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*Research Article*

# Interactive Landscape Design and Application Effect Evaluation of Community Sports Park by Wireless Communication Technology

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To improve the comprehensive quality of urban community sports parks and enhance the modern life quality of residents, first, wireless communication technology is discussed. Second, the construction of community sports parks and the concept of interaction design (IxD) are explored. Finally, a comprehensive assessment of the construction of sports facilities in the park is carried out. In the research method, a field investigation is carried out on the sports park built in Chongqing first, and the research content is designed according to the investigation results. Then, the current sports park construction results are investigated and evaluated by means of a questionnaire survey. The research results show that the five community sports parks in Chongqing still need to be improved in terms of their comprehensive construction. The most obvious in terms of their essential functions is the Yangtianwo community sports park, which has the lowest comprehensive score of 29 (total score is 60). Subsequently, in the comprehensive evaluation of community sports parks, Yangtianwo has the lowest satisfaction evaluation. Finally, in the evaluation of wireless communication technology, residents have the lowest satisfaction with Dashuijing community sports park, and the evaluation score is 20 (total score is 30). It denotes that the comprehensive evaluation of Yangtianwo is the worst among the five community sports parks. The research not only provides a reference for the construction of community sports parks in Chongqing but also contributes to the comprehensive development of community sports parks.

## 1. Introduction

With the progress of science and technology, human communication technology has been fully developed, and various types of communication technologies have created efficient communication effects. Among them, wireless communication technology, as the main means of communication at present, helps residents greatly improve their daily life [1]. As an indispensable part of current urban life, the comprehensive construction of community sports parks also has a certain role in improving the lives of urban residents, so it is necessary to study them [2]. Although the development of community sports parks is not ideal, many studies have provided technical references for them.

Yu and Wang (2021) pointed out that with the continuous development of the social economy, technological products were constantly innovating, and their applications in people's lives were becoming more and more extensive. The application of communication technology realized the nonmedia interaction of information to a certain extent. It not only promoted the continuous development of high technology but also improved people's living standards. On the basis of high-tech development, people's requirements for high-tech are getting higher and higher. To meet people's

different needs for communication technology, various communication means have been innovated [3]. Jeanes et al. (2021) proposed that as an important component of urban space, community sports parks were not isolated from the urban system and were also different from simple community parks and sports parks. It is a public service space that intervenes in the urban structure in the form of basic public facilities based on the cultural connotation and functional needs of sports. The establishment of community sports parks is not only a practical practice of practicing the concept of healthy China but also a significant measure to relieve the pressure of urban land construction [4]. Carbonell-Carrera et al. (2021) considered that interactive landscape design was an innovative concept and a new research perspective that conformed to the development of the times and the needs of users. It takes human-landscape interaction as the research focus and focuses on how the landscape integrates into people's living environment. It has made important contributions to the improvement of human life quality [5]. The literature suggests that communication technology has occupied a vital position in human life and is crucial to the improvement of human life. As the community sports park is an important place for the citizens to carry out physical exercise and leisure and entertainment in residents' daily life, it is very necessary to improve the construction work of the sports park. Therefore, as the necessities of citizens' life, the construction and improvement of wireless communication technology in community sports parks are one of the most significant tasks.

To sum up, the wireless communication technology is firstly analyzed, and second, the community sports park and the concept of interaction design (IxD) are discussed. Finally, the community sports park based on wireless communication technology and the concept of IxD are comprehensively evaluated. Through the above research contents, the importance of wireless communication technology to citizens' life and its necessity in the construction of community sports parks is firstly confirmed. The evaluation of the existing construction provides a significant reference for the subsequent construction and improvement of the wireless communication technology of the sports park. The research content breaks through the traditional research content of the community sports parks and puts forward constructive suggestions for the improvement of the sports park. The research not only provides a reference for the development of community sports parks but also contributes to the improvement of residents' quality of life.

## 2. Research Theory and Methods

*2.1. Wireless Communication Technology.* Wireless communication technology refers to a communication technology that uses the characteristics that electromagnetic wave signals can propagate in free space for information exchange [6]. In recent years, wireless communication technology has developed rapidly, many kinds of propagation modes have been provided, and various wireless communication technologies are used more and more widely by human beings [7]. Wireless communication technology mainly includes cellular networks, long-distance wireless communication technology, short-distance wireless communication technology, and satellite communication [8]. The main forms of wireless communication technology are shown in Figure 1.

In Figure 1, wireless communication technology, as the main basic communication technology at present, has become the main way for residents to travel together. Therefore, wireless communication technology has a great impact on the lives of residents [9]. In future urban construction, wireless communication technology will occupy an important position. With the development of science and technology, the construction method of wireless communication technology will also undergo major changes, so it is necessary to constantly detect and improve the construction of wireless communication technology in all areas of the city [10]. Through the popularization of wireless communication technology, the design of community sports parks will be studied to explore its influence on residents' lives and analyze the form of sports parks suitable for residents' lives.

*2.2. Community Sports Parks.* As one of the main components of modern cities, sports parks play a very significant role in the life of citizens. Sports parks are an important form of current urban parks, that is, the elements and main structures in the parks are related to sports, that is to say, the design theme of sports parks is sports. From the park's infrastructure, element composition to design style, strong sports elements need to be integrated [11]. The purpose of the construction of the sports park is to provide citizens with a more professional, scientific, and safe garden that meets the needs of sports. Through the construction of sports parks, it can help citizens to carry out more convenient sports, improve their physical quality, and promote a healthy life of citizens [12].

The sports park first appeared in 1982, and when the concept of the sports park was proposed, it was stipulated that the sports park is a special kind of urban park, the sports park must have certain sports facilities, and the sports facilities in the park must also be to meet certain requirements and specified standards, so as to meet the sports needs of residents [13]. Meanwhile, in addition to meeting the sports needs of the residents, the greening of the park environment should also be done, to ensure that people can not only exercise but also play and rest. The definition of foreign sports parks was proposed in 1985, which is three years later than China. Foreign sports parks are defined as sports places located in a beautiful garden and include sports facilities and stadiums. In general, it is a place that can carry out systematic sports training and sports performances, and it is also a park that can attract residents to exercise and rest [14].

Community sports parks, different from sports parks, are a new concept. The popularity of community sports parks is still relatively low, and the research on community sports parks is still in its early stages. The main construction nature of these includes the comprehensive nature of construction land and functions. Specifically, it refers to the construction of urban lands, street green space, flower arrangement land, and other unused lands. With greening

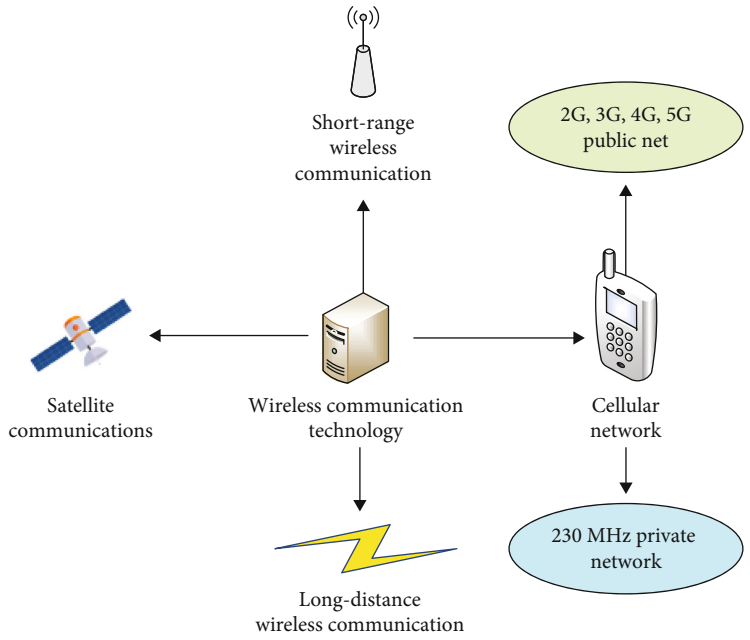



Figure 1: The main forms of wireless communication technology.

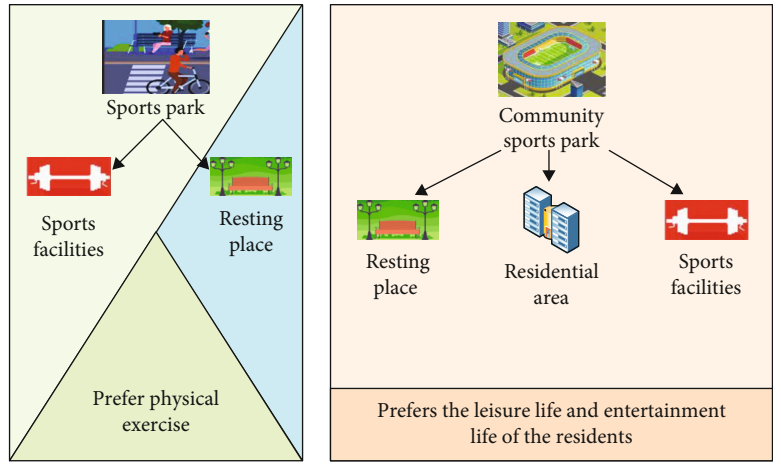



Figure 2: The form of the sports park ((a) is a sports park, and (b) is a community sports park).

as the fundamental purpose, and sports and leisure and fitness as the main functions, it has a certain comfortable environment and a public space that is free to open to citizens. With the improvement of people's quality of life, the emphasis on health has become higher and higher, and the requirements on the environment have become more stringent [15]. Therefore, more attention has been paid to the construction process of the sports park. The concept of a community sports park has certain restrictions on its scope, that is, a community sports park refers to a park in the community, and other aspects are basically the same as a sports park, so a community sports park is a combination of a community and a sports park. Therefore, compared with sports parks, the scope of community sports parks is smaller, and the service targets are community residents, so the number of service targets is relatively small. Its main function is to provide residents with fitness places and ensure their daily health care activities. Its role in sports competition may be relatively low [16].

There are also certain differences between community sports parks and sports parks. Community sports parks are different from generalized sports parks in the following characteristics: first, community sports parks are closer to residential areas, the construction area is small, and the construction land is generally limited places and street green spaces that do not have much significance. That is, the construction of community sports parks cannot change the original nature of the site. Second, although the function of the community sports park is mainly physical exercise, it also has a strong function of leisure and play, which includes

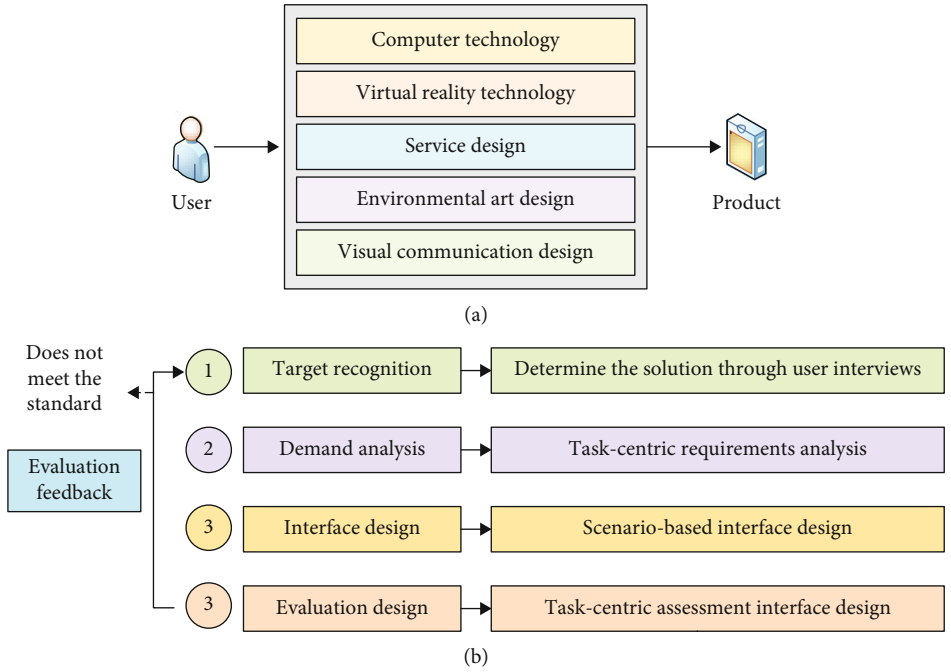


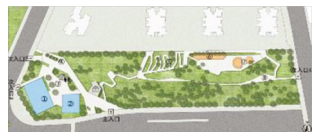

Figure 3: The basic concept and design process of IxD ((a) basic concept; (b) design process).

the leisure and physical exercise of the community residents [17]. Third, the exercise facilities in the community sports park are mainly simple, convenient, high-quality, and comprehensive in construction. And these facilities need to be placed in open-air places, not in larger indoor gymnasiums. Finally, the community sports park needs to be open to community residents free of charge after the construction is completed, and it needs to emphasize the atmosphere of the community to help community residents strengthen emotional communication with each other. Therefore, compared with sports parks, the service scope of community sports parks is smaller, and the nature of services is more inclined to leisure and entertainment. The basic nature of community sports parks and sports parks is shown in Figure 2 [18].

In Figure 2, (a) represents the construction content of the sports park, and (b) represents the construction content of the community sports park. There is a great similarity between the two, but the essence of the two is very different. Community sports parks have a weaker sports-competitive nature, but are more intense in terms of leisure and entertainment. Meanwhile, community sports parks are usually built within communities, so they can promote emotional exchanges among community residents to a greater extent, and are more suitable for improving community residents' life. Sports parks are usually built outside the community, but they need to provide fitness places for many community citizens, so their responsibilities are relatively large.

*2.3. Interactive Landscape Design.* The concept of IxD was put forward in 1984. After a long period of development, it has become an independent discipline, and the concept of IxD has produced different influences all over the world, which has caused the research of many scholars. A simple definition of IxD is that it is the behavior of artifacts, environments, and systems, and the design of appearance elements that convey this behavior [19]. From the user's point of view, IxD is a design that makes a product easier to use, more effective, and more comfortable for the user. Another definition of IxD is a discipline that specifically focuses on defining product forms that are closely related to the behavior and operation of the product. These include predicting the use and impact of products and the relationship between products and users; analyzing users' understanding of products; and exploring products, people, and their relationships [20]. On the whole, IxD is a design method based on the concept of customers, that is, a design with the purpose of customers as the main goal. The fundamental purpose of the design is to improve and expand the user's interaction space between work and life. IxD is also a comprehensive and interdisciplinary subject with a wide range of research directions. It includes information science and technology such as computer technology and virtual reality (VR) technology, as well as service design, environmental art design, and visual communication design. The goals of IxD mainly include usability goals and user experience goals. The former refers to the ease with which users can evaluate the design in the process of using the product [21]. The higher the ease of use of the product, the higher the cognitive efficiency of the product. Users feel the product is useful and easy to use, and the product can effectively help users complete certain tasks. The latter is evaluated from the user's perception. That is to evaluate whether the design of a product is interesting and whether it can make users feel emotions in the process of interaction. If the IxD makes the customer's emotions change more, the feedback results of the product will be more ideal, and the user's perception of the product will be higher [22]. The basic concept and the basic flow of IxD are shown in Figure 3.

Table 1: Overview of the park (source of the chart: self-drawn).

| Serial number | Name | Location | Area ($m^2$) | Park plan |
|---|---|---|---|---|
| 1 | Chaoyouchang | Banan District | 14254 |  |
| 2 | Xinhubei | Dadukou District | 20452 |  |
| 3 | Dashuijing | Jiangbei District | 11858 |  |
| 4 | Yangtianwo | Nanan area | 5200 |  |
| 5 | Jiangyucheng | YuBei District | 110000 |  |

In Figure 3, single lines mean that they are connected to each other, and (a) reflects the basic concept of IxD. The basic concept of IxD is to improve the user's experience of using the product, improve the use efficiency of the product, and increase the user's feelings for the product in the process of using it. (b) reflects the process of IxD, which is mainly divided into investigation and research, situation modeling, the definition of requirements, design of the system, detailed design, and modification of design. However, after the later design optimization, the IxD basically includes four stages, mainly target identification, demand analysis, interface design, and evaluation design. The four stages are carried out in sequence, and the results of the final evaluation design are fed back to the target identification stage for cyclic design until the design is completed and can meet people's needs [23].

*2.4. Evaluation Method of Community Sports Park Construction.* According to the preliminary investigation of the established community sports parks in Chongqing, research objects are selected five community sports parks with the same nature, suitable location distribution, and similar surrounding land use, namely, Dashuijing and Chaoyouchang, Yangtianwo, Xinhubei, and Jiangyucheng community sports park. The general situation of each park is sorted out through preliminary field research and related literature review, as shown in Table 1.

In Table 1, the basic conditions of the surveyed communities are shown. The field research was selected to be carried out from April to June 2021. Under the premise of avoiding holidays and extreme weather, each park chose to conduct the research on two days, the working day and the rest day. The research time lasted from 7 : 00 am to 9 : 00 pm to ensure the scientificity and representativeness of the research data. Among them, the surveyed items are classified through inspections in advance, mainly based on the daily activities of citizens and the infrastructure construction of the above community sports parks. During the field research in the park, the activity characteristics of residents of different ages and genders were observed and recorded; the sites and tour routes with high activity frequency of residents were marked; and the basic conditions of each site such as boundaries, roads, facilities, and plants were recorded. According to the preliminary investigation and related literature research, 12 scoring elements for community sports parks are selected, and each element is assigned a score of 1-5.

Table 2: Scoring criteria for the 12 elements of the park (source: self-drawn).

| Feature layer | Specific scoring criteria (assigned from 0-5) |
|---|---|
| Activity space | Number of spaces allowed for individual or group events<br>0 = none; 1 = 1; 2 = 2; 3 = 3; 4 = 4; 5 = 5 or more |
| Space type | Space types with different functions (fitness venues, rest venues, children's entertainment venues, cultural exhibition venues, gathering and distribution venues, etc.)<br>0 = none; 1 = 1; 2 = 2; 3 = 3; 4 = 4; 5 = 5 or more |
| Terrain | Aesthetically pleasing, dividing space, accessible, accessible<br>0 = no terrain; 1 = with terrain but without the above three characteristics; 2 = with terrain and with one of the above characteristics; 3 = with terrain and with the above two characteristics; 4 = with terrain and with the above three characteristics; 5 = have terrain and have the above four characteristics |
| Fitness venue | Number of fitness venues (equipment fitness, table tennis court, badminton court, gate court, running track, etc.)<br>0 = none; 1 = 1; 2 = 2; 3 = 3; 4 = 4; 5 = 5 or more |
| Equipment fitness facilities | Number of equipment fitness facilities<br>0 = none; 1 = 1; 2 = 2; 3 = 3; 4 = 4; 5 = 5 or more |
| Children's entertainment | Number of children's entertainment facilities<br>0 = none; 1 = 1; 2 = 2; 3 = 3; 4 = 4; 5 = 5 or more |
| Rest facilities | Rest facilities (benches, matching tables and stools, etc.)<br>0 = none; 1 = 1; 2 = 2; 3 = 3; 4 = 4; 5 = 5 or more |
| Auxiliary facilities | Types of auxiliary facilities (drinking water facilities, vending facilities, item storage facilities, sunshade and rain shelter facilities, guide facilities, etc.)<br>0 = none; 1 = 1; 2 = 2; 3 = 3; 4 = 4; 5 = 5 or more |
| Plant | The visual aesthetic and interaction opportunities that plants can provide<br>0 = none; 1 = rare; 2 = limited variety; 3 = some of the venues have several varieties; 4 = the entire venue has several varieties, with visual effects or encourages interaction; 5 = the entire venue has many varieties, which is visual and encourages interaction |
| Water feature | The visual aesthetic and interactive opportunities that water features can provide.<br>0 = none; 1 = only one water feature and no visual aesthetic and interaction opportunities; 2 = only one water feature and only visual aesthetic or interactive opportunities; 3 = only one water feature and provided visual aesthetic and interaction opportunities; 4 = multiple water features and only provide visual aesthetics or interaction opportunities; 5 = multiple water features and provide visual aesthetic and interactive opportunities. |
| Ground material | Type of material and whether it is attractive and ecological<br>0 = none; 1 = 1 type, not attractive or ecological; 2 = 1 or 2 types, attractive or ecological; 3 = 1 or 2 types, attractive and ecological; 4 = more than 2 types, attractive and ecological; 5 = 3 or more types, attractive and ecological |
| Sanitation | Number of littering places<br>0 = 5 or more littering places; 1 = 4 littering places; 2 = 3 littering places; 3 = 2 littering places; 4 = 1 littering place; 5 = no littering place |

Through field observation and scoring, an objective and scientific evaluation of each park is carried out. The evaluation system is shown in Table 2.

In Table 2, specific research is carried out according to the abovementioned evaluation criteria combined with the method of questionnaire survey. The on-site questionnaire survey is conducted through the interviewer's reading, and 80 questionnaires are distributed in each community sports park. 70 questionnaires are returned for Yangtianwo community sports park; 68 questionnaires for Chaoyouchang; 71 questionnaires for Xinhubei; 75 questionnaires for Dashuijing; and 76 questionnaires for Jianghecheng. A total of 400 questionnaires are distributed, and after excluding invalid questionnaires (incomplete answers or inconsistent answers), there are 353 valid questionnaires, with an effective rate of 88.25%. The main research content of the questionnaire is to investigate the activities of citizens of different age groups in the park for a day. According to the survey results, the types of citizens' activities are evaluated, and their satisfaction with the community sports parks is evaluated according to their attitudes towards the construction of the community sports parks. The reliability and validity tests manifest that the Cronbach's alpha coefficient of the designed questionnaire content is 0.82, the Kaiser-Meyer-Olkin (KMO) test coefficient is $0.747 > 0.5$, and the $P$ value of the significant probability of the $\chi^2$ statistical value of the Bartlett sphere test is $0.001 < 0.05$. Therefore, the questionnaire has good reliability and validity.

## 3. Results

*3.1. Analysis of Residents' Activities.* The research mainly surveys community residents through questionnaires and finally evaluates them through analysis. Table 3 shows the basic situation of residents' activities in the park.

Table 3: Summary of activity types and time of residents in the five parks (source: self-drawn).

| Type of activity | Morning (7-12 : 00) | Afternoon (12-18 : 00) | Evening (18-21 : 00) |
|---|---|---|---|
| Run | √ | \ | \ |
| Walk | √ | √ | √ |
| Square dance | √ | √ | √ |
| Aerobics | √ | \ | \ |
| Pingpong | √ | √ | \ |
| Chat | √ | √ | √ |
| Take care of children | √ | √ | \ |
| Sit around | √ | √ | \ |
| Chess and cards | \ | √ | \ |
| Musical instrument | \ | √ | \ |
| Badminton | √ | √ | \ |
| Basketball | √ | \ | \ |
| Fitness equipment | √ | √ | √ |
| Onlookers | √ | √ | √ |
| Walk the dog | √ | \ | \ |

(a) (b)

Figure 4: Residents' activities in the sports park ((a) Yangtianwo sports park; (b) Xinhubei sports park. Image source: self-photographed).

In Table 3, through the observation and record of the user behavior of the five community sports parks, it can be found that the activities of residents in the community sports parks are mainly during the daytime; the most important sports activities are walking, equipment exercise, ball sports; and other daily activities are babysitting, sitting, chatting, etc. It denotes that the residents generally carry out low-intensity activities in the park. This is because the residents do not have many competitive intentions in their daily psychology and physiology, which makes them less demanding in terms of physical strength, reflexes, agility, etc. Therefore, low-intensity physical activities are more suitable for the daily fitness of community residents. As shown in Figure 4, the activities of residents in different sports parks are displayed.

The field investigation found that the activities of residents in the park can be basically classified into three types: large-scale activity, group activities, and individual activities. Large-scale activities are mostly concentrated in the square at the entrance of the park, and the hard pavement area is large and relatively spacious, such as square dancing and aerobics. Group activities and individual activities are mainly concentrated in relatively quiet sites with high plant landscape or terrain enclosure, such as chess and cards and Tai Chi. The survey also found that most of the residents have obvious agglomeration. They hope to join the groups they are interested in to enrich their lives and gain recognition from others, to meet their belonging needs and communication needs.

*3.2. Grade Analysis of Park Elements.* The evaluation of the park is carried out according to the evaluation system established by itself. The evaluation method is mainly performed in the way of scoring, and comprehensive grade analysis is carried out through comparison. The evaluation results for five community sports parks are shown in Figure 5.

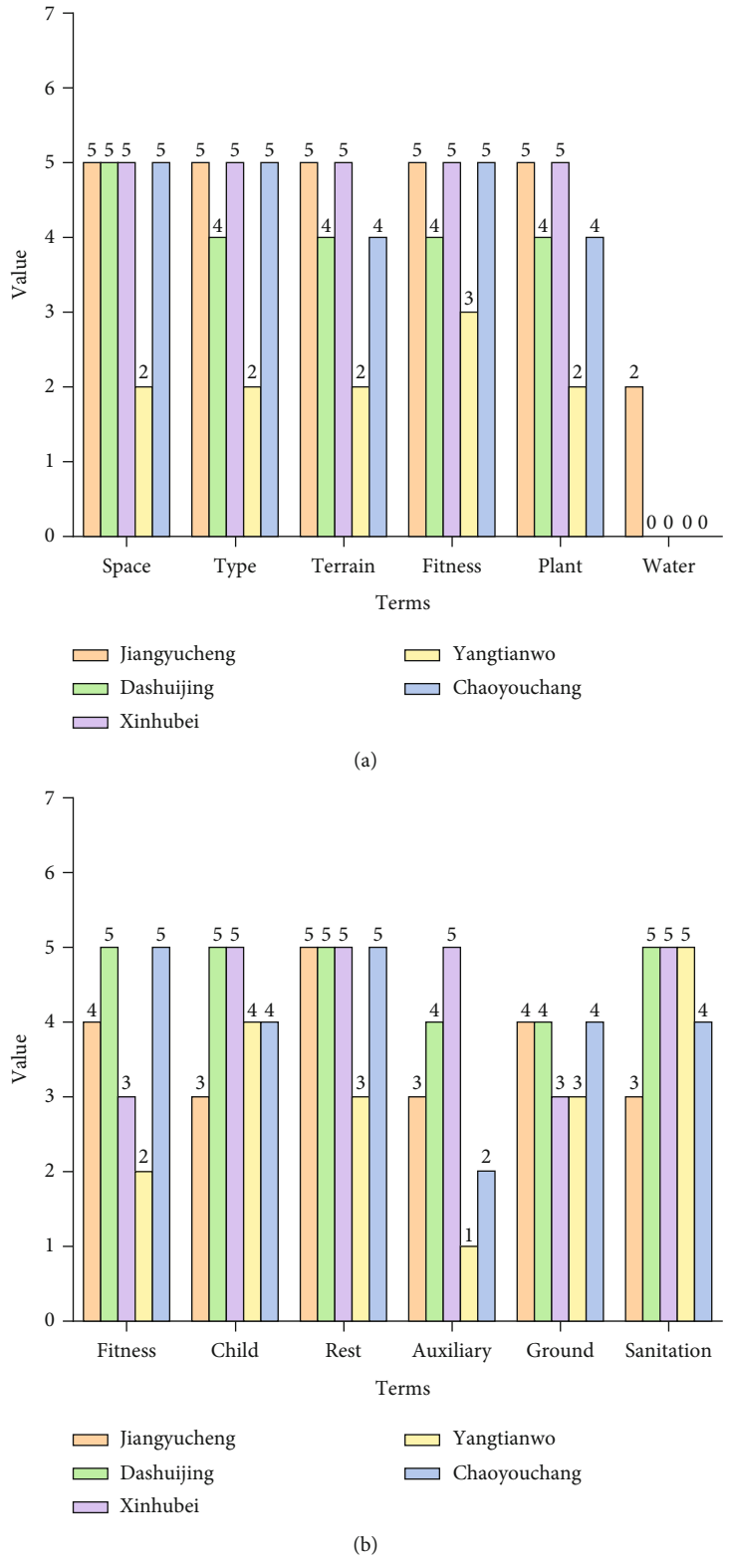



Figure 5: Comprehensive evaluation results of community sports parks ((a) the basic scene; (b) the infrastructure).

In Figure 5, statistics show that the score of Jiangyucheng community sports park is 49, the score of Dashuijing is 49, the score of Xinhubei is 51, the score of Yangtianwo is 29, and the score of Chaoyouchang is 47. The results can be divided into 3 grades according to the score (total score is 60): the score of 50-60 (1), the score of 40-50 (3 points), and less than 40 (3). The lowest score is Yangtianwo community sports park, which lacks the number and type of activity spaces, has fewer

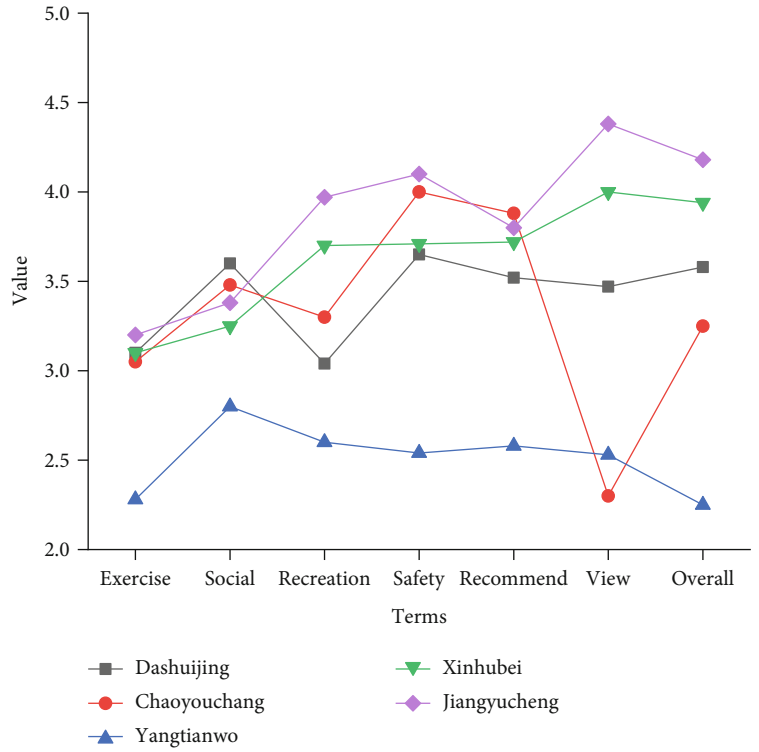



Figure 6: Satisfaction survey of residents in community sports parks.

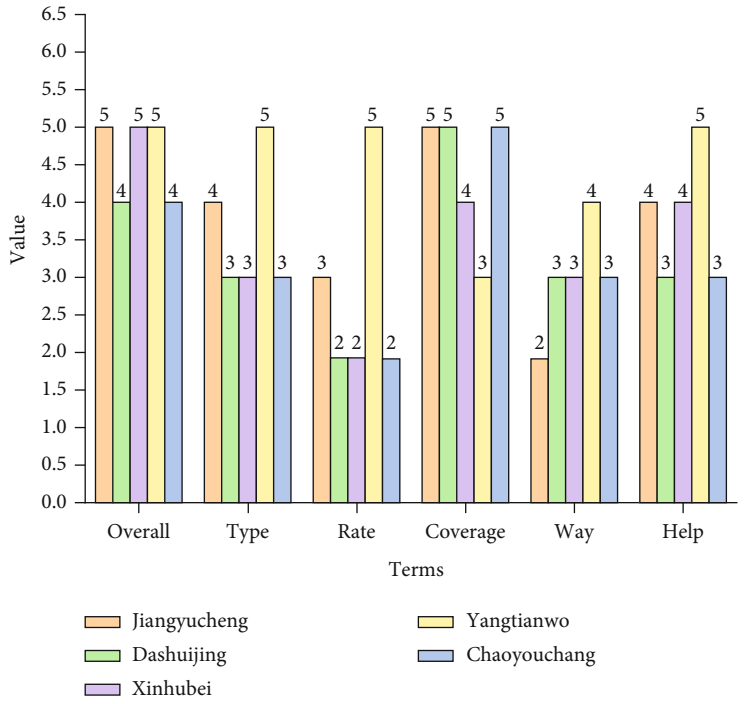



Figure 7: The evaluation results of the wireless communication network technology.

terrain changes and plant species, and lacks fitness venues and equipment fitness facilities. The highest score is Xinhubei community sports park, which has a large number and types of activity spaces, rich terrain changes, and a large number of children's entertainment facilities, sports facilities, and auxiliary facilities with reasonable settings. Comparing the overall scores of equipment fitness facilities and children's entertainment facilities, it can be seen that there are relatively few fitness facilities, and the number needs to be increased. In general, the waterscape settings in the five parks are relatively

lacking. The survey found that only Jiangyucheng community sports park has waterscapes, but its design facilities of close to water is insufficient, and the practical significance of waterscapes is low.

*3.3. Analysis of Residents' Satisfaction with the Park.* The first is to investigate the residents' overall satisfaction with the sports park. The residents of the five community sports parks are surveyed on the overall satisfaction of the park. Figure 6 shows the results of survey of residents' satisfaction.

Figure 6 demonstrates that the satisfaction of Yangtianwo community sports park is the lowest. The lack of sports facilities and venues makes it difficult for the park to meet the sports needs of residents. The lack of plant species also makes the park's scenery less attractive. There are only basic rest facilities. For example, the seating and gallery can better meet the social needs of residents. Residents' overall satisfaction with several other parks is relatively average, because the four parks have outstanding highlights, such as Xinhubei community sports park and Jiangyucheng with better landscapes, and Dashuijing and Chaoyouchang community sports park has higher comfort and safety. However, residents give low evaluations to the five parks in terms of whether they can meet their own exercise needs. First, the existing community sports parks are lacking in the design of residents' physical exercise. The second is the satisfaction survey of the wireless communication network technology in the park. The evaluation results of the wireless communication network technology in different sports parks are shown in Figure 7.

In Figure 7, the wireless communication technology construction of five sports parks is evaluated through the survey. It denotes that the score of Jiangyucheng community sports park is 23, the score of Dashuijing is 20, the score of Xinhubei is 21, the score of Yangtianwo is 27, and the score of Chaoyouchang is 23. Among them, Dashuijing has the lowest score, and it has the lowest score in the use of wireless communication technology, with a score of 2.

## 4. Conclusion

The interactive landscape design and application effects of community sports parks are studied and evaluated based on wireless communication technology. First, the current wireless communication technology is discussed. Second, the construction of community sports parks is analyzed. Finally, the construction of community sports parks in Chongqing is comprehensively evaluated by means of a questionnaire survey. The research indicates that there are obvious differences in the construction process of the Jianghecheng, Dashuijing, Yangtianwo, Xinhubei, and Chaoyouchang community sports parks in Chongqing. First, according to the construction purpose of the community sports park, in terms of physical exercise and leisure and entertainment, Yangtianwo has the lowest score, with a total score of 29. Xinhubei has the highest score, with a total score of 51, while the scores of the other three parks are all between 40 and 50, and has no great difference. Second, in terms of residents' satisfaction survey, Yangtianwo has the lowest satisfaction. The lack of sports facilities and venues makes it difficult for the park to meet the residents' sports needs. The lack of plant species also makes the park's scenery less attractive. There are only basic rest facilities. For example, the seating and gallery can better meet the social needs of residents. Finally, in the evaluation of the construction of the wireless communication technology of the community sports park, Dashuijing has the lowest score of 20, indicating that the construction of its wireless communication technology is not complete and cannot meet the needs of residents. The research not only evaluates the comprehensive facilities and site construction of the community sports park but also evaluates the construction of wireless communication in the sports park. It greatly improves the construction of the community sports park and provides important guarantees for citizens' various lives and entertainment. Although the comprehensive construction of five communities in Chongqing has been evaluated, there is a lack of research on construction and renovation. Therefore, the research on this part will be strengthened in the future.

## Data Availability

The datasets presented in this article are not readily available because we explained our institution and identity (certificate and letter of introduction issued by the University) to the interviewee. We ensured all the interviewee's information was only used for academic research and would not be disclosed in any way, which made the interviewee fully trust the research team and then authorized the research. Requests to access the datasets should be directed to 980201500026@cqjtu.edu.cn.

## Conflicts of Interest

The authors declare that they have no conflicts of interest.

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