

# *The Optimization of Full-Process Accessibility Service Design in Swimming Pools*

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**Abstract.** The demand for sporting activities among persons with disabilities is steadily increasing. Swimming, being highly adaptable and beneficial for both physical and mental well-being, has become the preferred activity for many. However, the overall provision of accessible services in swimming facilities remains significantly inadequate. The physical environment, facilities configuration, service process and signage guidance are not enough, which not only affect the use experience and safety of the disabled, but also cause the gap between their actual needs and the service supply of the venue. This paper focuses on the optimization of accessible service design in the whole process of swimming pool. Combining the principles of inclusive design and universal design, drawing lessons from the case studies and experiences of several accessible swimming pools, and through the field investigation of the swimming pool of Nanjing Olympic Sports Center, this paper systematically analyzes the accessible defects in the current service process. The research results show that strengthening physical facilities, guidance system, service procedures and user experience are all important ways to improve service quality.

**Keywords:** Accessible design, Service design, Principles of inclusive design, Principles of universal design, Swimming pool

## 1. Introduction

The purpose of this study is to solve the general concern of the current society about protecting the swimming rights of the disabled and the accessible development of public swimming facilities. Under the concept of national fitness, the demand for swimming by disabled people continues to rise, but the lack of accessible facilities and services in swimming pools is increasingly apparent. The accessible service in the swimming pool of Nanjing Olympic Sports Center does not fully meet the actual needs of the disabled. This study focuses on the experience of optimizing the comprehensive accessible service design of the whole swimming facility. Specially visited the swimming pool of Nanjing Olympic Sports Center to explore targeted service modifications to meet the needs of the disabled. This study uses the method of literature analysis to identify and review the relevant theoretical standards of accessible design. The advantage of this method is to systematically sort out the existing research foundation and industry norms, so as to clarify the core research direction and promote orderly progress. In addition, it also refers to successful cases at home and abroad and improves the research methods. The ultimate goal of this study is to provide optimization

suggestions for the whole process of accessible service transformation of Nanjing Olympic Sports Center swimming pool. This aims to effectively solve the challenges faced by disabled people when using swimming facilities.

## 2. Concept

### 2.1. Accessible design concept

The core goal of accessible design is to eliminate obstacles in the environment, so that all individuals can participate in social life independently, safely and fairly on the premise of maintaining dignity. It not only serves the permanently disabled, but also benefits the elderly, pregnant women, parents with children and people suffering from temporary sexual dysfunction—these groups will experience changes in their abilities at different stages of life. This fully demonstrates the inclusive nature of accessible design as a basic human right [1,2].

At first, accessible design mainly focused on physical access. At that time, it was common to add ramps, blind roads and other infrastructure. With the gradual evolution of the concept, it has now developed into a comprehensive and multidimensional system [3]. Firstly, the system will ensure the accessibility of the physical environment, so that all personnel can use the entrances and exits of buildings, internal passages and specific equipment smoothly and safely [1]. In addition, accessible design should focus on ensuring the fairness of information acquisition and transmitting key information through multiple sensory channels such as vision, hearing and touch. This method is very important to eliminate the information barrier faced by the hearing-impaired people [4]. The connotation of the service and system will be extended to inclusiveness, and the whole service process, management rules and personnel support should be flexible and responsive to meet the diverse needs of users.

Accessible design is not only a technical norm, but also a social concept formed from equality and tolerance in essence. It recognizes people's diverse and ever-changing abilities, and creates a truly friendly environment with forward-looking and flexible design [2].

### 2.2. Service design concept

In essence, service design is a method of systematically planning service processes and support systems around users [5]. Its core is to coordinate with all relevant parties to plan every contact point between users and services, and then create a smooth and satisfactory experience.

User journey map and service blueprint are commonly used tools in service design. These tools can completely present the behavior and emotional state of users from contact with services to completion, and can also sort out the internal relationship between the links directly perceived by users and the operation guarantee behind them, so as to find out the practical problems existing in the operation of the whole system.

Service design adopts a holistic problem-solving method, which extends the design consideration range from isolated hardware installation to the whole service operation system. By integrating the perspectives of users, employees and management, it can identify the root causes of problems and formulate comprehensive solutions covering front-end service interaction and back-end operational processes. This method ensures a more stable and accessible user experience, thus better safeguarding the personal well-being of service users [1].

### 2.3. Overview of the current situation and challenges facing swimming pools

In this study, by integrating the multi-dimensional standards of environmental information and operation mode put forward by accessible design in multi-scenarios, and combining the service design method throughout the whole process, a holistic analysis framework is constructed. The framework covers the user's perception evaluation of physical facilities and service operation, and transforms the original theory-oriented design principles into a practical methodology to evaluate the actual situation of accessible services in swimming pools.

In the process of using swimming facilities, individuals will encounter gradual obstacles that span multiple levels. Before going to the venue, the short-distance traffic conditions between the residential area and the swimming pool were generally unfriendly, which directly constituted the first space restriction for participating in related activities [6]. After entering the venue, the obstacles faced by users gradually shift from physical restrictions to more subtle psychological and social levels. Disabled children and their accompanying families may feel uncomfortable due to excessive attention and communication barriers in the space, and are more likely to fall into a passive position due to lack of customized support. This fully shows that the existing environment still has obvious shortcomings in ensuring the equal participation of diverse groups and maintaining their emotional well-being [7].

Hardware configuration problems will significantly affect the overall experience of users in the venue. The basic accessible facilities installed in many venues failed to achieve the expected function due to design omissions, and in some cases even failed to meet the basic use requirements [8]. The lack of necessary equipment to help users enter the water smoothly in the venue also makes it difficult for disabled people to really participate in swimming activities [4]. The lack of hardware components or abnormal functions will directly lead to poor user experience.

The seamless connection between operation process and background management system leads to many problems in environment and user experience. Part of the hardware equipment in the venue is idle or broken down, mainly due to the lack of stable and continuous daily maintenance and standardized management norms, not the quality problems of the equipment itself. The lack of coordinated and unified operating procedures between service links, coupled with the fact that employees did not receive systematic post-specific training and failed to establish a seamless inter-departmental cooperation mechanism, led to the failure to achieve stable continuity of services at key user demand nodes [7]. In the initial planning stage of the project, the actual needs of various users are fully considered, and the inclusive design concept is integrated into the overall construction plan. This makes all kinds of scattered problems that may occur in the later period be reduced from the source [9].

The challenges faced by swimming pools in providing accessible services often stem from the interaction of multiple factors. Insufficient hardware configuration directly affects the actual experience of users, which is essentially closely related to the fact that the whole process, from initial planning to subsequent construction and operation, can not really meet the actual needs of users. The relevant optimization work should not be limited to the supplement of scattered equipment, but also need to systematically adjust and reconstruct the existing service model with the overall analysis idea.

### 3. Case study

#### 3.1. Design principles

Improving the accessible service of swimming pool requires a clear and practical design scheme. In the process of implementation, it is essential to balance the needs of different user groups, ensure that the design concept covers a wider range of people, and create a working atmosphere of mutual assistance and progress. It is difficult for the existing swimming pool to achieve the ideal design state in one step, and it is necessary to gradually approach a more perfect design scheme through continuous optimization. This will make the service and environment of the venue adapt to the needs of more people.

Inclusive design will pay more attention to the whole process of design promotion, and will integrate the real state and actual demands of different users into all aspects of design. The real feelings of users in the scene can also provide important reference for problem sorting and scheme optimization [2]. The whole design work will always be close to the real situation of users, so that the final scheme can meet the actual use needs of the site and the crowd.

Universal design pays more attention to the characteristics that the design results can be adapted to more people in actual use. In the early stage of design, it will take into account the usage habits of different users and create a space and related results that are more acceptable to the public. The relevant design criteria also provide a reference standard for the evaluation and optimization of the scheme [2,3].

In this study, the swimming pool of Nanjing Olympic Sports Center is selected as the analysis object, aiming at testing the effectiveness of the above analysis methods and design principles in practical application, and discussing the typical problems encountered in the operation adjustment of large public stadiums.

#### 3.2. Analysis of the current situation of nanjing olympic sports center swimming pool

Nanjing Olympic Sports Center swimming pool was completed and put into use in 2005, which has the facilities for hosting high-level domestic and international competitions. Its overall construction scale and internal space layout can not only meet the diversified needs of professional competitions, but also meet the needs of the public. At present, the venue has been transformed from a professional competition venue to a public fitness center. The annual reception of swimming and fitness programs has always maintained a high level. While providing sports services to the public, venues also need to optimize and adjust their internal accessible environment to meet the actual needs of more users.

The venue has hardware facilities that meet international competition standards, but its internal accessible facilities are still relatively insufficient. When the venue is open to the public, it is difficult to meet the diverse needs of different user groups and fails to provide sufficient accessible conditions for the disabled.

The physical environment of the venue only meets the basic accessible requirements, as shown in the user journey map shown in Figure 1. The venue is not equipped with swimming pool auxiliary equipment specially designed for people with mobility difficulties. Most facilities do not meet the use requirements in terms of size and slope, and the changing shower area lacks necessary safety auxiliary facilities. Some accessible facilities are not maintained in time, and the signs in the venues are not clear enough. The service process is mainly designed according to the habits of healthy people. Although online booking is provided, it has not yet developed into a service model suitable

for special needs groups. The links are not well connected, employees lack relevant service experience and coping ability, and there is no special emergency plan. These problems cause people with mobility disabilities to face significant operational obstacles and need to rely on others to complete basic activities. In the long run, it is easy to produce psychological pressure, weaken the enthusiasm of participating in swimming activities, and it is difficult to truly understand the inclusiveness and care brought by the public environment.

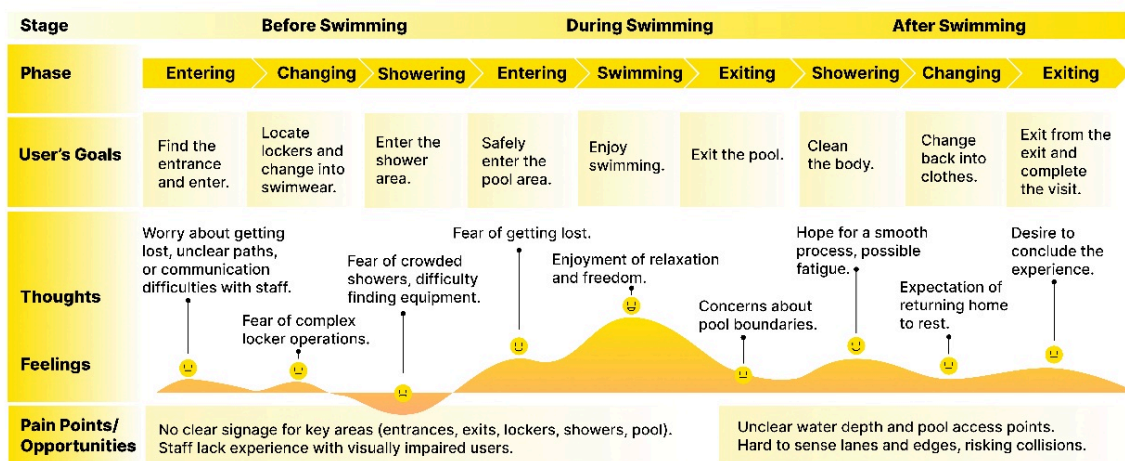


Figure 1. Accessibility service user journey map of Nanjing Olympic Sports Center swimming pool. (picture credit: original)

### 3.3. Optimization suggestions

When optimizing and adjusting the overall service according to the actual operation experience of the accessible service in the Nanjing Olympic Sports Center swimming pool, the strategy of overall layout planning must be adopted. This requires improving the level of environmental information dissemination and related daily operation and management tasks in the venues.

Following the principle of inclusive design, the real experience of users in specific situations provides a key reference for problem identification and solution optimization [2]. On this basis, the adjustment and optimization of physical facilities is the key link to improve the overall service. The focus of this work is to fill the functional gap and integrate security measures into every detail of the user experience. The main swimming pool area can be equipped with special equipment to help users enter the water smoothly, so that people with mobility difficulties can enter the core swimming pool area. The spatial layout and internal configuration of dressing room, shower room and toilet should also be adjusted accordingly, which not only ensures sufficient space for equipment installation and use, but also meets the traffic and operation requirements of special equipment.

Following the core principle of universal design, planning should adapt to the habits of different users from the beginning, and ensure that the space and facilities can meet the needs of a wider range of people [3]. After the hardware conditions are improved, it is necessary to do a good job of guidance and information transmission in the venue, so that people with mobility difficulties can obtain clear and coherent relevant information from the whole process of travel preparation to entering the venue. The venue can set up a special service section on the official online platform to present the route information of the venue and the application method of related services completely, so that users can master all the required contents before departure. After entering the venue, the existing signage system should also be upgraded. Users with different needs can get all kinds of

information in the venue smoothly through more recognizable visual presentation and different forms of perceptual prompts.

Inclusive design emphasizes the real needs of users as the core, and the crowd experience runs through the whole process of service construction [2]. The role of venue hardware and information guidance can not be played without a service operation mode that is more suitable for users' feelings. Another important direction of overall optimization is to adjust the existing service operation mode and make all links revolve around the actual needs of users. Venues can set up a service application and docking mechanism for coordinating multiple departments. Let users' related demands be transmitted to all work areas before they arrive at the site, so that the work of different positions can form a smooth connection. Front-line staff should receive corresponding service training and have the ability to communicate with special people and provide corresponding help [10]. Service points that are easy to identify can also be set up inside the venue, so that users can quickly find channels that can provide help when needed. At the same time, it continuously collects users' actual feelings and relevant suggestions, and constantly adjusts the existing working mode through multi-party communication. Let the overall service system better adapt to the needs of different groups of people in continuous adjustment.

Universal design pursues a natural, equal and unobtrusive use environment to avoid psychological pressure caused by specialized design [3,8]. When optimizing the identification system and carrying out relevant training for staff, it is essential to grasp the appropriate scale. All kinds of auxiliary methods should play a practical role while maintaining a natural and low-key state, thereby safeguarding the user's sense of independence and self-dignity. Accessible-related signs must be easy to identify and view while remaining coordinated with the surrounding environment. Avoid making users feel different from others because the design form is too special. Staff who have received systematic training should predict users' needs and provide assistance in a professional and low-key way. Give timely support when necessary to minimize the psychological impact. This approach not only accords with the emphasis of inclusive design on real scenes, but also embodies the purpose of universal design to meet the needs of multiple users [2,3]. While improving physical accessibility, ensure that everyone can feel the atmosphere of equality and nature in the environment.

#### 4. Conclusion

This study takes Nanjing Olympic Sports Center swimming pool as a specific case, integrates accessible design and service design theory, and uses the user journey mapping method to identify various obstacles existing in large public swimming venues from the dimensions of physical environment, information guidance, service operation and personnel support. Although the venue has high-standard competition facilities, there are obvious problems such as insufficient accessible facilities, fragmented service processes, lack of targeted operation and management, and insufficient attention to the experience and dignity of special groups. This study provides a reference for the research on accessibility and inclusive services of public stadiums and gymnasiums, and shifts the research paradigm from the transformation of isolated facilities to the practical path and methodology of establishing large stadiums and gymnasiums to achieve universal accessibility. Future work should focus on optimizing the use experience of different disabled groups, collecting long-term use feedback, and exploring innovative models of digital accessible services to promote equality and inclusiveness of public spaces.

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