

Research on the Design of Activity Spaces for Children Left Behind in Rural Areas: Cite Space-Based Data Visualization Analysis

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Abstract

The purpose of this paper is to (1) understand the research status of the activity space design of left-behind children, and (2) identify the development and research hotspots in this field.

The findings are as follows:

1. This study uses the data visualization software of Citespace to select valuable articles on "left-behind children", "children's activity space" and "design" from Chinese knowledge networks.

2 This study analyzed the number of articles, keyword co-occurrence rate, clustering and time zone on the activity space design of left-behind children in the past ten years, and found that scholars only began to pay attention to left-behind children and their activity space environment in 2018–2019.

3. On the basis of data visualization and analysis results, combined with domestic research and application status, this study summarizes the design of activity space for left-behind children and puts forward suggestions and suggestions.

Keywords: Left-Behind Children; Children's Activity Space; Cite Space; Visual Analysis; Design

Introduction

In China, the issue of children left behind in rural areas is a stage problem in the country's economic and social development, a profound reflection of the uneven development of China's urban and rural areas, unequal public services, and inadequate social security. However, in recent years, as China's rural poverty eradication and new urbanization have been in full swing, and also due to the impact of the epidemic, most of the parents who have gone out to work have returned

home. According to statistics, there will be more than 27 million children of migrant workers in compulsory education in 2020. Among them, 14,297,400 children (migrant children) are in school, accounting for 9.1% of the total students; 12,896,700 children are left behind. The data shows that although the number of children left behind has declined in recent years, and the total number has been less than that of children accompanying migrants for two consecutive years, the volume is still huge. The education and growing environment for children is also a concern for society.

According to CNKI data, the total number of articles searched by December 2021 was 36,300, with the theme of "left-behind children." According to the top 20 items in the discipline distribution, experts and scholars from all walks of life mainly focus on the education, management, social phenomena, and psychological health of left-behind children. However, more research needs to be conducted on the growing environment of left-behind children, such as after-school outdoor and indoor activity spaces. In this study, we will quantify and analyze the research literature related to "left-behind children" and "design" published in journals to discover the current status, hot spots, and frontier evolution of research on "design of activity space for left-behind children." The study will also guide more authors and research teams to focus on studying left-behind children.

Research Objectives

Analysis of the volume of articles issued

A graph of annual trends in the research literature published on the design of activity centers for children left behind in Figure 4. It shows the chronological change in the volume of research literature in this area published at CNKI.

- 1) A total of 1397 literatures were retrieved from 2012 to 2022.
- 2) From 2012 to 2015, there were 23 papers.
- 3) Stable trend from 2012 to 2015.
- 4) Increased gradually in 2016.
- 5) It peaked at 217 articles in 2022. From 2012 to 2022.

This shows that the study of activity space design for left-behind children is gradually gaining attention from Chinese researchers.

However, among the 1397 data, some of them were published on the education of left-behind children,

1) A total of 939 valid data were selected, including 306 journal literatures (32.6%), 627 master's literatures (66.8%) and 6 doctoral literatures (0.6%).

2) The average number of authors was 3.2, involving 229 institutions and 295 authors.

3) Anhui University has the highest number of published papers, with 39.

4) Among the valid data, there were 753 papers signed by a single author, accounting for 80.1% of the total literature, and 186 papers signed by two or more authors, accounting for 19.9% of the total literature.

This shows that research on the design of activity centers for left-behind children has yet to be studied collaboratively among Chinese research scholars. However, according to the trend graph, researchers in this field have also increased their attention in recent years.

Literature Review

1. Data and methods

(1) Data

The data sources for this study were selected from CNKI (China National Knowledge Infrastructure) and WOS (Web of Science) core data collection.

1) Two groups of keywords were used for advanced search in CNKI journals. One group took "left-behind children" and "design" as the theme, as shown in Figure 1; The other group focuses on "Children's activity space" and "Design", as shown in Figure 2.

2) The relationship between each group of keywords is "and", the search scope is Chinese literature, and the time range is from June 1, 2012 to June 1, 2022. As of June 1, 2022, the two groups searched a total of 1397 literature, including 376 journal papers with research projects or funded research results, accounting for 27% of the research literature on left-behind children's activity space design, indicating that governments and organizations at all levels have a low degree of acceptance of research on left-behind children's activity space design.

3) In addition, research literature on left-behind middle and high school students in rural areas, teaching courses for left-behind children and migrant children that are unrelated to this subject are also included in the data analysis. Finally, 939 valid literatures were selected, and the valid literatures were exported in RefWorks format and renamed as research samples.

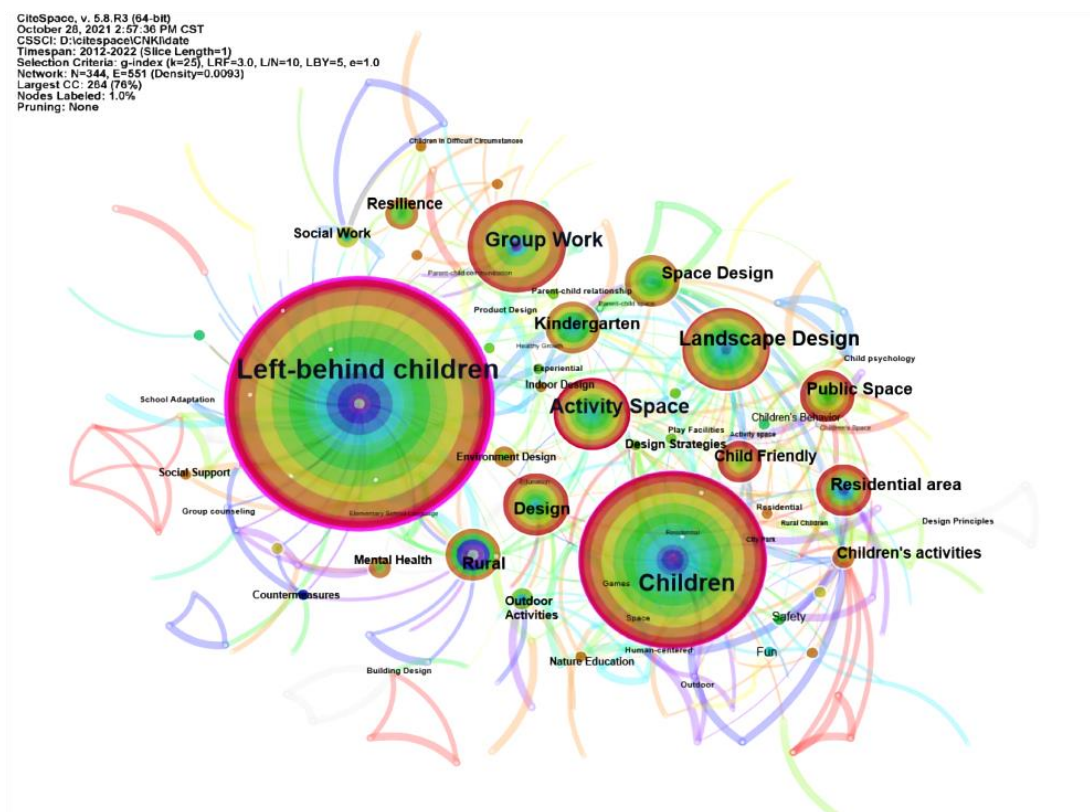
In the WOS (Web of Science) literature data, search in "Web of Science Core Collection," Editions for All, search for the topic: "left-behind children" or "children left behind" or "stay-at-home children" and design behind children" or "children left behind" or "stay-at-home children"

and design The document type is limited to "Article" and "Review"; the Language of the document is limited to "English"; the Publication Date is The search yielded a total of 69 valid documents from 1 January 2011 to 31 December 2021 in Figure 3. The retrieved data were eliminated for non-academic literature and those not strongly related to the topic. Finally, four valid documents were selected and exported as plain text files with complete records and cited references.

During the ten years, the CNKI and WOS databases were screened to find 939 valuable articles in the CNKI database and 4 in the WOS database. The comparison of the data reveals that because there are few "left-behind children" in other countries, there are few studies on the design of spaces for left-behind children in other countries, except for China. Therefore, the following analysis focuses on the design of spaces for left-behind children in China.

Conceptual Framework

The size of keyword word frequency can well reflect the research hotspots in the field at that period, and the analysis of keyword co-occurrence helps grasp the research direction of the field. Cite Space software was used to analyze the keywords in 939 papers, and LRF (Link Retaining Factor) was set to 1 to retain the line with the greatest strength of relationship, LBY (Look Back Year) was set to 8, and Pathfinder (pathfinding algorithm cropping) was chosen as the graph network cropping method. The number of nodes is 344, the number of lines is 551, and the density is 0.0093. The node's size indicates the number of keyword occurrences: the more occurrences, the larger the node. When the probability of other keywords co-occurring in the literature, and the greater the influence in the co-occurrence network, the higher the centrality of the keyword will be, and the darker the color of the edges of the circle in Figure 5. Accordingly, the top 20 keywords in terms of centrality were collated in Table 1. The keywords that appeared more frequently than 10 were left-behind children, children, group work, activity space, landscape design, spatial design, residential area, design, rural, kindergarten, public space, child-friendly, resilience, children's activities, social work, outdoor activities, mental health, and design strategies. This reflects the hot spots and frontiers of research in the spatial design of activity centers for left-behind children in academia and the plurality of research on the socialization of left-behind children in academia.



As can be seen from Table 1, the top 20 keywords related to children are: "left-behind children," "children," "child-friendly," "resilience strength," and "mental health" (centrality 0.74, 0.27, 0.01, 0.01, 0), and design-related: "landscape design," "spatial design," "design" "design strategy" "interior design" (centrality 0.17, 0.07, 0.07, 0.01, 0.03), and to children's activity spaces: "activity spaces" "public spaces" "children's activities" "outdoor activities" (centrality 0.14, 0.06, 0.05, 0.06 respectively), and those related to rural areas: "residential areas" "rural" (centrality 0.06, 0.06 respectively). In terms of frequency of occurrence, "left-behind children" is the focus of research on the design of activity spaces for left-behind children (211 times), and this keyword appears most frequently, with the top 10 keywords appearing 20 times or more, and the 10–20 keywords appearing nine times or more.

Table 1 Top 20 keywords for centrality

Sequence number	Count	Centrality	Keywords	Year	Sequence number	Count	Centrality	Keywords	Year
1	211	0.74	Left-behind children	2012	11	19	0.06	Public spaces	2018
2	102	0.27	Children	2012	12	18	0.01	Child friendly	2016
3	52	0.09	Group work	2013	13	17	0.01	Resilience	2016
4	42	0.14	Event space	2012	14	15	0.05	Children's activities	2013
5	40	0.17	Landscape design	2013	15	13	0.02	Social Work	2012
6	25	0.07	Space design	2015	16	12	0.06	Outdoor activities	2013
7	25	0.06	Residential areas	2013	17	12	0	Mental Health	2012
8	21	0.07	Design	2016	18	11	0.01	Design strategy	2017
9	21	0.06	Rural	2012	19	9	0.03	Interior design	2015
10	20	0.08	Kindergarten	2013	20	9	0.01	Security	2016

Research Methodology

This study uses CiteSpace visualization software for literature analysis, developed in 2004 by Chaomei Chen, a renowned Chinese American and tenured professor at Philadelphia University. Scholars mainly use the software in researching scientific literature for visual identification and to show new trends and developments in scientific development. It can help this potential knowledge contained in the field of research on the design of activity spaces for children left behind. The software runs to generate a visual graph, the 'scientific knowledge map,' which visualizes the relationships between the literature in the form of a subject knowledge map. A deeper analysis of the visual map allows for an understanding of the research lineage and history of this research area, the current state of development, research hotspots, future trends, which research topics will explode, etc.

Research Results

Objective 1. The results showed that from the current research literature on the activity space design of left-behind children, the total number of articles has shown an upward trend year by year, gradually increasing since 2015 and reaching a peak in 2019, indicating that research in this field has gradually received attention.

Objective 2. The results showed that in terms of research objects, most experts and scholars study left-behind children in rural areas from the perspective of education, covering sociology, pedagogy, psychology and other theoretical aspects. They conducted a large number of surveys and studies to obtain more comprehensive data.

Objective 3. The results showed that in terms of research institutions, according to the analysis of the high-frequency words "left-behind children" and "design" in China, it can be seen that the key research hotspots on the social support of the activity space design of left-behind children in China are not concentrated enough.

Objective 4. The results showed that in terms of research content, "left-behind children" is a high-frequency keyword in 2011. In keyword cluster analysis, "left-behind children", "design" and "family structure" are all large clusters. This indicates that family structure is the central focus and future research direction of activity space design for left-behind children. It also influences the factors of space design.

Discussions

According to the results, it can be concluded that the research hotspots in the study of activity spaces for left-behind children in China are "left-behind children," "rural areas," and "design." At the same time, there is a four-year gap between the emergence of "left-behind children" and "design." There is a four-year gap between the emergence of 'left-behind children' and 'design,' suggesting that the focus on design for left-behind children was only a concern four years after the focus on left-behind children. The research on children left behind in rural areas and the design of activity spaces has also been gaining attention in recent years and is being refined.

In terms of Count content, on the one hand, high-frequency terms that are similar in meaning to the search terms "left-behind children," "design," and "children's activity spaces" include "activity space," "space design," "rural," "child-friendly" "children's activities," etc. On the

other hand, high-frequency words reflect the research on social support for children's activity spaces left behind in the following ways.

(1) Information on the research subjects. "Rural population," "children's activity space," and "children left behind in rural areas" reflect the fact that most of the children left behind are from rural areas and are the result of the continuous construction of rural areas after the implementation of rural revitalization in China. This is a phenomenon that has intensified.

(2) The high-frequency words "group work," "social work," and "mental health" indicate that social support is heavily researched in the field of left-behind children. Social support can be specific to parent-child relationships, peer relationships, and other areas. Research on social support for left-behind children in psychology currently focuses on the psychological impact of social support on left-behind children. The stronger the social support, the less lonely they feel and the more subjectively happy they feel. The lower the social support, the more likely they are to develop 'problem behavior.' Another variables that play a role in the psychological impact of social support on left-behind children are: 'coping styles,' 'mental toughness,' etc.

(3) Interventions for social support for children left behind: "educational services," "social work," etc.

In short, the physical and mental health of left-behind children, educational issues, social support and influencing factors, social support from NGOs, and various measures of government policies for left-behind children are all topics that can be studied in increasing depth in the study of left-behind children.

Knowledge from Research

1. Keyword clustering analysis

Research hotspots reflect the intrinsic connection between a certain period and a specific research field, and thus the focus and direction of research in the field, which is of great importance for an in-depth understanding and analysis of the research content in this field. Based on keyword co-occurrence analysis, the keyword co-occurrence network relationships are simplified into a relatively small number of clusters using clustering statistics.

This study analyses the research hotspots of "left-behind children" and "design," "children's activity space," and "design" through the method of keyword cluster analysis, in order to explore the hot topics of research in this field in China.

The aggregation of 10 research themes on the design of activity spaces for left-behind children, numbered 0–9, is shown in Figure 2. The overlap between the themes suggests that research on the design of activity spaces for left-behind children in China has generally been expanded beyond a single theme in the last decade. For example, the terms "left-behind children" cluster: left-behind children, children, group work, social support; the terms "design" cluster: landscape design, design principles, architectural design, product design. The "children's activity space" clusters are public and experiential spaces. Further analysis of the clusters follows.

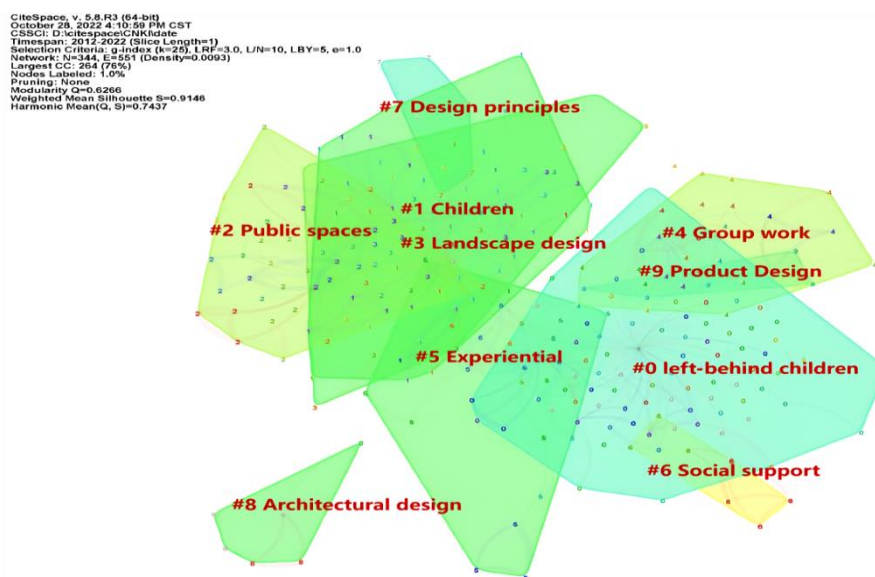


Fig. 2 Keyword clustering scientific knowledge mapping

The log-likelihood ratio was obtained from "Cluster Explorer" (one of the clustering tag word extraction algorithms) to obtain the keyword co-occurrence network clustering table in Table 2.

Table 2 List of keyword co-occurrence network clusters

Cluster ID	Size	Silhouette	Label name	Year	Top Terms (LSI) (partial selection of the top five)
#0	79	0.996	left-behind children	2016	Left-behind children; Maslow's Hierarchy of Needs; Communication design; Rural junior high schools; Executive function
#1	50	0.855	Children	2016	Outdoor space; Animated elements; Landscape evaluation; Dezhou Xinhui; Children's needs
#2	37	0.87	Public spaces	2017	Children's activities; Space design; Urban park; Environmental design; Rural children's activity space
#3	27	0.851	Landscape design	2016	Landscape design; Activity space; Residential district; Ribbon polycentre; Under the Sun
#4	26	0.893	Group work	2017	Group work; Left-behind children; Interpersonal interaction; Social work; Emotional vulnerability
#5	21	0.866	Experiential	2016	Environmental design; Design principles; Activity space; Children's aesthetic education; Emotional needs
#6	7	0.994	Social support	2020	Social support; Mediation effects; Mental toughness; Intervention studies; Impact effects
#7	6	0.979	Design principles	2015	Design principles; Design elements; Children's outdoor play spaces; Tropical cities; Outdoor spaces
#8	6	0.948	Architectural design	2016	Architectural design; Creative interaction; Social activities; Youth centres; Active spaces
#9	5	0.989	Product Design	2016	Product design; Children left behind; Urban environment; Public facilities; Children's products

The detailed analysis is as follows.

(1) Studies related to "left-behind children" (#0, #1, #4, #6)

This cluster examines the living environment of children left behind, encompassing the environment in which they grow up, care, children's needs, mental health, interpersonal interaction, and social support.

For example, Li et al. (2020) analyzed the main influencing factors of the current outstanding mental health problems of rural children in China and proposed measures to improve the current situation of mental health education for rural children. Gaohua et al. (2019) studied the intervention effect of football on loneliness among left-behind children from a psychological perspective, concluding that football significantly and continuously reduces loneliness among left-behind children. About the guardianship of left-behind children, Kui Daiyan (2017) analyzed the relationship between grandparenting styles on the emotional regulation of preschool left-behind children in his study. Shoufen (2018) compared the differences between left-behind and non-left-behind children in terms of family functioning, sense of deficiency and mental health of rural children: a comparison between left-behind and non-left-behind children in his article exploration and analysis. Yue (2019) comprehensively analyses the health problems of left-behind children and their causes from three aspects: physical, psychological, and social adaptation, and constructs a more complete and systematic theory. Qinglin (2019) researched the education of left-behind children, developed relevant social work service plans, and through the implementation of social work service projects, compensated for the missing content of family education for left-behind children and enhanced the social space for the growth of social organizations. Peiyong (2012) explores the development trend of rural left-behind children from the perspective of research on their development and the ideas and methods of building school space and proposes an educational environment conducive to the healthy development of left-behind children physically and mentally. Shoufang (2019) studied how to use folk games to improve the interaction ability of left-behind children. Leilei (2019) designed a social support system for school adaptation of left-behind children, with a structural framework of "government support as the leader, school support as the main promoter, family support as the supporter, and community support as the interface". Chuanjing researches the security of left-behind children from multiple dimensions and perspectives, solving real-life problems from a psychological perspective and providing new ideas and methods to address psychological development and education.

(2) Studies related to "children's activity spaces" and "design" (#2, #3, #5, #7, #8, #9)

This cluster focuses on research on the design of activity spaces for children left behind in rural areas. Contains keywords such as children's activities, spatial design, rural children's activity space, environmental design, activity space, rural landscape design, residential area design, design principles, design elements, architectural design, and product design.

For example, based on the psychological development characteristics and needs of school-age children, Luofeng (2018) made design recommendations on six spatial elements of various public activity spaces on school campuses, including spatial form, scale, color, and color material, light environment, and furniture furnishings. Jiyu (2015) took rural activity centers for left-behind children as an entry point, focusing on the needs of left-behind children for space, and made an in-depth investigation and study on the current situation of the environment of rural activity centers, the lifestyle of rural left-behind children, and the construction context, and proposes corresponding improvement strategies. Jia-Li (2018) takes nature experience as the starting point, combines nature experience with the behavioral and psychological characteristics of rural children, elaborates on the creation of outdoor activity spaces for rural children, and proposes a strategy for the development of outdoor activity spaces for rural children driven by the rural outdoor environment. Zhou Xiaojing (2018) emphasized the importance of the environment to children's growth, proposed that multiple spatial environments can help left-behind children's growth, and analyzed and summarised the problems of rural left-behind children's spatial environments, thus proposing design strategies for rural left-behind children's spatial environments. Shuo (2019) analyses and explores the design strategies for children's public activity environments based on experiential design principles to promote the development of children's growth. Wangwang (2021) combined the integrated development of urban and rural areas proposed by the state, the construction of rural children's activity space, using the advantages of idyllic natural resources to create a suitable rural field experiential space for children. Xinxin (2022) proposes complementary design strategies for renovating children's activity spaces in old communities to create healthy, safe, and comfortable public activity spaces for children to provide the best support and assistance for their healthy development and growth. Dong (2018) analyzed the rural outdoor activity environment and left-behind children's psychological needs and behavioral characteristics. A landscape design strategy for outdoor activity spaces for left-behind children that focuses on locality, emphasizes guidance, increases the fun, highlights ecology, and improves ornamental qualities is proposed.

2. Research Preface and Trend Analysis

(1) Preface to the study

The research preoccupations and hotspots in a certain period can be reflected by the Burstterms, which are keywords that are suddenly cited more frequently in a certain period. Given this, to further study the development trend of activity space design research for left-behind children in China, CiteSpace was run with the parameter "Burstterms" and the γ value set to 0.6, and 14 keywords were found for Burst items in Figure 3.

Top 14 Keywords with the Strongest Citation Bursts

Keywords	Year	Strength	Begin	End	2012 - 2022
Rural	2012	5.1	2012	2014	
Education	2012	2.28	2012	2014	
Responses	2012	2.19	2013	2014	
Outdoor Activities	2012	1.98	2013	2016	
Group Tutoring	2012	1.59	2013	2015	
Safety	2012	2.23	2016	2018	
Fun	2012	2.22	2016	2017	
Kindergarten	2012	1.98	2016	2017	
Space Environment	2012	1.98	2017	2018	
Children's Behavior	2012	1.72	2017	2019	
Child Development	2012	1.68	2019	2020	
Child Friendly	2012	1.56	2019	2022	
Public Space	2012	1.79	2020	2022	
Rural Primary Schools	2012	1.5	2020	2022	

Fig. 3 Keyword Burst Chart View Citation Burst History

As can be seen from the graph, the emergent words in the period 2012–2014 are "rural" and "education"; in the period 2013–2014, the emergent word is "The emergent word for the period 2013–2016 is "outdoor activities"; for the period 2013–2015 is " group counseling"; "safety" for the period 2016–2018; "fun" for the period 2016–2017 ", "kindergarten"; the emergent word for the period 2017–2018 was "spatial environment"; the emergent word for the period 2017–2019 was "child behavior"; between 2019–2020 the emergent term is "child development"; between 2019–2022 the emergent term is " Child-friendly"; "public space," "rural primary schools" for the period 2020–2022.

The prominence of 'public space' and 'rural primary schools' has continued to the present day, indicating that they will exert influence on the design of activity spaces for left-behind children in China for some time to come and are expected to become research hotspots and the main the development trend.

(2) Research trends

The temporal keyword chart can be used to reflect the main research content of a research topic over time and the research trend in a certain period to a certain extent. Therefore, Cite Space was run to generate a temporal keyword chart by time segment based on keyword co-occurrence analysis in Figure 8. From Figure 8, it can be seen that the six clusters of keywords #0, #1, #2, #3, #4, and #5 have a particular temporal relationship and interconnection with each other, indicating that there is a certain continuity and correlation in their research hotness. The keywords in clusters #1, #7, and #8 do not form an obvious temporal horizontal line between each other, and the temporal relationship is weak; the starting and ending dates of cluster #9 are 2016 and 2017, indicating that its research topic keywords are only stage research hotspots, and the continuity is poor. The five clusters, #0, #1, #2, #4, and #8, cover the period from 2012 to 2022, indicating that they are the most active and persistent. Regarding the time horizon of each cluster, the main keyword "left-behind children" appears first in cluster #0 and is the most influential. The most influential keywords in order of appearance are #1 'child,' #2 'public space,' #3 'landscape design,' and #4. "The above keywords appear from 2012 to 2019, indicating that scholars' attention to the design of activity spaces for left-behind children is rising. On average, one new keyword emerges each year. This shows that the research on this cluster is gradually gaining attention from society.

The keyword mapping was plotted by time zone, and a time series analysis of the keywords was conducted, with the study spanning 2012–2022, resulting in a keyword time zone map. Figure 9 shows that the number of publications related to the study of activity space design for left-behind children is gradually increasing. Their healthy growth is related to revitalizing rural talents, culture, industry, etc. Research on left-behind children's living environment and activity space will continue to increase and deepen.

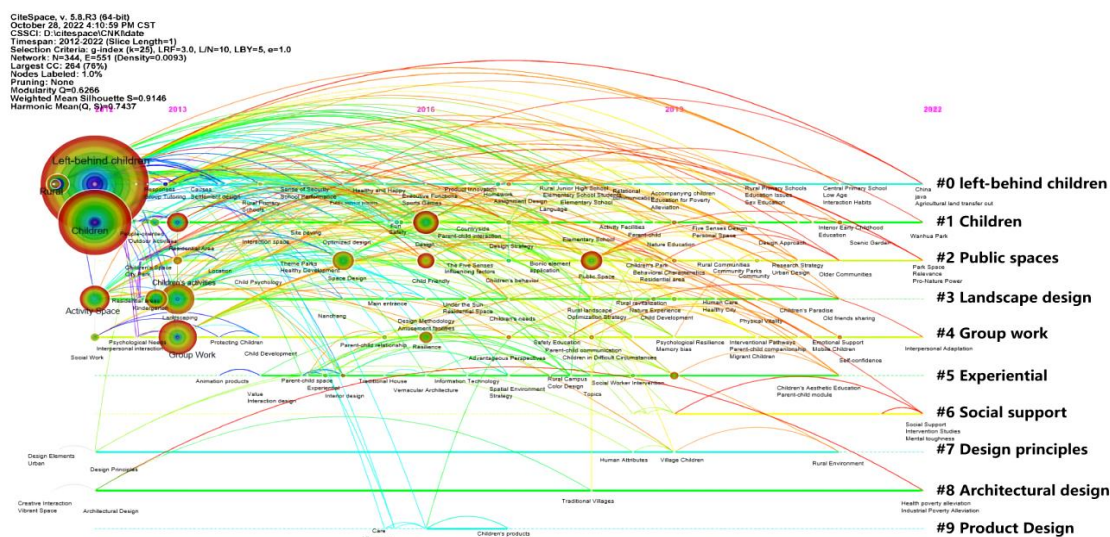


Fig. 4 Keyword timeline analysis

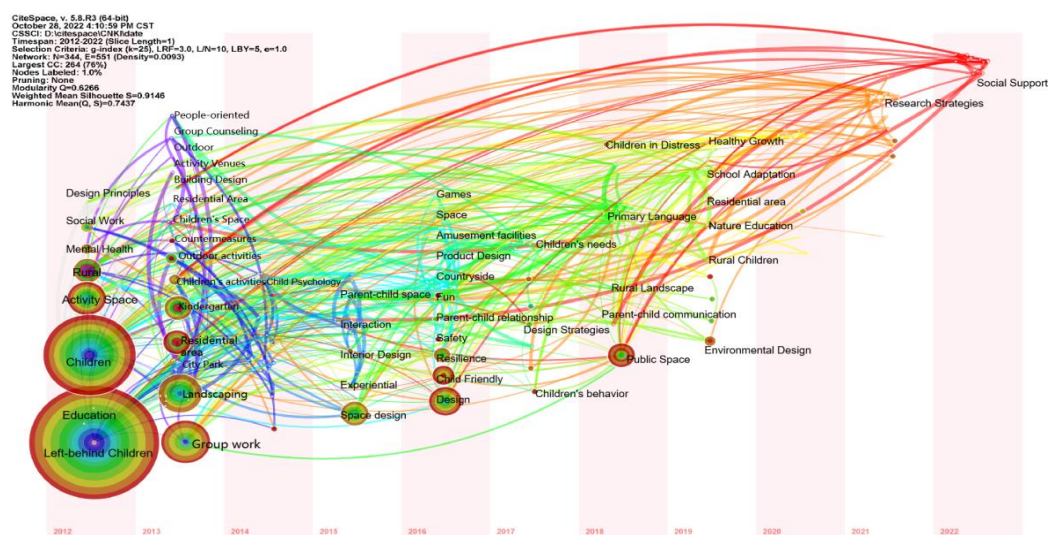


Fig. 5 Time zone distribution of keywords

Combining Fig. 4 and Fig. 5, the development trajectory, duration cycle, and distribution characteristics of the research hotspots at different stages can be reflected. From 2012 to the present, the focus of attention is different in different periods, which mainly depends on the different needs of left-behind children for living space in different periods. By analyzing the high-frequency keywords in each time series, the research in this field can be divided into three stages: stage 1 from 2012–2015, stage 2 from 2016–2018, and stage 3 from 2019–2022. This also coincides with the analysis of the number of posts in Figure 5, which more strongly indicates the change in the thematic structure of research on the design of activity spaces for left-behind children in these three phases.

1) The first stage (2012–2015). This phase mainly researches left-behind children, education, children, activity space, rural areas, mental health, social work, landscape or residential area design, group work, etc. The main research concepts in this period have been highlighted, and scholars began to pay attention to the living space of the left-behind children group and explore the needs of responding to left-behind children.

2) Phase 2 (2016–2018). In this stage, the focus is on design, child-friendliness, child behavior, public space, parent-child relationship, and the emergence of children's needs, which can be seen in the focus on the living environment of left-behind children while paying more attention to the satisfaction of children's psychological needs.

3) The third stage (2019–2022). In this stage, public space, parent-child communication, environmental design, nature education, research strategies, and social support emerge. Scholars have focused on integrating parent-child relationships into different life and learning activity scenarios. 2019 to present, explore how to establish a sound and complete care system for left-behind children and then design the activity space for left-behind children in a targeted manner.

Conclusion

To sum up, this study only retrieved the full-text data of CIKN Chinese journals, and the research in this field in English and foreign research developments should have been covered. However, it intuitively showed the current situation, hot spots, and research trends in this field in China.

Suggestion

1. Studies on the indoor and outdoor spatial environment of left-behind children are only sporadic, with no more attention and research. Only a small number of experts and scholars began to pay attention to the living space environment of left-behind children around 2018, and there is a lack of traditional institutions to organize experts to conduct systematic studies. Future research needs to increase and deepen the research on the living environment and living space of left-behind children.

2. In order to better promote the research on social support for left-behind children in China, it is necessary to strengthen the sense of cooperation between authors and relevant

research institutions, give full play to their respective wisdom, break down academic barriers, and attract more people to pay attention to the social support for left-behind children in China.

3. In the process of rural revitalization, how to effectively improve the social support for left-behind children from objective, subjective, social support and other aspects, and help them establish a sound mental health support system is a problem worthy of scholars' consideration.

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