. Therefore, it is becoming increasingly important to research customer loyalty towards self-service fitness centers and explore how to improve their operational management level. Given the profound change of SST on the way of service interaction, understanding consumers' attitudes towards different service interaction methods in the self-service fitness environment also shows research and practical significance.

Therefore, this study aims to analyze the factors and mechanisms affecting customer loyalty in the current self-service fitness centers, through the relationships among service quality, service convenience, customer satisfaction, Word-of-Mouth (WOM) intentions, and repatronage intentions. In addition, testing the impact of different service methods, with or without the presence of staff, on the above relationships is another important theme of this study. In this process, we also make the following contributions. Firstly, loyalty measurement is carried out through two independent behavioral intentions structures - repatronage intentions and WOM intentions, rather than a single aggregate structure, thereby improving measurement accuracy and providing a more specific understanding of customer loyalty [17]. Furthermore, this study further explores the influence relationship between service convenience and service quality, narrowing the gap in related research in the fitness service field. The research results contribute to understanding customer loyalty in self-service fitness centers, while also providing actionable suggestions for managers to allocate human resources rationally and enhance sustainable operation capability.

The following sections will first elaborate on the related definitions of the constructs involved in this study and explore their interconnections. Subsequently, we will propose research hypotheses and conceptual model, outline research methods, and report research results. Finally, we will discuss the main findings and significance of the study, and put forward limitations and recommendations for future research.

2. Theoretical Foundation and Hypothesis Development

2.1. Self-Service Technology and Self-Service Fitness Centers

Self-service Technology (SST) refers to those technological interfaces that enable users to obtain services directly in most cases without the need for staff participation [18]. This concept was first

proposed by Dabholkar to explain the self-service process involving technological interfaces [19]. Compared to traditional face-to-face service interactions, SST transfers some of the service processing responsibilities to customers, reducing reliance on staff. Today, SST is widely used in various industries. For example, in the hotel and tourism industry, customers can independently complete check-in, check-out, ticketing, and ordering services through SST[20].

SST offers numerous benefits to service providers, including cost reduction, enhanced service quality, efficiency, and productivity [21–23], and bolstered corporate image that attracts new customer segments [24]. Concurrently, it provides greater convenience for consumers, in terms of location, accessibility, time, and cost savings [25,26]. By standardizing services and reducing the impact of human factors on the service experience, SST is perceived to better fulfill customer needs, thereby improving customer satisfaction and loyalty [27]. However, customers' attitudes towards this unstaffed service are not always positive. Existing studies have investigated customer acceptance of self-service from perspectives of technology readiness [28], technological characteristics [29], and consumer traits [30]. Other researchers have explored the impact of self-service on customer satisfaction and loyalty in different service sectors, such as postal services and online retail [31,32], and how various factors, such as the presence of staff and locational convenience, affect customers' attitudes towards SST usage [33]. These prior studies demonstrate that customers' attitudes towards self-service are not static, but are influenced by the specific service environment and service delivery circumstances. Currently, research results related to self-service in the fitness service environment and customers' views on different service interaction methods are not clear.

Against the backdrop of digital transformation, numerous global large-scale chain fitness centers have begun to actively adopt the self-service model, such as Anytime Fitness in the United States, JOYFIT and Fastgym24 in Japan, The Gym Group and PureGym in the United Kingdom, and Supermarket and Lefit in China. In China, fitness centers that only provide fitness space, based on Internet of Things and Internet technologies, can implement remote automated control of lighting, access control, and air conditioning ventilation systems, enabling the fitness centers to operate 24 hours a day on a self-service basis. These fitness centers are known as self-service fitness centers, unstaffed fitness centers, or 24-hour fitness centers [34]. This model leverages high-quality group classes as a competitive strategy, with class retailing and membership fees as the core profit model. Through applications and online platforms, self-service fitness centers offer efficient course scheduling and virtual guidance, while big data analysis provides customers with personalized fitness suggestions. In the physical fitness environment, self-service kiosks, smart access controls, vending kiosks, and other self-service facilities simplify the process of customer registration, booking, and payment, enabling unstaffed operations. However, this does not imply that customers lack support during fitness activities. On the contrary, dedicated staff monitor the fitness center remotely to ensure customer safety and smooth service delivery. Customers can also contact customer service via telephone or onsite communication devices. Staff can arrive on site within a short period to handle relevant matters. This mode of service ensures customer support while providing flexible self-service.

2.2. The Relationship between Service Quality, Customer Satisfaction, and Behavior Intentions

Understanding consumers' perceptions of service quality is crucial for sports and fitness centers aiming to enhance their management efficiency and maintain competitiveness, representing a focal point in contemporary quality management within the service sector [35,36]. However, due to the intangible nature of services, service quality proves challenging to measure accurately. Consequently, early research harbored various interpretations of the definition of service quality and its measurement models. Initially, researchers defined it as the gap between customer expectations and their perceptions of actual service performance [37,38]. Building on this, Parasuraman et al. designed the SERVQUAL, a five-dimension service quality measurement tool applicable across all services [38]. However, the tool's validity and applicability encountered criticism from some researchers. For instance, Cronin and Taylor's study suggested that the SERVPERF scale, which concentrates on perception, demonstrated superior validity in assessing service quality compared to SERVQUAL [39]. Therefore, Cronin et al. proposed conceptualizing service quality as a consumer's perception

structure based on performance [40], while the specific dimensions should vary depending on the service context [41]. For instance, within the fitness service field, researchers have developed new assessment tools due to SERVQUAL's inability to provide dimensions specific to the context of fitness centers, such as the QUESC scale developed by Kim et al. for Korean sports center service quality [42], the SSQRS leisure sports service quality scale proposed by Ko et al. [43], and the SQAS service quality assessment scale established by Lam et al. based on American fitness centers [44].

Customer satisfaction refers to consumers' evaluations and emotional reactions to a product or service [45], typically categorized into transaction-specific satisfaction and cumulative satisfaction. Transaction-specific satisfaction involves the assessment of a particular product or service, while cumulative satisfaction pertains to the overall evaluation of a product or service [46]. Among these, cumulative satisfaction has been proven to be more stable and effective in predicting customer loyalty [47,48] and has been widely adopted in research in the field of fitness services [3,49,50]. Therefore, in this study, customer satisfaction is defined as customers' overall assessment of the fitness center and its service experience.

The relationship between service quality and customer satisfaction has been empirically supported in early studies, with service quality widely regarded as a significant predictor of customer satisfaction [51]. For instance, the study by Rust and Oliver suggested that customer satisfaction is directly dependent on service quality [52]. In the relationship between service quality and customer loyalty, Taylor et al. observed that service quality should directly influence customer satisfaction, which in turn elevates customer loyalty [53]. In the fitness service domain, Foroughi et al. underscored the positive correlation between service quality and customer satisfaction in the context of Malaysian fitness centers [54]. A recent review study further confirms that customers' positive perceptions of the service quality in fitness centers lead to increased customer satisfaction [55]. Therefore, self-service fitness centers that provide superior service quality are more likely to boost customer satisfaction. Based on the above theories and research, we propose the following hypothesis:

H1. *There is a positive correlation between service quality and customer satisfaction.*

Loyalty is often defined in the literature as "a steadfast commitment to re-purchase a favorite product or service in the future, despite situational influences and marketing efforts that might cause switching behavior" [45]. There are mainly two perspectives on measuring loyalty: the behavioral perspective and the attitudinal perspective. The behavioral perspective emphasizes customers' actual behaviors, such as the frequency and persistence of purchasing behavior [56]. The attitudinal perspective, on the other hand, focuses on customers' behavioral intentions, such as the willingness to repatronage services or recommend them to others [5]. Oliver suggested that actual behavior is often guided by behavioral intentions [48], a viewpoint also supported by attitude-behavior theories and goal theories [57]. Therefore, by comparison, the attitudinal perspective is often considered more helpful for a more comprehensive understanding of loyalty formation. In this study, we follow this perspective. In the prior studies on attitude structure, Zeithaml et al. pointed out that repatronage intentions and WOM intentions are key indicators to assess customer loyalty [5]. These two indicators are related to customer retention and are widely used in the sports and fitness service domain [58,59]. However, due to the lack of significant association between repatronage intentions and WOM intentions, researchers suggest treating them as two separate structures for deeper analysis [17,60]. This study follows this suggestion.

Service quality has been proven to have a positive impact on customer loyalty, especially in relation to repatronage intentions and WOM intentions. Bitner et al. found that service quality has a direct impact on customers' WOM and repurchase intentions [61]. Empirical research conducted by De Ruyter et al. under five different service environments reached similar conclusions [62]. This relationship has been verified in recent empirical studies, such as enhancing customer recommendation and revisit intentions by improving service quality in self-service [27], and the direct connection between e-service quality and customers' green purchase intentions [63]. In the field of fitness services, a study by Zopiatis et al. under the environment of hotel fitness centers found that

the dimension of fitness facilities in service quality has a direct impact on customers' future intentions [64]. Therefore, a high level of perceived service quality by customers could potentially contribute to more positive behavioral intentions. Based on the aforementioned research, we propose the following hypotheses:

H2a. *There is a positive correlation between service quality and customers' WOM intentions;*

H2b. *There is a positive correlation between service quality and customers' repatronage intentions.*

2.3. The Relationship between Service Convenience, Service Quality, Customer Satisfaction, and Behavioral Intentions

Research has pointed out that time scarcity is a significant issue faced by consumers worldwide [65]. The aspiration to minimize the expenditure of time and effort has increasingly become a key demand of consumers towards service providers. Consequently, service convenience has been widely incorporated into service and management research in recent years. Service convenience refers to consumers' perception of the time and effort required to purchase or use a service [66]. This definition, proposed by Berry et al., has been widely accepted. Service convenience is divided into five dimensions: decision convenience, access convenience, transaction convenience, benefit convenience, and post-benefit convenience, which encompass the entire process of customers selecting services, accessing services, transacting services, benefiting from services, and maintaining relationships with service providers. Studies have indicated that the evaluation of service convenience must be combined with the specific service environment and consumer experience [67]. For instance, in the context of e-retail services, the convenience of decision-making, transactions, benefits, and post-benefit would have a more significant impact on consumer behavior intentions [68]. In mobile banking services, users' service evaluations would be significantly influenced by access, transactions, benefits, and post-benefit convenience [69]. Therefore, the five-dimensional structure of service convenience may not be applicable in all services. A similar situation may occur in self-service fitness center. Factors such as operating hours, service methods, and automated payment methods may affect customers' perceptions of convenience. Hence, further analysis of the service convenience in self-service fitness centers is needed.

Previous research has emphasized the direct relationship between service convenience and service quality [66]. In some service industries, such as mobile phone services and retail banking services, the dimensions of convenience have had a positive impact on the perception of service quality [70]. Similarly, Reynaldo et al. found in their study on long-distance logistics services that the perceived service convenience enhanced the perceived service quality [71]. These studies suggest that convenient services might improve perceived service quality by reducing customers' investment in time and effort [72]. However, the influence of service convenience on service quality in the fitness service field has rarely been touched upon in current research. As self-service fitness centers gain a competitive edge by offering highly convenient services, we infer that customers might consider service convenience an essential factor when assessing service quality. Based on the above discussion, we propose the following hypothesis:

H3. *There is a positive correlation between service convenience and service quality.*

Existing research has observed a direct relationship between service convenience and customer satisfaction, encompassing both physical services and online services [73,74]. For instance, Bi et al., in their study on online tourism shopping services for the elderly, and Benoit et al., in their study on in-store services, both found that the dimensions of service convenience had a significant impact on customer satisfaction [75,76]. In the field of fitness services, research by García-Fernández et al. showed that besides decision convenience, the dimensions of access, transaction, benefit, and post-benefit convenience had a direct and significant impact on customer satisfaction in low-cost fitness centers, subsequently influencing customer loyalty [3]. Given the potential of convenient service

delivery in a SST environment to improve customer satisfaction, we propose the following hypothesis:

H4. *There is a positive correlation between service convenience and customer satisfaction.*

Service providers are advised to always prioritize offering convenient services, as it directly influences customer loyalty [66]. Some prior research has examined the impact of service convenience on the behavioral intentions aspect of customer loyalty. For instance, studies by Ozturk et al. in hotel booking services, and Eryiğit et al. in the field of e-services, have both demonstrated that service convenience directly influences consumers' repurchase and referral intentions [77,78]. Similarly, in the fitness service field, a study by Baena-Arroyo et al. on fitness centers in Spain showed a positive and significant direct relationship between service convenience and customers' future intentions [12]. These studies suggest that customers who perceive higher service convenience are more likely to generate behavior intentions favorable to service providers [68]. Thus, we propose the following hypotheses:

H5a. *There is a positive correlation between service convenience and customers' WOM intentions;*

H5b. *There is a positive correlation between service convenience and customers' repatronage intentions.*

2.4. Relationship between Customer Satisfaction and Behavioral Intentions

Positive customer experiences with a service often increase their intentions to maintain a relationship with an organization. Therefore, customer satisfaction is usually seen as a direct influencing factor of customer loyalty [79,80]. In measuring the behavioral intentions aspect of loyalty, researchers have confirmed the direct impact of customer satisfaction on repatronage intentions or WOM intentions. For instance, a study by Slack et al. found that supermarket customers' satisfaction significantly affects their WOM and repurchase intentions [81]. Lin et al.'s research revealed that for less experienced low-cost airline passengers, their satisfaction significantly directly affects their referral intentions [82]. In the fitness service field, a study on the loyalty of users of fitness channels on social media platforms points out that when users feel satisfied, they are more willing to recommend the fitness channel to others and continue to use the channel [83]. Therefore, we believe that satisfied customers are more likely to enhance their loyalty to the organization and show positive behavioral intentions. Based on the above research, we propose the following hypotheses:

H6a. *There is a positive correlation between customer satisfaction and customers' WOM intentions;*

H6b. *There is a positive correlation between customer satisfaction and customers' repatronage intentions.*

2.5. The Mediating Role of Service Quality and Customer Satisfaction between Service Convenience and Behavioral Intentions

Based on the discussed impact relationships among service convenience, service quality, customer satisfaction, and behavioral intentions, i.e., service convenience can positively impact service quality and customer satisfaction [71,74], and the latter can enhance customers' WOM intentions or repatronage intentions [63,79]. We further speculate that there may exist a chain-like mediating impact relationship, i.e., a high level of service convenience might act as a driving factor, enhancing customers' evaluations of service quality, subsequently improving customer satisfaction, and ultimately influencing customers' WOM intentions and repatronage intentions. This impact relationship reveals the possible path for service convenience to influence customers' behavioral intentions through service quality and emphasizes the key role of service quality and customer satisfaction in this process. Therefore, based on the above discussion, we propose the following hypotheses:

H7a. *Service quality plays a mediating role between service convenience and WOM intentions;*

H7b. *Customer satisfaction plays a mediating role between service convenience and WOM intentions;*

H7c. *Service quality and customer satisfaction play a chain-mediated role between service convenience and WOM intentions;*

H8a. *Service quality plays a mediating role between service convenience and repatronage intentions;*

H8b. *Customer satisfaction plays a mediating role between service convenience and repatronage intentions;*

H8c. *Service quality and customer satisfaction play a chain-mediated role between service convenience and repatronage intentions.*

2.6. *The Moderating Role of With Staff Versus Without Staff Presence*

Generally, the fitness service industry involves direct interactions between staffs and customers. As soon as customers walk through the door, interaction occurs. Therefore, face-to-face service interaction has always been a key factor for fitness centers to establish strong customer relationships [84]. Based on this service inertia, some self-service fitness centers still arrange a few employees on site to assist customers in using SST. Compared to Without Staff service methods, With Staff means that customers can directly see and interact with staffs while using self-service [33]. This is similar to on-site assistance services in other industries, such as banks and supermarkets.

Previous studies have explored the impact of different service methods on customer evaluations. Empirical research in the hotel and airline service industries indicates that employee image, courtesy, and proactive response are closely associated with customer perceptions of service quality and satisfaction [85,86]. Service research in the restaurant industry has shown that direct interaction between staffs and customers positively influences repatronage intentions [87]. However, over-interaction could lead to service redundancy and customer complaints, thereby reducing customer satisfaction and loyalty [88]. On the other hand, SST is enhancing service convenience by reducing and replacing staff-customer interactions [89]. This unstaffed methods of service has been found beneficial for improving customers' evaluations of service quality, satisfaction, and loyalty [90]. However, customers' views on service interaction methods may vary depending on the type of service. For example, research in the retail service field found that under Without Staff conditions, customer satisfaction is usually lower than under With Staff conditions [91]. In self-service retail stores, customers usually wish to see staff during the transaction process [89]. In the field of fitness services, staffs' professional skills, social skills, and communication abilities have been observed to have a significant impact on customer satisfaction and behavior intentions [54,92]. Therefore, it is believed that the service methods, either With Staff or Without Staff, could moderate the relationships among the constructs of service quality, service convenience, customer satisfaction, and loyalty, and we propose the following hypothesis:

H9. *The service methods of with staff and without staff have significant differences in the impact on the relationships among service quality, service convenience, customer satisfaction, WOM intentions, and repatronage intentions.*

2.7. *Conceptual Model*

Based on the above analysis, this study constructs a conceptual model to examine the relationships among service quality, service convenience, customer satisfaction, WOM intentions, and repatronage intentions in self-service fitness centers, as shown in Figure 1. The model posits service convenience as the independent variable, with service quality and satisfaction as mediators, and WOM intentions and repatronage intentions as dependent variables. It presumes that both service quality and convenience significantly affect customer satisfaction, WOM intentions, and repatronage intentions. Service convenience positively impacts service quality, and both service quality and customer satisfaction serve as chain mediators in the relationships between service

convenience and WOM intentions and repatronage intentions. This model structure expands on the research by Brady et al. and Berry et al. [66,93]. Similar models have been applied and validated in various domains such as sports services [4,64,94].

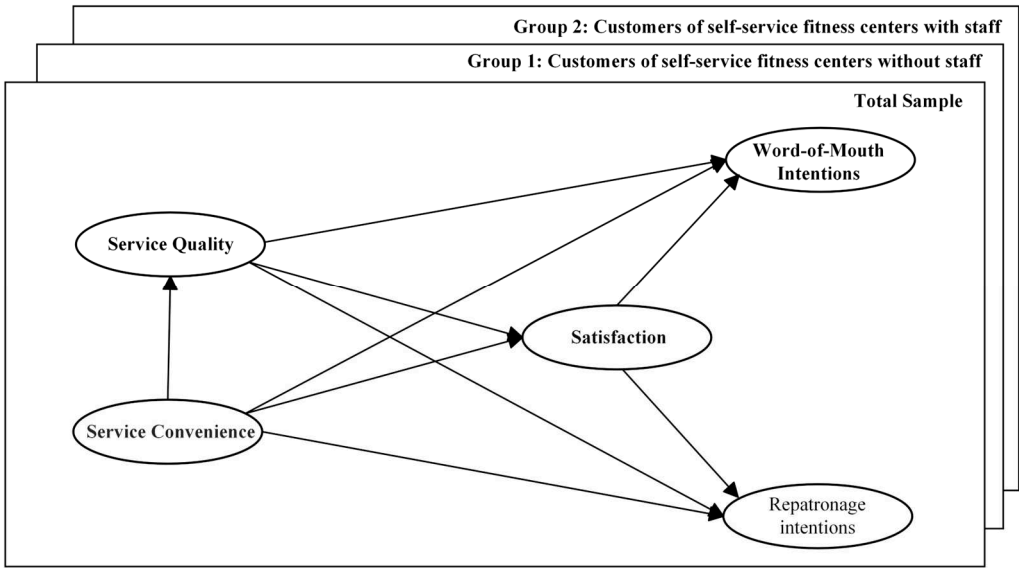


Figure 1. Conceptual Framework of the study.

3. Methods

3.1. Measures

The measurement model of this study includes five main constructs: service quality, service convenience, customer satisfaction, WOM intentions, and repatronage intentions. All the scales used have been validated in previous studies to ensure their validity and reliability. Additionally, we used nominal scales to collect demographic information such as gender, age, and education level. To quantify various responses, we employed a Likert seven-point scale (1 indicates "strongly disagree," and 7 indicates "strongly agree"). We established an expert panel consisting of two managers from self-service fitness centers, two fitness coaches, and two service design graduate students. They reviewed and revised all vague or inconsistent item descriptions with the research objectives to enhance their precision. We also conducted pre-tests to ensure the validity and reliability of all measurement tools and employed back-translation for language equivalence tests.

The measurement items for service quality were adapted from the SQAS scale developed by Lam et al. [44], encompassing six dimensions: staff, programs, locker room, physical facilities, workout facilities, and child care. This scale was constructed based on the research of Rust, Oliver, and Parasuraman [37,52]. The SQAS has now been widely used and validated in the fitness service field. For example, Eskiler et al. removed the "child care" dimension and added an "other" dimension in their study conducted in the context of an Istanbul fitness center [95]. AbouRokbah et al. used the original five dimensions and added two new dimensions: parking and social environment in their research in women's fitness centers [96]. All these studies have demonstrated the effectiveness and reliability of the SQAS. At the suggestion of the expert panel, we referred to previous studies, and according to the characteristics and service content of the self-service fitness centers, added a new "self-service" dimension and eliminated the "child care" dimension as well as the "shower cleanliness" item in the "locker room" dimension. The items for the newly added "self-service" dimension are derived from the STTQUAL scale [97], based on the work of Lin and Hsieh and have been widely used in related studies of SST [30,98].

The measurement items for service convenience originated from the leisure environment service convenience scale by Chang and Polonsky, which was adapted based on Berry et al.'s suggestions for various convenience measurements [66,99]. In the fitness service environment, García-Fernández et

al.'s research validated the effectiveness and reliability of the four dimensions: access, transaction, benefit, and post-benefit, each containing two items [3]. This scale has been validated in other fitness service research [12].

The cumulative satisfaction scale consisting of four items was used to measure customer satisfaction. Respondents were asked to evaluate their satisfaction with the self-service fitness centers based on their overall experience. This measurement tool comes from the research of Oliver and Cronin et al. [45,100]. The same items have been used in existing fitness service research to measure customer satisfaction [95,101].

Customer loyalty was evaluated by measuring two behavioral intentions of customers. It has been proven that separating measurements for repatronage intentions and WOM intentions is superior to measuring loyalty through aggregate methods [17]. The measurement tool for repatronage intentions was adapted from the four-item repurchase intentions scale proposed by Oliver and Swan [102]. WOM intentions was measured using a three-item scale adapted from Zeithaml et al. [6]. In previous studies, these two scales have been considered reliable and effective [103,104].

3.2. Pre-Testing

The pre-test was conducted in two self-service fitness centers that provide different staff service methods. A total of 150 questionnaires were distributed and 104 valid questionnaires were collected. The pre-test data were not included in the final data analysis. The collected data were subjected to Exploratory Factor Analysis (EFA) using the SPSS 27.0 program. The results showed that the Kaiser-Meyer-Olkin (KMO) measures of all variables were above 0.7, and the p-values in Bartlett's test of sphericity were less than the significant level of 0.05, indicating that the data were suitable for factor analysis. The KMO values of the "service quality", "service convenience", "customer satisfaction", "word-of-mouth intentions", and "repatronage intentions" scales were 0.827, 0.760, 0.840, 0.732, and 0.812, respectively. However, the maximum factor loadings of some items in the dimensions of staff (Sta2, Sta4, Sta5, and Sta8), programs (Pro5 and Pro6), locker room (LR3), physical facilities (PF3 and PF4), and self-service (Ss2) did not reach the conservative threshold of 0.60 after rotation [105], and these measurement items had a corrected item-total correlation (CITC) level of less than 0.4 in Cronbach's α reliability test [106]. Therefore, we removed these measurement items to improve reliability, and revised the questionnaire for formal testing.

3.3. Sample Size Estimation

The MedPower program was used to estimate the minimum sample size required [107]. MedPower was chosen because we need to detect mediating relationships in the measurement model, and this tool can handle standardized coefficients. This method has been applied in the field of sports and health [108]. In this study, we assumed that the standardized path coefficients of the mediating effect were both 0.2 before and after, set the desired power at 0.8, and fixed the alpha error probability at 0.05. Through these settings, the calculated sample size is 250 people. We referred to the method of prior research to double the sample size to improve the accuracy of multi-group analysis and to cope with possible invalid responses [109]. Therefore, this study needs to recruit more than 250 fitness customers in each of the two types of self-service fitness centers that provide different staff service methods.

3.4. Data Collection and Respondents

To ensure a representative sample, we collected official test data from March to May 2023 from four self-service fitness centers in two first-tier cities in southern and northern China. These fitness centers all belong to the two largest chain fitness brands in China. The number of monthly active customers in each fitness center ranges from 400 to 600, and similar pricing strategies are adopted. Based on the research objectives, the chosen fitness centers can be divided into two categories

according to the method of staff service: two of them offer without-staff services, and the other two have a small number of on-site service staff.

Before starting the data collection, we first contacted the person in charge of each fitness center and explained the purpose and process of the research. After getting their approval, we collected data through electronic questionnaires and posted questionnaire survey notices with QR codes inside each fitness center. To protect the participants' right to information, we clarified the purpose of the research and data collection, voluntary participation, and anonymity in the notice. To incentivize respondents and increase the validity of the questionnaire, customers who completed the questionnaire had a chance to win a functional beverage.

A total of 552 valid questionnaires were received from both types of self-service fitness centers. Of the respondents, 315 were male (57.1%) and 237 were female (42.9%). In terms of age, most respondents were aged between 30-39 (48.9%), while the rest were distributed among the age groups of 18-29 (37%), 40-49 (10.5%), and over 50 (3.6%). Regarding education level, 0.5% of the respondents had received primary education, 17.2% had received middle school education, 37% had high school education, and 45.3% had received university or higher education.

Specifically, 269 valid questionnaires (48.7%) and 283 questionnaires (51.3%) were collected from self-service fitness centers without staff (group 1) and with staff (group 2), respectively. We used a chi-square test to examine the differences in gender, age, and educational level distributions between the groups, as shown in Table 1. The results indicate no significant differences in the basic characteristics of the respondents under the two different staff service methods ($P>0.05$).

Table 1. Respondent Profile and Chi-Square Test Results for Different Sample Groups.

Variable	Category	Total Sample		Grp1 (Without Staff)		Grp2 (With Staff)		χ^2	P
		n	%	n	%	n	%		
Gender	Male	315	57.1	144	53.5%	171	60.4%	2.674	0.102
	Female	237	42.9	125	46.5%	112	39.6%		
Age	18-29	204	37.0	100	37.2%	104	36.7%	3.335	0.343
	30-39	270	48.9	132	49.1%	138	48.8%		
	40-49	58	10.5	31	11.5%	27	9.5%		
	50 and above	20	3.6	6	2.2%	14	4.9%		
	Elementary School	3	0.5	2	0.7%	1	0.4%		
Education level	Middle School	95	17.2	48	17.8%	47	16.6%	1.594	0.661
	High School	204	37.0	93	34.6%	111	39.2%		
	College and Above	250	45.3	126	46.8%	124	43.8%		

3.5. Common Method Bias

Harman's single-factor test was used to examine the potential common method variance issue in the study. After conducting a factor analysis on all the items in the measurement model, the results of principal component analysis indicated that the variance contribution rate of the first factor was 26.042%, which is lower than the 50% threshold. This implies that the single factor bias is less than 50%, hence common method bias is not a major concern in this study [110].

3.6. Data Analysis

This study adopted Partial Least Squares Structural Equation Modeling (PLS-SEM) to implement the two main steps of data analysis, which include the evaluation of the measurement model and the structural model [111]. Hair et al. emphasized the value of PLS-SEM for analyzing both small and large amounts of data. Moreover, compared to covariance SEM, it is more suitable for the analysis of complex models and has stronger predictive power, making it more applicable for the exploration or expansion of theoretical models [112]. At the same time, PLS-SEM is considered more effective in testing mediation relationships, which aligns with our research purpose [113]. We used

the SmartPLS 4.0 software to perform the following analysis on the obtained data, which will be detailed in the next chapter.

Firstly, we assessed the measurement model following the empirical rules for reflective measurement indicator evaluation proposed by Hair et al.[114], reporting internal consistency reliability, convergence validity, and discriminant validity. Secondly, we evaluated the structural model, again following the empirical rules proposed by Hair et al., sequentially reporting predictor collinearity, the coefficient of determination R^2 of endogenous latent variables, the effect size f^2 of exogenous constructs on the determination coefficient of endogenous constructs, the predictive relevance Stone-Geisser Q^2 , and the Bootstrap method significance of path coefficients. Finally, Partial Least Squares Multi-Group Analysis (PLS-MGA) was utilized to explore the differences between the with staff and without staff service methods in the proposed model.

4. Results

4.1. Assessment of the Measurement Model

The result shows that all constructs demonstrate good reliability and convergent and discriminant validity. Firstly, concerning internal consistency reliability, the results are shown in Table 2. The minimum values for the Cronbach's alpha coefficient and Composite Reliability (CR) are 0.705 and 0.836, respectively, both of which are above 0.7, indicating good consistency reliability.

Table 2. Measurement model assessment.

Constructs	Items	Loadings	CA	CR	AVE
1st Order					
Access	Acc1 It was easy to contact my FC	0.815	0.797	0.881	0.711
	Acc2 It did not take much time to reach this FC	0.845			
	Acc3 I can easily figure out the location of this FC	0.868			
Transaction	Tra1 This FC allows diversified methods of payment	0.842	0.816	0.891	0.732
	Tra2 The method of payment provided by this FC is convenient	0.860			
	Tra3 I was able to complete my purchase quickly in this FC	0.863			
Benefit	Ben1 I could easily obtain benefits from the services provided in this FC	0.818	0.705	0.836	0.629
	Ben2 The services in this FC were easy to use	0.772			
	Ben3 The speed of providing services in this FC met my requirements	0.788			
Post-benefit	Pb1 When I had a problem, this FC resolved my problem quickly	0.818	0.804	0.885	0.719
	Pb2 This FC enabled me to arrange my next exercise programs/plans with minimal effort	0.877			
	Pb3 This FC has a good channel to handle complaints and recommendations	0.848			
Staff	Sta1 Possession of required knowledge/skills	0.774	0.859	0.899	0.641
	Sta2 Willingness to help	0.809			
	Sta3 Responsiveness to complaints	0.801			
	Sta4 Courtesy	0.727			
	Sta5 Provision of consistency of service	0.886			
Program	Pro1 Variety of programs	0.839	0.866	0.904	0.653
	Pro2 Availability of programs at appropriate level	0.830			

	Pro3	Convenience of program time/schedule	0.744			
	Pro4	Quality/content of programmers	0.866			
	Pro5	Adequacy of space	0.754			
Locker Room	LR1	Availability of lockers	0.862	0.761	0.863	0.678
	LR2	Overall maintenance	0.848			
	LR3	Safety	0.756			
Physical Facility	PF1	Convenience of location	0.836	0.853	0.896	0.634
	PF2	Hours of operation	0.794			
	PF3	Parking lot safety	0.715			
	PF4	Temperature control	0.737			
	PF5	Lighting control	0.885			
Workout Facility	WF1	Pleasantness of environment	0.860	0.910	0.930	0.690
	WF2	Modern-looking equipment	0.850			
	WF3	Adequacy of signs and directions	0.840			
	WF4	Variety of equipment	0.790			
	WF5	Availability of workout facility/equipment	0.806			
	WF6	Overall maintenance	0.833			
Self-service	Ss1	SST provides efficient services	0.827	0.812	0.877	0.640
	Ss2	SST can be used effortlessly	0.773			
	Ss3	Smooth service completion through SST	0.826			
	Ss4	SST service items/functions are error-free	0.772			
Satisfaction	Sat1	I am satisfied with the programs and services of this FC	0.770	0.825	0.884	0.656
	Sat2	I am happy with the programs and services of this FC	0.846			
	Sat3	I am pleased to have taken the decision to become a member of this FC	0.796			
	Sat4	My decision to be a member of this FC was successful	0.826			
Word-of-Mouth Intentions	WOM1	Say positive things about this FC to other people	0.841	0.759	0.861	0.674
	WOM2	Recommend this FC to someone who seeks my advice	0.828			
	WOM3	Encourage friends and relatives to do business with my FC	0.793			
Repatronage Intentions	RI1	Given the opportunity, I intend to exercise at this FC	0.865	0.843	0.895	0.680
	RI2	I am likely to exercise at this FC	0.805			
	RI3	It is likely that I will actually exercise at this FC in the near future	0.847			
	RI4	Given the opportunity, I would consider exercising at this FC in the future.	0.779			
2nd Order						
Service Convenience	Acc	Access convenience	0.729	0.873	0.857	0.601
	Tra	Transaction convenience	0.770			
	Pb	Post-benefit convenience	0.773			
	Ben	Benefit convenience	0.825			
Service Quality	Sta	Staff	0.751	0.937	0.882	0.555
	Pro	Program	0.789			
	LR	Locker Room	0.638			
	PF	Physical Facility	0.723			

WF	Workout Facility	0.812
Ss	Self-service	0.745

Note: CA = Cronbach's alpha; CR = Composite reliability; AVE = Average variance extracted.

Tests were conducted using outer loadings of reflective indicators and the Average Variance Extracted (AVE) to evaluate the convergence validity. Table 2 shows that the outer loadings of all items are above 0.6 [105]. The AVEs for all constructs are greater than 0.5 (minimum value = 0.555), indicating that the constructs in the model explain 50% or more variance of the items constituting the constructs, thus proving adequate convergent validity.

The test of discriminant validity includes indicators such as cross loadings, HTMT, and Fornell-Larcker criterion. Firstly, the evaluation criterion for cross loadings of each measurement model factor is that an indicator's outer loading on a construct should be higher than all its cross loadings with other constructs. After testing, no cross loadings occurred in each first-order construct in this study, indicating that all indicators in this study can be well distinguished. Secondly, the Heterotrait Monotrait Ratio (HTMT) criterion stipulates that the HTMT ratios between all first-order constructs should not exceed 0.85, and the confidence intervals of the HTMT statistics should not include 1. In this study, service convenience and service quality used high-order variable statistics. As shown in Table 3, the HTMT values of all variables were less than 0.85, demonstrating good discriminant validity. Finally, the Fornell-Larcker criterion was used to test the discriminant validity between constructs [105]. As shown in Table 4, after comparison, the square roots of the AVE of each construct were greater than the absolute values of the correlation coefficients between each construct. A combination of these tests indicated that the measurement model of this study has good reliability, convergent validity, and discriminant validity.

Table 3. HTMT statistics.

	SC	SQ	Sat	RI	WOM
Service Convenience (SC)					
Service Quality (SQ)	0.466				
Satisfaction (Sat)	0.603	0.523			
Repatronage intentions (RI)	0.534	0.494	0.688		
Word-of-Mouth intentions (WOM)	0.512	0.524	0.662	0.581	

Note: The values of service quality and convenience are derived from higher-order constructs.

Table 4. Fornell-Larcker Criterion.

	SC	SQ	Sat	RI	WOM
Service Convenience (SC)	0.775				
Service Quality (SQ)	0.423	0.744			
Satisfaction (Sat)	0.513	0.462	0.81		
Repatronage intentions (RI)	0.46	0.44	0.574	0.825	
Word-of-Mouth intentions (WOM)	0.421	0.444	0.533	0.473	0.821

Note: The values of service quality and convenience are derived from higher-order constructs.

4.2. Assessment of the structural model

Following the assessment of the measurement model, empirical guidance provided by Hair was still adhered to in progressively testing the structural model [114]. The results are shown in Table 5. Firstly, the collinearity issues of the predictive constructs were examined to ensure that they would not bias the regression results. The results show that the maximum Variance Inflation Factor (VIF) of the predicting constructs in the model is 1.507, which is less than 3, suggesting that there are no collinearity issues between the constructs. Subsequently, the R² values of the endogenous constructs were evaluated to assess the predictive power of the model. The results show that the R² values of service quality, customer satisfaction, WOM intentions, and repatronage intentions are 0.179, 0.336,

0.348, and 0.390 respectively. According to the empirical standard, the R² values of the endogenous constructs of 0.75, 0.50, or 0.25 can be respectively described as strong, moderate, or weak.

Table 5. Path test results and hypotheses.

Hypothesis	Path	β	S.E.	t	P	f ²	VIF	R ²	Q ²	Result
H1	SQ→Sat	0.298	0.044	6.742	0.000	0.110	1.219	0.336	0.217	Supported
H2a	SQ→WOM	0.217	0.047	4.653	0.000	0.054	1.353	0.348	0.226	Supported
H2b	SQ→RI	0.180	0.040	4.453	0.000	0.039	1.353	0.390	0.261	Supported
H3	SC→SQ	0.423	0.047	8.983	0.000	0.219	1.000	0.179	0.066	Supported
H4	SC→Sat	0.387	0.045	8.659	0.000	0.185	1.219			Supported
H5a	SC→WOM	0.145	0.050	2.932	0.003	0.022	1.444			Supported
H5b	SC→RI	0.180	0.039	4.645	0.000	0.037	1.444			Supported
H6a	Sat→WOM	0.358	0.045	7.966	0.000	0.130	1.507			Supported
H6b	Sat→RI	0.398	0.040	10.054	0.000	0.173	1.507			Supported

Note: SC = Service Convenience; SQ = Service Quality; Sat = Satisfaction; RI= Repatronage Intentions; WOM = Word-of-Mouth Intentions.

In the third step, the effect size (f^2) was evaluated to examine the relative impact of the predictor constructs on the endogenous constructs. According to the guiding principle of f^2 , values above 0.02, 0.15, and 0.35 represent small, medium, and large f^2 effect sizes respectively. The f^2 of each path in the model ranges from 0.022 to 0.219, indicating a small to moderate effect size. Among them, the relationships between service convenience and service quality ($f^2=0.219$) and customer satisfactions ($f^2=0.185$), and the relationship between customer satisfaction and repatronage intentions ($f^2=0.173$) show a moderate impact.

In the fourth step, the Q² value was utilized to assess the predictive relevance. The Stone-Geisser Q², obtained based on the blindfolding procedure, can provide information on the model's predictive ability for specific endogenous construct data. The Q² values of service quality, customer satisfaction, WOM intentions, and repatronage intentions in the model are 0.066, 0.217, 0.261, and 0.226 respectively. According to the guidance, a Q² value greater than 0 indicates that the model has predictive relevance to the endogenous constructs, while a value of 0 or less indicates a lack of predictive relevance. The results show that the model has sufficient predictive ability.

Finally, this study evaluated the statistical significance and correlation of the model's path coefficients. The path coefficients and significance were evaluated through bootstrapping with 5,000 resamples. The standardized path coefficient (β value) for each path is shown in Figure 2 and Table 5. Following the significance level guidance proposed by Hair et al., when the t-statistics > 1.96 at $p < 0.05$, the impact relationship is considered significant. The standardized path coefficient is used to indicate the strength of the relationship between the independent and dependent variables.

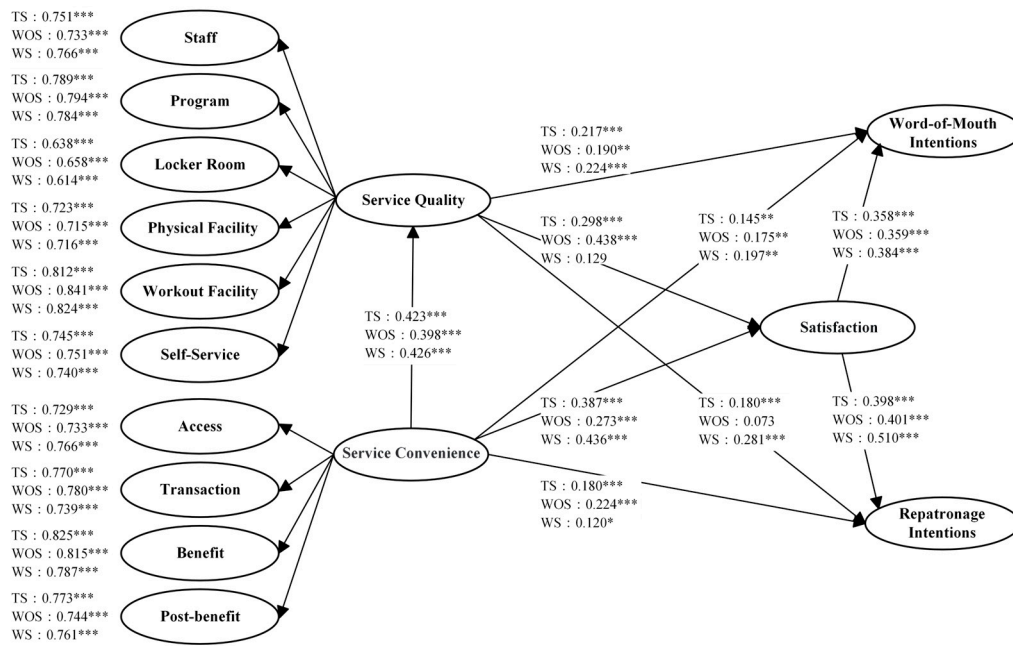


Figure 2. Results of structural model with standardized path coefficients (β-values) with multi-group analysis. Note: *** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$.

The results show that all hypotheses involving direct impact relationships were accepted. Specifically, service quality has a positive impact on customer satisfaction ($\beta = 0.298$, $P < 0.001$), WOM intentions ($\beta = 0.217$, $P < 0.001$), and repatronage intentions ($\beta = 0.180$, $P < 0.001$), therefore hypotheses H1, H2a, and H2b were confirmed. Next, there is a positive relationship between service convenience and service quality ($\beta = 0.423$, $P < 0.001$), customer satisfaction ($\beta = 0.387$, $P < 0.001$), WOM intention ($\beta = 0.145$, $P = 0.003$), and repatronage intentions ($\beta = 0.180$, $P < 0.001$), which supports hypotheses H3, H4, H5a, and H5b. Finally, the study observed that customer satisfaction has a positive impact on WOM intention ($\beta = 0.358$, $P < 0.001$) and repatronage intentions ($\beta = 0.398$, $P < 0.001$), which means H6a and H6b were supported. Among them, the strongest relationship is between service convenience and service quality ($\beta = 0.423$), followed by the relationship between customer satisfaction and repatronage intentions ($\beta = 0.398$). The weakest relationship is between service convenience and WOM intentions showing moderate significance ($p < 0.01$), all direct impact paths show very significant impact relationships ($p < 0.001$).

4.3. Assessment of the Mediation Effect

The purpose of this section is to examine the mediating role of service quality and customer satisfaction in the relationship between service convenience and WOM intentions, as well as repatronage intentions. Bootstrapping was used with 5000 resamples, and if the 95% confidence interval of the resampled estimated distribution does not contain zero, it indicates that the mediation effect is significant [115]. As shown in Table 6, none of the upper and lower bounds of the 95% confidence intervals for the indirect effects include zero, indicating significant mediation effects, and all hypotheses regarding indirect relationships are accepted.

Table 6. Results of the mediation effect test.

Hypothesis	Mediation Path	β	S.E.	95%CI		Result
				2.50%	97.50%	
H7a	SC → SQ → WOM	0.092	0.024	0.052	0.144	Supported
H7b	SC → Sat → WOM	0.138	0.026	0.096	0.195	Supported

H7c	SC→SQ→Sat→WOM	0.045	0.009	0.029	0.067	Supported
H8a	SC→SQ→RI	0.076	0.018	0.045	0.113	Supported
H8b	SC→Sat→RI	0.154	0.025	0.111	0.207	Supported
H8c	SC→SQ→Sat→RI	0.050	0.010	0.033	0.071	Supported

Note: SC = Service Convenience; SQ = Service Quality; Sat = Satisfaction; RI= Repatronage Intentions; WOM = Word-of-Mouth Intentions.

For indirect effects on WOM intentions, the lower and upper limits of the 95% confidence interval for the mediating effect of service quality between convenience and WOM intentions are 0.052 and 0.144 respectively, and the 95% confidence interval does not contain 0. This means that service quality has a significant mediating effect between convenience and WOM intentions, and the standardized mediation effect is 0.092. Therefore, hypothesis H7a is supported. Under the same test standard, the results show that customer satisfaction has a significant mediating effect between service convenience and WOM intentions (95%CI= [0.096,0.195], $\beta=0.138$), therefore, hypothesis H7b is accepted. Similarly, both service quality and customer satisfaction have a significant chained mediating effect between convenience and WOM intentions (95%CI= [0.029,0.067], $\beta=0.045$), indicating that hypothesis H7c is supported.

Regarding the indirect effects on repatronage intentions, the results show that service quality has a significant mediating effect between convenience and repatronage intentions (95%CI= [0.045,0.113], $\beta=0.076$), supporting hypothesis H8a. Similarly, customer satisfaction has a significant mediating effect between convenience and repatronage intentions (95%CI= [0.111,0.207], $\beta=0.154$), and hypothesis H8b is supported. Finally, both service quality and customer satisfaction have a significant chained mediating effect between service convenience and repatronage intentions (95%CI= [0.033,0.071], $\beta=0.050$), supporting hypothesis H8c.

4.4. Multi-Group Analysis

This study utilized PLS-MGA to analyze the differences in customers' evaluation of the influence paths and structural relationships under the service interaction methods of "Without Staff" and "With Staff". This method does not rely on distribution assumptions, and hence is considered the most appropriate multi-group comparison method based on PLS [116]. According to the standard of PLS-MGA, if the p-value is above 0.95 or below 0.05, it can be concluded that there is a significant difference in the specific path coefficients between the comparison groups [112].

As shown in Table 7, the test results reveal that, first, there is a significant difference in the impact of service quality on repatronage intentions under different staff service methods ($P=0.015$, difference=-0.208). Specifically, under the service method "With Staff", the impact of service quality on repatronage intentions ($P<0.001$, $\beta=0.281$) is significantly stronger than that in the "Without Staff" method ($P>0.05$, $\beta=0.073$). Moreover, it was found that there is a significant difference in the impact of service quality on customer satisfaction under the "Without Staff" and "With Staff" conditions ($P=0.001$, difference=0.310), that is, under the "Without Staff" service method, the impact of service quality on customer satisfaction ($P<0.001$, $\beta=0.438$) significantly exceeds the "With Staff" scenario ($P>0.05$, $\beta=0.129$). Besides the above two significant effects, other influence paths did not show significant differences between with staff and without staff conditions ($P>0.05$). These results provide support for hypothesis H10, demonstrating significant differences in the impact on various construct relationships under different service interaction methods.

Table 7. Multi-group analysis results.

Path	Grp1 (Without Staff)		Grp2 (With Staff)		Difference	P
	β	P	β	P		
SC→WOM	0.175	0.008	0.197	0.001	-0.022	0.810
SC→RI	0.224	0.000	0.120	0.016	0.104	0.192
SC→SQ	0.398	0.000	0.426	0.000	-0.028	0.776
SC→Sat	0.273	0.000	0.436	0.000	-0.164	0.110

SQ→WOM	0.190	0.008	0.224	0.000	-0.034	0.725
SQ→RI	0.073	0.310	0.281	0.000	-0.208	0.015
SQ→Sat	0.438	0.000	0.129	0.104	0.310	0.001
Sat→WOM	0.359	0.000	0.384	0.000	-0.025	0.765
Sat→RI	0.401	0.000	0.510	0.000	-0.109	0.136

Note: SC = Service Convenience; SQ = Service Quality; Sat = Satisfaction; RI= Repatronage Intentions; WOM = Word-of-Mouth Intentions.

5. Discussion

SST has ushered in a "high-tech, low-touch" service paradigm for the sports and fitness industry, potentially replacing the "high-touch, low-tech" interpersonal interactions in traditional fitness centers [117]. Presently, self-service fitness services are beginning to demonstrate their industry competitiveness globally. In a competitive setting, elevating customer loyalty is vital for the sustainable progression of fitness service enterprises [48]. Yet, no current research offers pertinent managerial insights and empirical data for self-service fitness centers. Accordingly, this study proposes a structural model, integrating constructs such as service quality, service convenience, customer satisfaction, WOM intentions, and repatronage intentions. By means of empirical analysis, the study investigates the factors and mechanisms that influence customer loyalty in self-service fitness centers, and further analyses the relationship between service convenience and service quality. Additionally, we contemplate the differential impacts of varied service interaction methods, with and without staff. The research results reveal the influence relationships among the constructs. Additionally, different methods of service exert a significant influence on these relationships.

Initially, the study results exhibit a significant positive impact of service quality and service convenience in self-service fitness centers on customer loyalty, WOM intentions, and repatronage intentions. This finding emphasizes the pivotal role of superior and convenient services in the process of forming customer loyalty. This aligns with the research findings by Zopiatas and García-Fernández in hotel fitness centers and low-cost fitness centers, indicating service quality and convenience as key determinants of customer satisfaction and loyalty [3,64]. This underlines the central and universal role of service quality and service convenience in the management strategy across the entire fitness service industry. In contrast, this study further deepens our understanding of the impact of antecedents of customer loyalty on specific customer behavioral intentions. For instance, a high level of convenience favors customer repatronage, while a high level of service quality promotes customers' WOM intentions.

Additionally, this study reemphasizes the significant correlation between customer satisfaction and customer loyalty. The results show that customer satisfaction has a significant positive impact on WOM intentions and repatronage intentions, and mediates the influence of service convenience and service quality on WOM intentions and repatronage intentions. This aligns with the results of numerous studies in the service industry [81,82], indicating that customer satisfaction directly impacts customer loyalty and can mediate the association between service quality, service convenience, and behavioral intentions. Therefore, in self-service fitness centers, when customers are satisfied with the service, they are more likely to form positive behavioral intentions and higher loyalty. In contrast to research results that view satisfaction as a prerequisite for service quality [118], this study provides empirical support for the view that satisfaction is the result of service quality [55].

Furthermore, our research provides new empirical evidence for the influence study of service convenience and service quality. Although existing research has proven the impact of service convenience on response variables such as customer satisfaction, to eliminate confusion, researchers have called for further exploration of whether this relationship is mediated by variables such as service quality [8]. Based on literature review findings, few researchers in the fitness service field, compared to other service areas, have examined the possible association between the two. Our study narrows this gap, and the results show that, in the context of self-service fitness centers, service convenience has a very significant positive impact on service quality, and service quality plays a significant mediating and chained mediating role between service convenience and behavioral

intentions (WOM intentions and repatronage intentions). This means that customers regard their perception of service convenience as an important source for evaluating service quality, and service convenience can indirectly enhance customer satisfaction and loyalty through service quality. From the consumer's perspective, the underlying reason may be that customers who choose self-service fitness centers are more constrained by time and effort, and therefore place greater emphasis on the convenience of the fitness experience [99]. For service providers, this to a certain extent underscores the positive impact of the value of convenience brought about by self-service technologies in the fitness service environment on customer service quality evaluation. This result is different from the view of Brady and others, who regard service convenience as a component of service quality [119]. This study supports the view of treating service convenience as a precursor to service quality and customer satisfaction [66]. Our research findings further enrich our understanding of the influencing path of customer loyalty in fitness centers. Relying on a high degree of service convenience to enhance customers' perception of service quality has become a potential and feasible path to cultivate customer loyalty.

Finally, this study reveals the influence of With Staff or Without Staff conditions on the above structural relationships. Prior research in the field of fitness services generally believes that face-to-face interaction between employees and customers is a key factor in determining the service experience and is considered a prerequisite for customer satisfaction [55]. However, this study shows that, in self-service fitness centers without staff presence, the positive impact of service quality on customer satisfaction significantly exceeds that in situations with staff presence. This may be related to customers' preference for unsupervised environments and the freedom to choose their fitness approach. On the other hand, for self-service fitness centers with staff presence, the influence of service quality on customers' repatronage intentions is significantly stronger than in fitness centers without staff. This result may be similar to Foroughi et al.'s viewpoint [54], in that fitness centers with staff presence may increase customers' repatronage intentions by providing a stronger sense of security and social elements. In general, our research results emphasize the complexity of customers' perceptions of staff service methods in self-service environments. Although prior research has confirmed that face-to-face interactions with staff in fitness centers play a crucial role in improving customer satisfaction [92], this conclusion may not apply to self-service style fitness centers. However, for the actual benefits of a business, the service method with staff present is more conducive to customers' repeated visits.

5.1. Managerial Implications

The findings of this study offer practical insights into improving customer loyalty and retention in self-service fitness centers. The results show that customers' positive evaluations of service quality and convenience improve customer satisfaction, which further affects WOM and repatronage intentions. These findings are crucial for the sustainable development of companies. Accordingly, improving service quality standards and reducing the time and effort customers put in should become key strategies for customer management. Meanwhile, businesses need to ensure that customers are satisfied with the service, as it directly affects their behavioral intentions and loyalty.

Furthermore, based on the most important influencing dimensions in service quality and service convenience, our research found that customers' evaluations of "fitness facilities" and "benefit convenience" dominated their assessments of customer satisfaction, WOM, and repatronage intentions. In terms of fitness facilities, customers are most concerned about the suitability of the environment. This finding is consistent with previous research that environmental elements such as cleanliness, the fitness center itself, and the size of the exercise space are very important in building customer satisfaction as predictors of customer satisfaction [120–122]. Meanwhile, it is noteworthy that "self-service" has not become the dominant dimension impacting the quality of fitness center services, a result differing from the perception of self-service technologies in leisure service industries such as tourism [123]. Although self-service has shown a positive influence on customer satisfaction and loyalty in fitness centers through service quality, it has not shown significant impact. According to Howat et al., this may be attributed to customers' differing views on the core and non-core services

provided by fitness centers, where SSTs could be considered non-core or auxiliary services [124]. Another possible reason could be customer dissatisfaction or skepticism towards SSTs. Hence, it is recommended for managers to prioritize the enhancement of service quality indicators with greater impact, while collecting feedback from customers, to better understand the problems and challenges they encounter when using self-service. In terms of benefit convenience, customers value the ease of benefiting from the fitness center. This is consistent with the research conclusion of Chang et al., that in long-term highly participatory services like fitness and leisure services, consumers value the service outcomes obtained when experiencing the service [99]. Therefore, in specific operational practices, focusing on the environmental quality of fitness facilities and ensuring that customers find each fitness experience convenient will bring more positive benefits to the company.

Finally, the research results show that the service methods, either with staff or without staff, have different impacts on the service evaluation of customers in self-service fitness centers. Therefore, managers need to flexibly adjust the service methods of employees when designing and managing service processes to achieve the desired management objectives. For example, increasing the use of SST in service provision and using remote responses to replace face-to-face interactions with staff on-site may help improve customer satisfaction. Self-service fitness centers with staff on-site need to pay attention to staff service attitude and professional skills to meet customer needs and thereby increase their intention to revisit. However, it is worth noting that the service methods of whether staff are present or not did not show significant differences in more influence paths. Therefore, neither of the two service interaction methods has shown any significant advantages. This means that in industry practice, the two types of service methods, with staff or without staff, may coexist in the service model of self-service fitness centers for a certain period. At the same time, this also prompts managers that, regardless of whether there are staff on duty, service convenience and service quality will be key to improving customer satisfaction, WOM, and repatronage intentions.

6. Conclusions and Limitations

Overall, this study explores a type of fitness center that fully adopts SST - self-service fitness centers. As one of the few empirical studies targeting the self-service mode in fitness services, the research results provide a new perspective for understanding customer loyalty in the fitness service industry, which is of great significance for the sustainable operation of fitness centers. Through the multidimensional dimensions and projects of service quality and service convenience, this research provides specific information to the management of fitness centers to assist in improving operational practices. Compared to the aggregate measurement of customer loyalty, the separate measurement of WOM intentions and repatronage intentions provides managers with the specific connections between the antecedents of loyalty and different behavioral intentions. As the fitness service industry continues to develop and the competitive trend intensifies, it is indispensable to focus on the impact of technology adoption in fitness service scenarios. Researchers and enterprises need to timely analyze and understand the influencing factors and mechanisms of customer loyalty, seek more sustainable management plans to ensure a high level of customer retention and service experience.

Future research should consider some limitations existing in this study. First, the sample of this study comes from self-service fitness centers in first-tier cities in China. Therefore, the consumers may have a higher willingness to use SST. Given that the self-service fitness model is rapidly replicating and developing in developed and emerging economies, conducting relevant empirical research in different countries and regions will be more conducive to promoting and improving the research results of this service model.

Secondly, this study focuses on the specific fitness service model of self-service fitness centers, so the research results do not fully reflect the situation of all sports and fitness centers. Compared with other types of fitness centers, customers of self-service fitness centers may pay more attention to the investment of time and energy. Therefore, replicating the current study in different types of fitness centers may have its value.

Finally, it is worth noting that recent industry practices and research in the field of fitness services are showing that fitness centers are adopting digital technology more broadly to improve

management levels and provide outstanding fitness experiences. In the future, examining the impact of emerging technologies and service models on service management and experience in the field of sports services will possess great research potential.

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