

Optimizing Public Seating Design in Post-Pandemic Urban Community Parks: A Comprehensive Framework

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Abstract In the post-pandemic context, public seating furniture, an essential part of urban community parks, is vital in meeting people's needs for a comfortable resting space. The current design and layout of public seating in community parks in the post-pandemic period do not meet the needs of different groups of people in many aspects. This study aims to develop a comprehensive design framework that covers the user characteristics, use patterns, space features, location, and activity characteristics of public seating in community parks. This framework will provide valuable reference information for industrial designers and urban planners to optimise the layout and design of park seating to further meet the needs and expectations for improved public seating in the post-pandemic period. This research used an on-site observation method and statistical analysis of data using Excel. Research shows that users of community park seating furniture cover all age groups, including special groups (pregnant women and people with disabilities). Although individual use is predominant, users have expectations of social interaction. Preferred seating locations are close to children's play areas, beautifully landscaped, and shaded tree areas. The type of activity is statistically diverse and includes accompanying children, socialising, watching dynamic activities, and using mobile phones. Based on the findings, however, there are

limitations to this study, such as the limited sample size and the choice of observation periods and locations. In conclusion, the design framework is valuable to improve the attractiveness and promote the sustainable development of urban community parks.

Keywords Social Activities, Seat Design, Environment, Layout

1. Introduction

Urban community parks, an important place for residents to relax, socialize, and exercise daily, shoulder the critical task of improving urban residents' quality of life amid the accelerated urbanization process [1, 2]. As an essential component of urban community parks, public seating is vital in meeting residents' needs for comfortable open spaces [3- 5]. Moreover, the recent global COVID-19 epidemic has profoundly impacted individuals' outdoor lifestyles, especially in terms of how they perceive and use public spaces [5]. This has led to an evolution in their needs and expectations of public spaces. To meet these heightened requirements, it is particularly important to understand the usage patterns of public seating in urban

community parks [6]. Additionally, factors such as safety, hygiene, comfort, adaptability, and convenience impact the layout and design of public seating furniture in community parks in the post-pandemic era [7]. Notably, current seating layouts are no longer adequate to suit the needs of various populations due to monotony, a lack of safety features, and accessibility difficulties [8-10]. To address these health and safety challenges, layout patterns that are compatible with social proximity, hygiene, and other safety measures must be explored [8].

Given the limited extant understanding of public seating design and layout optimization, there is an urgent need for more in-depth research into the usage patterns, space features, and activity characteristics of public seating in urban community parks in the current era. To address this gap and provide valuable insights into post-pandemic public seating design and layout in urban community parks, this research aims to develop a comprehensive design framework for public parks that encompasses user characteristics, usage patterns, space characteristics, and activity types. This framework enables a clear understanding of residents' current needs and expectations towards public seating, thereby providing urban planners and industrial designers with targeted recommendations to improve seating layout and design.

By examining and proposing suitable seating layout and design for the post-pandemic era, this study makes significant contributions. On the one hand, improved seating patterns can enhance the appeal and functionality of community parks, which encourages more people to visit and participate in outdoor activities. This positively affects their mental and physical health [10,11] and promotes social cohesion among the local community [12,13]. On the other hand, optimized seating can achieve inclusive and accessible spaces that meet the needs of users of different ages, genders, income levels, and disabilities [8]. Ultimately, the findings of this study are valuable and beneficial for the attractiveness of urban community parks, the solidarity and satisfaction of residents, and the sustainable development of community parks.

2. Materials and Methods

A diverse range of park users constituted the research population, including the elderly, middle-aged, young adults, teenagers, and children. To collect data from this population, direct observation of the natural state was adopted as the research design. The site selection and observation procedures are explained in the following sub-sections.

2.1. Site Selection

Nie Er Community Park, located in Hongta District, Yuxi City, Yunnan Province, was selected as the site for this study. Yunnan is a southwestern Chinese province

that is known for its rich biological and cultural diversity as well as its numerous indigenous ethnic minorities. The city of Yuxi is located approximately 90 kilometers (56 miles) south of Yunnan's provincial capital, Kunming. The Nie Er Community Park in Yuxi is a popular public space in the city, known for its lush greenery, recreational facilities, and relaxed atmosphere. This community park, named in honor of the musician Nie Er, combines cultural, recreational, and leisure functions in one community park, providing a pleasant relaxation space for residents and visitors [13]. It is noteworthy that, relative to parks in large cities, parks in small cities such as Yuxi have been understudied. This gap offers the present study a unique research perspective.

2.2. Onsite Observation

The primary research method for understanding environmental behavior is observation, in which researchers collect data by observing and recording the behavior of individuals in their natural environment using visual sensing and camera tools [14]. Xiaolei [15] stated that this method does not involve sampling; rather, it focuses on observing the entire population based on "temporal sampling" [16]. Accordingly, this research employed direct observation of the natural state of Nie Er Community Park users as the research method.

The observation design was based on the functional layout of Nie Er Community Park, which comprises four main recreational areas: a children's play area, a forest area, and a fitness and sports area. These areas were divided into designated priority areas to observe and collect relevant data. Veitch et al. [16] recommended that observations should occur during a normal or temperate season, such as spring or autumn. These seasons typically feature moderate weather conditions, providing a more accurate representation of typical park usage and user behavior patterns. Therefore, this study's observations were conducted on one weekday and one weekend day per week from October 22 to October 31, 2022, with similar weather conditions on all observation days.

Additionally, the choice of timing determines the success or failure of an observation. Based on a preliminary survey and considering the habits of park users in the autumn season, two morning periods between 8am and 12pm and two afternoon periods between 2pm and 6pm were chosen for observation. The observation periods ranged from five to 10 minutes, in line with the acceptable fatigue time limit of 20 minutes with a standard interval of 20 minutes [12]. During the 10-minute intervals, users' gender, age, and type of activity were recorded at the observation site. A specific recording tool, in the form of a recording sheet, was used to clearly document behavior types at suitable observation positions.

This research maximized reliability and validity through various means. First, in terms of reliability, the observation process was standardized to ensure consistency and

accuracy in the following ways: adopting a semi-structured observation schedule; clearly defining observation categories; training observers to categorize observed behaviors precisely; dividing the observation site into designated priority observation areas; and using two observers to record observations simultaneously. Second, the study chose a fixed observation site with high foot traffic to minimize the impact of environmental variables. Lastly, the validity of the observations was enhanced by dedicating sufficient time to obtaining comprehensive information.

The acquired data was analyzed using Microsoft Excel, whereby gender and age differences in access times were examined on a case-by-case basis. Users' seating postures and usage patterns of community park seats were also categorized in terms of time, place, and type of activity.

3. Results

Based on the field observations and analysis, the seating usage characteristics of Nie Er Community Park are presented in this section. Tables 1, 2, 3, and 4 report the statistics on user characteristics, usage patterns, space and location, and activity types, respectively. The statistical

classifications in the tables are based on the number of simultaneous seat users.

Table 1. Age composition of community park seating users

Age Group	Total
Children	14
Teenagers	9
Youth	22
Middle-aged	25
Elderly	40

Table 2. Usage patterns of community park seating

Use Pattern	Total
Back-to-back	14
Face-to-face	29
Side-by-side	38
Individual	30
Semi-circular	2
Wheelchair users	1

Table 3. Space features and locations of community park seating

Space features and location	Total	Space features and location	Total
Children's play area with beautiful scenery	28	Artificial water feature with wide and beautiful view	4
Children's play space, walkway side, shade	5	By the small square with a wide view	8
Gazebo, beautiful water landscape, visual openness	8	Open view and a variety of plants	4
Open tree space along the walkway, shaded by trees	10	Smoking area with abundant plants and shade trees	2
Sports plaza with a wide view to watch dynamic activities	7	View of dynamic activities on walkway side	2
Walking path with open space	18	Shaded area with lush trees	6
Walkway side, abundant plants, and the shade of trees	5	Wetland with beautiful scenery and abundant plants	4

Table 4. Activity types in community park seating usage

Activity Type	Total	Activity Type	Total
View scenery	9	Wait for child(ren)	1
Do homework	1	See birds and chat	1
Drink water	1	Watch dynamic activities	8
Eat snacks	2	Watch activity	8
Practice embroidery	1	Watch dancing	1
Take photos	3	Look at phone	14
Play poker	10	Play chess	7
Read books	1	Rest and wait	8
Sleep	1	Chat socially	16
Stay with children	20		

3.1. User Characteristics

To facilitate the analysis of the age composition of visitors, users were categorized into five age groups: children (under six years old), youth (six to 17 years old), young adults (18 to 45 years old), middle-aged (46 to 69 years old), and seniors (over 69 years old). According to the data in Table 1 and Figure 1, older individuals utilize community park seats the most, accounting for 36.36%. They are followed by middle-aged and young adults at 22.7% and 20%, respectively. Children and adolescents are the least frequent users, representing 12.73% and 8.18% of total usage, respectively. In summary, community park seats are most frequently used by older adults and least frequently used by youths. These results indicate not only the diverse user composition of public seating in community parks, but also the unique seating needs and expectations of different age groups in the post-pandemic context.

Simultaneously, the study observed a lack of customized seating designs for the elderly, children, and special groups

like pregnant women. Overall, these findings suggest that park design should comprehensively address the requirements of various age groups to improve their comfort and satisfaction.

3.2. Usage Patterns

The observed statistics, as presented in Table 2 and Figure 2, reveal that the most prevalent pattern of community park seat usage is side-by-side, accounting for 32.76%. This is followed by solo usage at 25.86%, face-to-face usage at 24.14%, and back-to-back usage at 12.07%. The semi-circular usage pattern is relatively less common, constituting only 1.72%, while wheelchair users represent the least-used pattern at 0.86%. These results indicate the diverse nature of public seating usage in community parks, emphasizing the importance of considering different usage patterns to meet various user needs. Notably, the usage patterns of wheelchair users cannot be neglected.

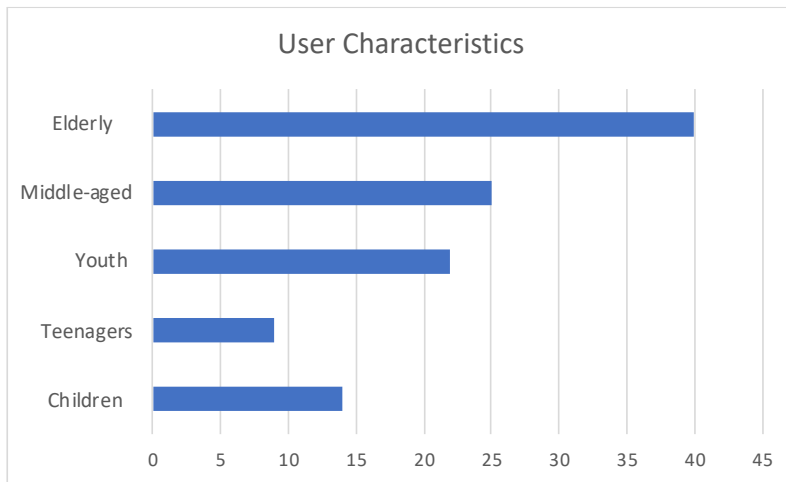


Figure 1. User age composition

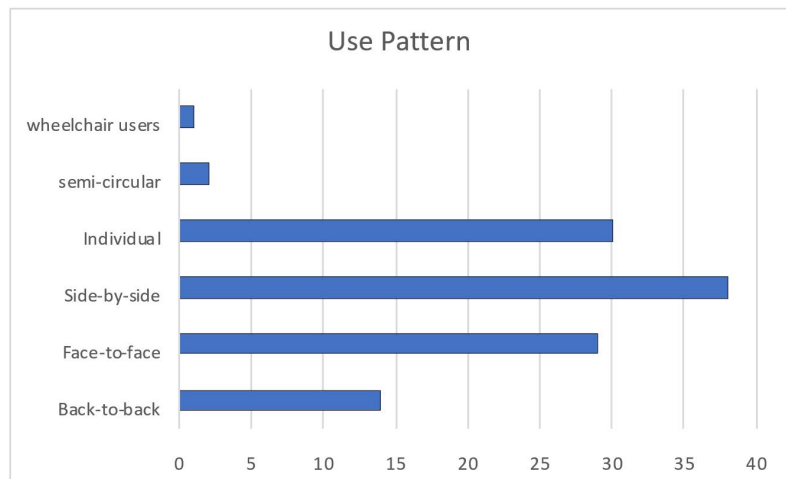


Figure 2. Usage patterns

The high proportions of side-by-side and individual seating patterns in the post-epidemic context reflect the evolving preferences of users in public spaces. The popularity of side-by-side seating for two people indicates a prevailing desire for intimate or friendly social interaction while adhering to precautionary measures. Likewise, the high prevalence of solo seating may be attributed to people's awareness of the need to maintain social distance, reducing the risk of virus transmission. Additionally, it was observed that three or more people sitting together is common, suggesting the continued need for families or small groups to spend time together in parks.

In conclusion, in the post-epidemic context, community park seating patterns play an essential role in meeting people's needs for social distancing, intimate interaction, and family leisure. Therefore, future urban planning and public space design must fully consider these changing needs to optimize seating design and improve the comfort and satisfaction of park users.

3.3. Space Features and Locations

According to the data in Table 3 and Figure 3, the most favored location in the park is the children's play area with beautiful scenery at 28%, followed by the walking path with open space at 17% and the open tree space along the walkway at 10%.

walkway at 10%. Other notable areas include the gazebo and the small square, both at 8%, and the sports plaza at 7%. User preferences for spaces with scenic views, a blend of recreational and restful spots, and shade from trees show substantial variety in their desired features. These results emphasize the significant need for an expansive seating layout across these spaces to cater to park-goers' needs.

3.4. Activity Types

As revealed by the statistics presented in Table 4 and Figure 4, park seating is used for a wide range of activities. "Stay with children" emerged as the predominant activity, constituting 17.70%, indicating the role of public seating in providing a place for rest and supervision during children's recreational activities. Next, the "Social chat" activity at 14.16% emphasizes the importance of public seating in facilitating socialization within the community park. Recreational and leisure activities are also prominent, with substantial percentages for "Play poker" (8.85%) and "View scenery" (7.96%). These figures show that people appreciate leisure time and relaxation amid their increasingly fast-paced lives. The findings further highlight the versatile functions of public seating in urban parks, serving as both a resting place and a supportive space for various user activities.

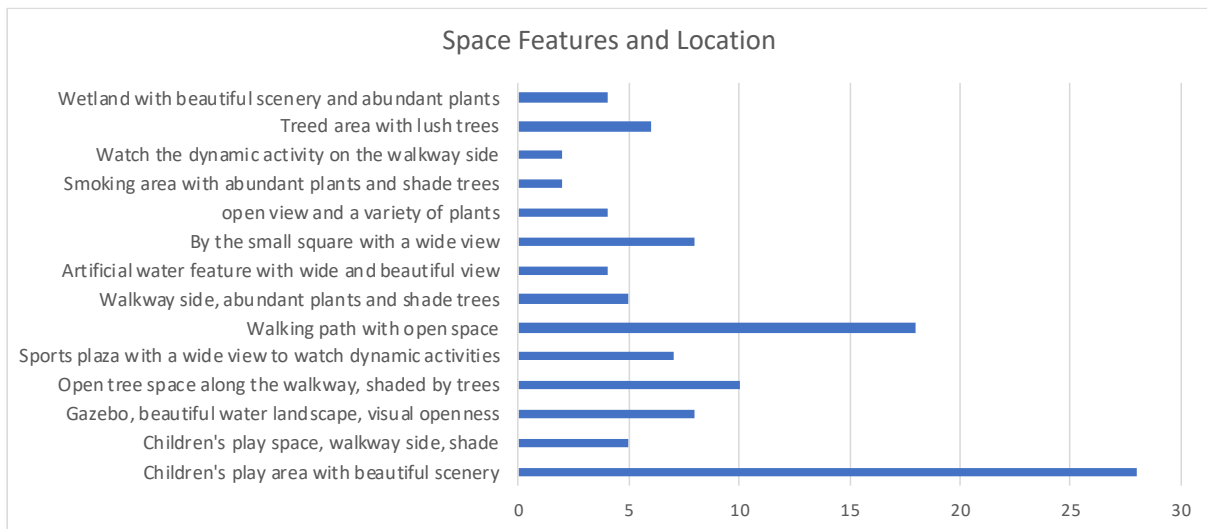


Figure 3. Space features and locations

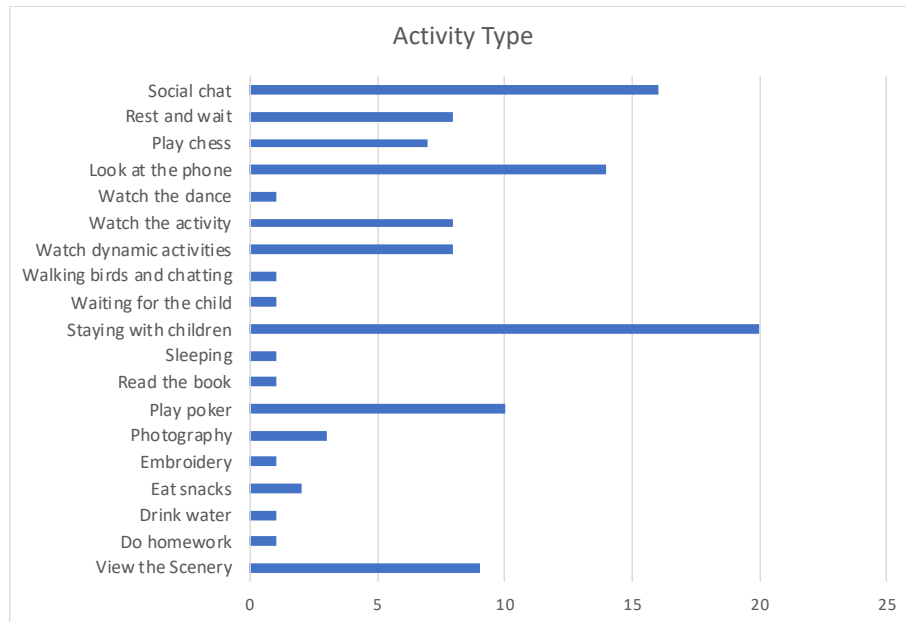


Figure 4. Usage activity types

Activities falling within the 7% to 8% range, such as "Watch dynamic activities", "Watch activity", "Rest and wait", and "Play chess", demonstrate that while they may not be the most popular, they still attract a sizeable portion of the park's users. On the other hand, lower percentages for activities like "Do homework", "Drink water", and "Practice embroidery" (all at 0.88%) may suggest that they are more private and less common in communal areas.

In summary, the types of activities of public seating users encompass a wide range of needs, including supervising children, engaging in social interactions, observing various activities, and using mobile phones. Therefore, urban planning and public space design should comprehensively take account of the diverse requirements of the public and provide seating that accommodates all types of activities. Moreover, from the observations, it was noted that park seating design lacks provisions for pregnant women and people with disabilities, highlighting the need to expand seating options to cater to special populations.

4. Discussion

This observational research, conducted at Nie Er Community Park in Yuxi, China, provides a detailed analysis of the age composition, usage patterns, space features, and activity types of community park seating users in the post-pandemic era. These findings are discussed in this section.

First, the analysis of users' age composition reveals that park seats are most utilized by seniors, followed by children, young adults, middle-aged individuals, and finally, teenagers. Older individuals prefer to engage in group activities while using park seats, such as playing cards, playing chess, or chatting. Young and middle-aged

individuals, on the other hand, tend to use seats to rest or spend time with their children, while teenagers use them mostly to scroll their phones and eat snacks. Notably, there is a lack of seating designed to accommodate specific groups, such as pregnant women and people with disabilities. The observations highlight the necessity of thoroughly considering the needs of different age groups and special groups in park design.

Second, community park seating patterns exhibit diversity. The side-by-side and individual positions are the most prevalent, as they are associated with maintaining social distance in the post-pandemic era. Double face-to-face, double side-by-side, and triple or multi-person usage patterns are also common, reflecting a desire for intimate or friendly social interactions while adhering to precautionary measures. Therefore, future urban planning and public space design should take note of these evolving needs and offer a variety of seating designs.

In addition, detailed statistics on the space features and locations of public seating reveal that certain types of seating, such as those near children's play areas, beautifully landscaped areas, shaded spots under trees, and seating adjacent to open squares with scenic views, are more popular in community parks. These findings corroborate previous research [7, 17-19]. For example, Yeh and Huang [18] posited that locations with views of an open field can influence usage. The current findings can serve as a reference in the park design and renovation process to provide higher-quality seating spaces for community park users.

Finally, the analysis of activity types associated with public seating shows a wide range of user activities, including staying with children, chatting socially, appreciating the view, resting while observing the scenery, watching dynamic activities, playing poker or chess,

reading books, supervising children's games, relaxing, snacking, and even practicing embroidery. These findings align with those of Uzgür et al. [5], who recommended layout designs based on the diversity of seating activities during the epidemic. Therefore, in urban planning and public space design, it is crucial to fully consider citizens' needs and provide seating environments that facilitate their various activity types.

Based on the findings, this research has developed a comprehensive framework for post-pandemic public seating in community parks, encompassing user characteristics, usage patterns, space features, and activity types. The framework, depicted in Figure 5, provides a practical reference for urban planners and designers in the following areas:

- 1) **User characteristics:** When designing park seating, it is essential to ensure that it fulfills the needs of users of all age groups. For example, seating with armrests and backrests should be provided for the elderly, while fun and engaging designs can be incorporated for children. Importantly, more comfortable and accessible seating options should be offered for pregnant women and individuals with disabilities.
- 2) **User patterns:** The design and layout of seating should take into account the various usage patterns. This includes the creation of multi-person seating, solitary seating for those who prefer to relax alone, and face-to-face seating for those seeking a private

setting. Consider providing multiple-person seating or solitary seating.

- 3) **Type of activity:** Seating should be tailored to accommodate different types of activities. For social interactions, seats can be designed for two or more individuals, with semi-enclosed spaces in certain areas to enhance privacy. Seats oriented towards children's play areas should be provided for those accompanying kids, offering a comfortable location for supervision. Seating positions should also provide the best views for park events or festivities that users choose to attend. For users who typically engage with their mobile phones, the addition of charging ports near seats and protection from sun and rain can substantially enhance their experience. Furthermore, flexible seating designs that can be moved may be ideal for those who enjoy playing chess or similar games. In essence, public seating should serve multiple purposes and meet a wide range of user needs, beyond merely being a place to sit.
- 4) **Space features and locations:** The positioning of seating should be aligned with the park space's features and location to enhance the overall user experience. For instance, placing seats near children's play areas allows parents to conveniently watch over their children. Similarly, positioning seats in well-landscaped areas offers park-goers a comfortable and pleasant viewing experience.

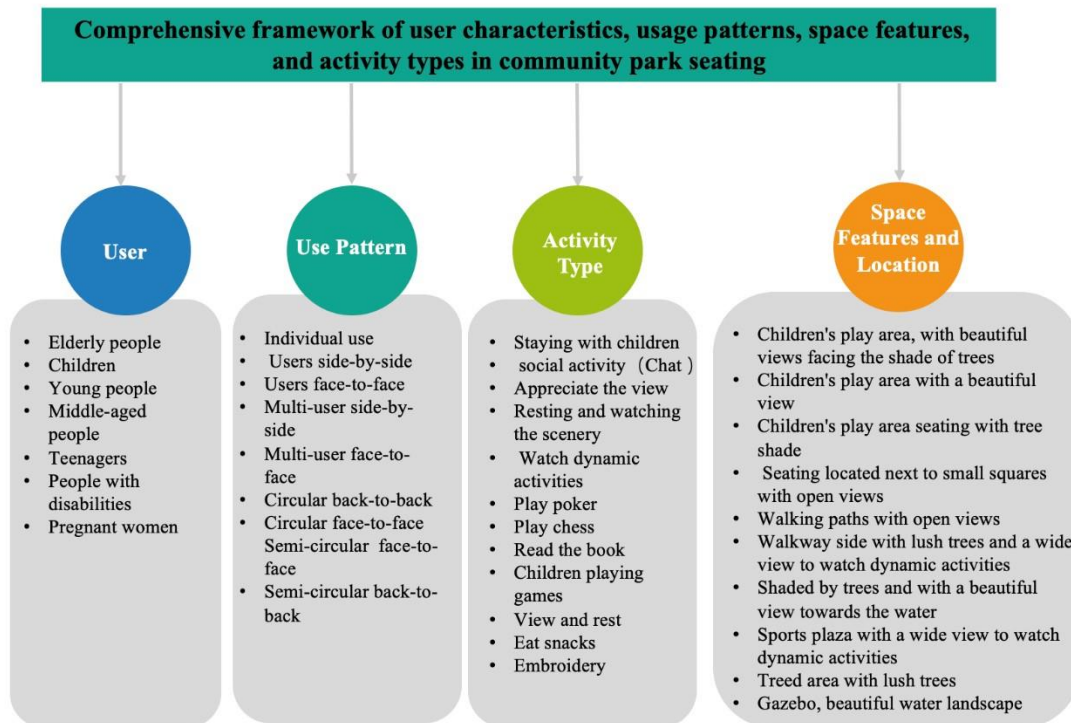


Figure 5. Comprehensive seating design framework for urban community parks in the post-pandemic period

5. Conclusions

In conclusion, this study has explored the user profiles, usage patterns, space features, and activity types associated with public seating among community park users in the post-pandemic period. Through field observations and statistical analysis, the research offers a comprehensive understanding of users' current public seating needs and expectations in the aftermath of the pandemic. Significantly, it has developed a comprehensive design framework, encompassing the user characteristics, usage patterns, space features, and activity types of public park seating. This framework serves as a valuable resource for urban planners and designers, enabling them to optimize park seating layout and design to meet urban users' evolving needs and expectations in the post-pandemic era. This, in turn, enhances the attractiveness and sustainability of urban community parks. The study also contributes to the field by addressing a research gap in understanding post-pandemic public seating usage and space features in community parks, offering valuable insights for future research. While the study offers suggestions for seating layout and design, it is important to acknowledge its limitations related to sample size and geographic scope. Therefore, future research should continue to explore public seating usage patterns and activity types to guide effective urban planning and public space design, ultimately promoting the improvement of community parks and urban environments.

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