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Evaluation of Child-Friendly Outdoor Spaces in Old Residential Areas

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Abstract: Creating child-friendly outdoor spaces in old residential areas has become a necessary part of the construction of child-friendly cities nowadays. This paper first collects data to establish the evaluation system of child-friendly outdoor space in old residential areas in Huizhou City through the literature collection method, then conducts sample research on three old neighborhoods in Huizhou City through fieldwork, and finally combines the evaluation system to evaluate the child-friendly outdoor space in old neighborhoods in Huizhou City.

Keywords: Child-friendly; Old residential areas; Outdoor spaces; Evaluation system

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1. Introduction

China is now comprehensively promoting the renovation of old residential areas and the improvement of community construction, and incorporating child-friendly concepts into the measures of renovation and construction. The outdoor space in old residential areas is an important place for children's daily activities, but they have some inconvenient and unsafe problems for children, so analyzing these problems and putting forward evaluations are the focus of the research. This paper takes Huizhou City as an example, adopts the research method of literature review, summarizes the assessment tools in the relevant literature to form a child-friendly evaluation indicators system, and finally applies the method during fieldwork to evaluate the outdoor space in three samples of old residential areas in Huizhou, thus derives the child-friendly evaluation results.

2. Establishment of the child-friendly evaluation indicators system

2.1. Analysis of literature data

This literature search is mainly based on the academic resource library of CNKI. Indicator literature is selected as the main research object. The study first selected "child-friendly", "old residential areas", "outdoor spaces",

and “evaluation system” as the main keywords for mutual combination retrieval.

2.2. Determine the primary evaluation indicator system

There are 9 indicators related to residential areas, neighborhoods, communities, and streets mentioned in the evaluation tool, 8 indicators related to outdoor space, public space, open space, and game space, 5 indicators related to travel safety, 5 indicators related to landscape and parks mentioned in other indicators, and 2 indicators related to friendship with old friends (**Table 1**).

The indicators collected in this study are based on Maslow’s hierarchy of needs theory, which divides evaluation indicators into three major indicators: macro environment, middle environment, and microenvironment, with 24 sub-indicators. Only 22% of the evaluation tools cover all three major categories of indicators, 94% of the evaluation tools cover the two major indicators of “middle environment” and “microenvironment”, and 28% of the evaluation tools involve “macro environment” (**Table 2** and **Table 3**) [1].

Table 1. Basic information of the 18 sample

Sample number	Sample title
1	Research on the Evaluation Indicator System of Child-friendly Streets [2]
2	Evaluation Indicators of Children’s Travel Safety in Community Environment Based on Foreign Literature Review [1]
3	Exploring the Safety Evaluation System of Children’s Outdoor Activity Space in Zhengzhou Residential Area [3]
4	An Evaluation Study of Child-friendly Public Activity Spaces in Residential Neighborhoods [4]
5	Evaluation Study on the Safety of Children’s Outdoor Open Space in Residential Areas [5]
6	Research on Comprehensive Evaluation System of Children’s Outdoor Open Space Safety in Residential Areas [6]
7	A Comprehensive Evaluation Study of Landscape Interest in Urban Parks [7]
8	An Evaluation Study of the Interest of Children’s Outdoor Playgrounds in Residential Areas [8]
9	Satisfaction Evaluation of Urban Integrated Parks under the Concept of Child-friendly Cities [9]
10	Survey and Evaluation Research on Children’s Play Space in Residential Areas from a Child-friendly Perspective [10]
11	An Evaluation Study of Children’s Outdoor Play Space in Chinese Urban Parks Based on Play Value [11]
12	Research on Child-friendly Open Space in Settlements And its Evaluation System [12]
13	Evaluation of Children’s Activity Ground Utilization in Chengdu Urban Comprehensive Park (POE) Study [13]
14	Evaluation of the Utilization Status of Children’s Activity Sites in Beijing’s Urban Comprehensive Parks (POE) Study [14]
15	Research on the Composite Spatial Elements and Boundaries of the Old and Young under the Perspective of Availability Theory—Taking the Community and Surrounding Green Spaces in Tianjin as an Example [15]
16	Research on the Performance Evaluation and Optimization Strategy of Intergenerational Mutual Aid in Residential Public Space [16]
17	Evaluation and Strategy Research on Old and Young Friendliness of Outdoor Space in Residential Communities—Taking Jiangbei District of Chongqing as an Example [17]
18	Evaluation and Optimization Strategies of Child-friendly Public Space in Changsha’s Older Neighborhoods [18]

Table 2. Basic information of sub-indicators in the 18 sample

Indicators number	Sample title	
A	Pedestrian system separated from vehicle system	Macro environment
B	Road network structure	
C	Slow moving system	
D	Ecological green environment	
E	Area Connection	
F	Site enclosure	
G	Security	Middle environment
H	Accessibility	
I	Paving	
J	Plant selection	
K	Characteristic space	
L	Diverse paths	
M	Natural atmosphere	
N	Guide sign	Micro environment
O	Supervision and care	
P	Emergency warning	
Q	Facilities maintenance and management	
R	Noise	
S	Sunshine and ventilation	
T	Sanitation	
U	Lighting facilities	
V	Landscape sketch	
W	Public rest chair	
X	Sports Facilities	

Table 3. Categorization of sub-indicators

Sample number	Evaluating indicator																							
	Macro environment						Middle environment							Microenvironment										
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X
1	√		√			√	√	√	√			√		√	√		√							
2	√		√		√		√	√	√			√		√	√									
3	√	√			√	√	√	√	√	√			√		√	√	√		√		√			√
4				√	√			√	√	√	√		√	√	√		√		√	√	√	√	√	√
5							√	√		√				√	√						√			

Table 1 (Continued)

Sample number	Evaluating indicator																							
	Macro environment						Middle environment							Microenvironment										
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X
6	√	√			√		√			√			√	√	√	√		√	√		√			
7				√					√	√	√		√									√		√
8				√					√	√												√		√
9		√	√				√	√		√	√		√	√	√					√	√	√	√	√
10		√				√	√	√	√	√	√	√		√	√		√	√			√		√	√
11	√			√			√	√	√	√	√	√	√	√	√								√	√
12	√			√	√	√	√	√	√	√	√	√	√						√	√		√	√	√
13		√		√		√			√		√						√	√		√			√	√
14				√		√	√	√	√		√									√			√	√
15						√			√	√				√					√				√	√
16		√	√	√		√	√	√	√	√					√				√		√	√		
17	√	√	√	√	√		√		√	√	√	√	√	√	√					√	√	√	√	√
18		√				√	√	√	√	√	√		√	√	√				√			√	√	√
Frequency of occurrence	7	8	4	9	6	8	12	11	14	14	10	5	9	10	11	2	4	3	7	6	8	8	10	13
Total				42						75									82					

2.3. Determine the primary evaluation indicator system

According to the statistics of sub-indicators, indicators that appear more than 10 times include “Security”, “accessibility”, “paving”, “plant selection”, “supervision and care”, and “sports facilities.” The indicators that appear less than 5 times include “Slow moving system”, “emergency warning”, “facility maintenance and management”, and “noise.” Based on expert evaluation and local conditions, the primary evaluation indicators will be optimized and adjusted as follows. In indicators that appear less than 5 times, “noise” and “facility maintenance” are retained. Although they appear less frequently in indicator collection, these two indicators have a greater impact on child-friendly evaluation. The content of “ Slow moving system” and “emergency warning” overlaps with other evaluation indicators, so the two items of “chronic system” and “emergency warning” have been excluded. The viewpoint of “natural atmosphere” in other indicators is too subjective and cannot be quantitatively judged, so it is excluded. In addition, “accessibility” has been changed to “barrier-free accessibility”, and “area connection” has been changed to “regional interweaving”. Based on the above adjustments and optimizations, establish the final child-friendly evaluation system for outdoor spaces in old residential areas, as shown in **Table 4**.

Table 4. The evaluation indicator system of child-friendly outdoor spaces in old residential areas

Indicators number	Sub indicators title	Indicators title
A	Pedestrian system separated from vehicle system	Macro environment
B	Road network structure	
D	Ecological green environment	
E	Regional interweaving	
F	Site enclosure	
G	Security	
H	Barrier-free accessibility	
I	Paving	Middle environment
J	Plant selection	
K	Characteristic space	
L	Diverse paths	
N	Guide sign	
O	Supervision and care	
Q	Facilities maintenance and management	
R	Noise	Micro environment
S	Sunshine and ventilation	
T	Sanitation	
U	Lighting facilities	
V	Landscape sketch	
W	Public rest chair	
X	Sports Facilities	

3. Research on the evaluation of child-friendly outdoor spaces in old residential areas in Huizhou

3.1. Evaluation of child-friendly outdoor space in Guangxia Xinyuan Community

Macro environmental evaluation: The Guangxia Xinyuan community plot is in an "L" shape. Due to limitations in area and shape, the separation of people and vehicles in the community is unreasonable. Children can only walk along the roadside. The residential area is isolated from other areas by red brick walls and barbed wire (**Figure 1a**). There are two entrances and exits, north and south. The south entrance and exit provide access for motor vehicles, electric bikes, bicycles, and people, while the north entrance only provides access for electric bikes, bicycles, and people (**Figure 1b**).

Middle environmental evaluation: Each independent area of the Guangxia Xinyuan community is equipped with cameras. The overall safety is good. There is a lack of barrier-free access design in the community, and many illegal parking and uneven ground conditions pose significant safety hazards for children's activities (**Figure 1c** and **Figure 1d**). There are a few walking paths and recreational spaces within the community, but the number and area used by children in the entire community are far from enough.

Micro environmental evaluation: The narrow spacing between buildings in the Guangxia Xinyuan community has resulted in poor overall lighting and ventilation. The cameras set up in each area, real-time monitoring by property management, and security guards at the entrance provide basic protection for children's supervision. However, some cameras have malfunctioned. The sanitation facilities are relatively complete, but the lighting facilities are not sufficient (**Figure 1e**). There are no sports facilities set up in the community (**Figure 1f**).

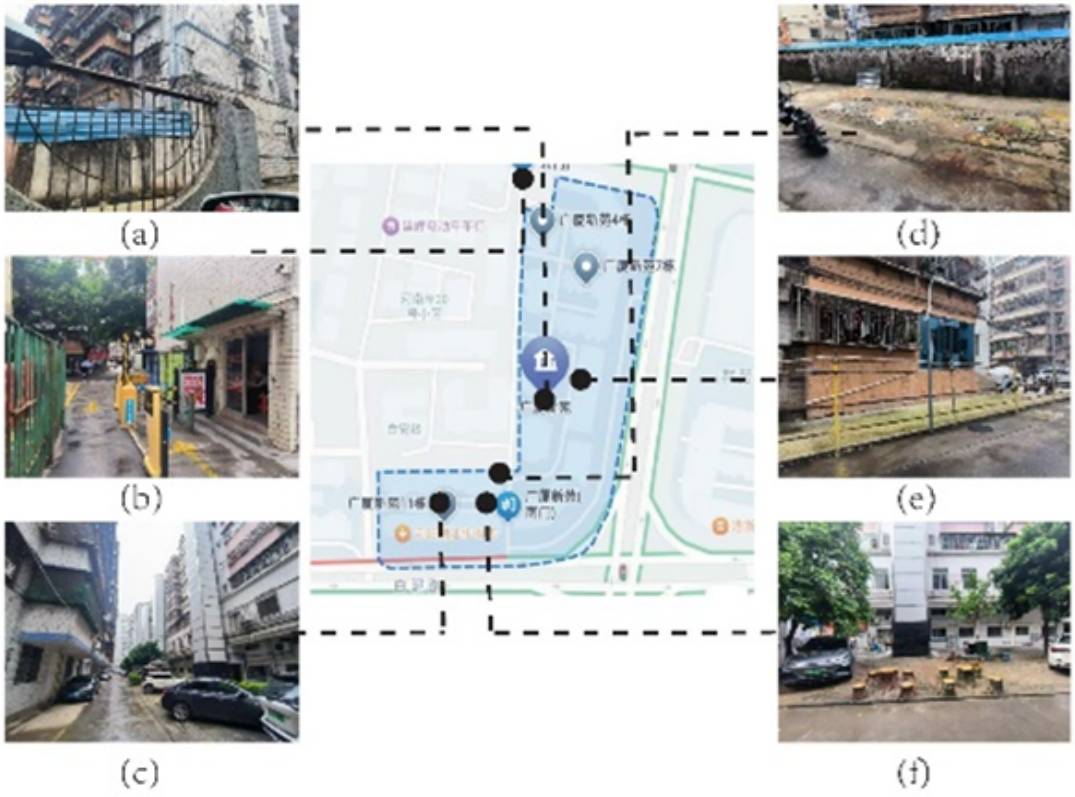

Figure 1. Site photos

3.2. Evaluation of child-friendly outdoor space in Zhengtai Garden Community

Macro environmental evaluation: The plot of Zhengtai Garden residential area is square in shape, with three residential buildings. There is a large tree near the entrance, which can be used for children and the elderly to rest (**Figure 2a**). The parking spaces in the community are reasonable, leaving a relatively wide pedestrian space (**Figure 2b**). Since its construction, the surrounding area has been surrounded by vegetable markets. The entire community has only one entrance and exit.

Middle environmental evaluation: The community has sufficient ground parking spaces, which can effectively regulate parking. 90% of the window sills in residential buildings are equipped with protective nets (**Figure 2c**). The types of landscape plants in the community are single, and 70% of the landscape ornaments are planted by the bottom floor residents themselves (**Figure 2d**).

Micro environmental evaluation: There are two sports facilities in the Zhengtai Garden community (**Figure 2e** and **Figure 2f**). Due to its early construction, there are issues with facilities and seating. The wider spacing between buildings and the form of the residential buildings provide better lighting and ventilation for the community.

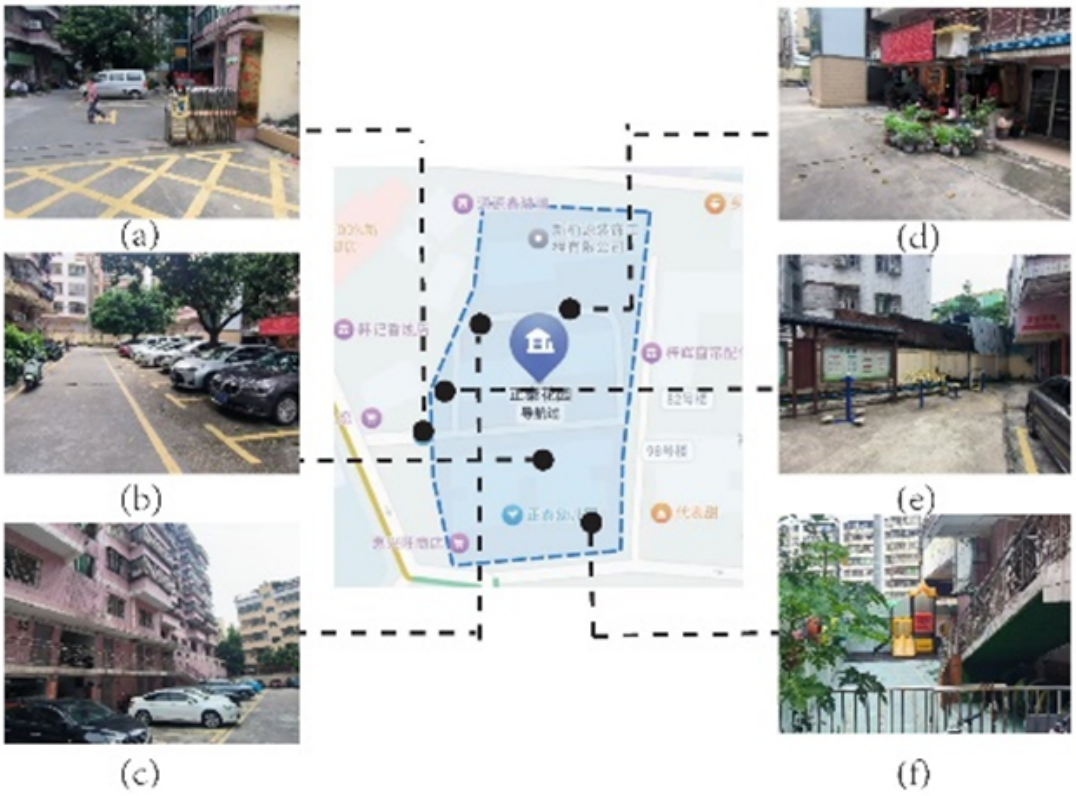

Figure 2. Site photos

3.3. Evaluation of child-friendly outdoor space in Xinxing Huayuan Community

Macro environmental evaluation: The community adopts an open management approach, with commercial spaces on the ground floor of buildings facing the street, mostly used for dining, supermarkets, and so on (**Figure 3a**). The plot of the community is in the shape of a long strip and has four entrances and exits (**Figure 3b**). In terms of landscape, the overall greening situation is good. There are courtyard gardens, roadside shrubs, and landscape ornaments. The community has a rich variety of spatial functions.

Middle environmental evaluation: There are many scattered spaces in the Xinxing Huayuan community, but most of them are utilized. Small children's play slides are set up in the transitional spaces between buildings and the play area is enclosed by bushes (**Figure 3c**). The courtyard space of the residential building provides sports facilities such as table tennis and badminton, and the ground is made of plastic materials that protect the joints, making it easier for children to exercise (**Figure 3d**). There are various paths within the community, and there are barrier-free passages to better ensure accessibility.

Micro environmental evaluation: There are well-equipped facilities for children's use in the community, such as signage, lighting, monitors, and trash cans (**Figure 3e**). The community has specially established the Huimin Space Yiqu Garden, which is a public welfare project. In addition, the rich sports facilities in the community have improved the quality of children's activity space. There are some non-standard parking situations in the community, such as some residents parking their electric vehicles in the hallway (Figure 3f).

Figure 3. Site photos

4. Conclusion

This paper takes old residential areas in Huizhou as research samples. Combining local conditions and expert evaluations, the valuation indicator system for the child-friendly outdoor spaces in old residential areas in Huizhou is established, which consists of three indicator items and 21 sub-indicator items. Finally, by examining and analyzing three community samples, the final child-friendly evaluation was obtained, to provide a reference for government departments in formulating relevant policies and regulations.

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Disclosure statement

The authors declare no conflict of interest.

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