

UNUSED OUTDOOR SPACE UPDATE: IMPROVING NEIGHBORHOODS IN HIGH-DENSITY URBAN COMMUNITIES WITH A FOOD-CORED ENVIRONMENTAL SCIENCE COURSE

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ABSTRACT

As urbanization accelerates year by year, China's urban public spaces are shrinking exponentially. The serious lack of outdoor space has led to the gradual degradation of urban blocks in Nanjing, a city with a population of 9 million, and the loss of space reuse potential in high-density urban buildings.

The research case is a sunken space on the south side of the main building of the Children's Palace in Jianye District, Nanjing. The design team used its educational resources to position the site as an outdoor base for nature education for children in surrounding communities. The garden uses food education as a medium to correspond to the 24 solar terms (traditional crop planting calendar in the Yangtze River Basin of China), forming a year-round planting plan for more than 60 kinds of fruits and vegetables and formulating more than 20 phenology courses. The course content is formulated according to the diet and planting customs corresponding to the solar terms, including farming operations and traditional food production.

Chinese urban residents are still keen on agricultural practices, and planting crops as a medium increases the site's readability and explores new possibilities for utilizing abandoned community spaces. In this garden, locally sourced plant materials enhance the site's resilience; the total cost is less than \$1.5w. While the courses are free of charge to families in the surrounding communities, collective events promote widespread participation from the surrounding communities, and the initially loose neighborhood relationships are strengthened.

Keywords

Environmental science course, Edible Garden, Twenty-four Solar Terms, China

1 INTRODUCTION

Urban micro-renewal advocates changing some small-scale urban public spaces slightly and gradually to solve some of the social problems brought about by the rapid incremental development of cities, and at the same time, make up for the traditional large-scale urban renewal that is difficult to penetrate trivial and negative urban corners (Liefinder A K et al., 1986). Urban micro-renewal has not been used as a globally popular concept in academic research in various countries. However, its basic meaning has been widely used in various urban studies since Jane Jacobs. Since the 1960s, it has been practiced in many cities worldwide for nearly 60 years, and thus has accumulated a considerable theoretical system and practical methods (Jan Gehl, 2016; William H. Whyte, 2016). Urban vitality requires incremental renewal from the bottom up (Jane Jacobs, 1961). "Urban micro-renewal" is closer to the concept of "Urban Acupuncture" (Urban Acupuncture) commonly used in urban development around the world. Urban Acupuncture advocates the use of small-scale precise interventions to improve the overall urban environment on a larger level (Bai Xueyan et al., 2020). Separation of living, working and leisure in metropolitan areas is a major cause of urban inactivation, and urban acupuncture can mix incompatible functions in cities using low-cost precise interventions without large-scale changes and improvement to improve the overall urban environment (Lerner, 2014).

China's cities have experienced rapid expansion in recent decades, and construction land tends to be saturated. "Urban micro-renewal" considers the development of urban space stock, based on public participation, and targets community public spaces and public facilities. The local incremental renewal method aims to stimulate urban vitality, increase community cohesion, optimize neighborhood relations, and promote community co-governance (Shan Ruiqi, 2017). A highly dynamic public space should have diverse functions and spatial characteristics, and be able to meet the diverse needs of citizens (Dong Hexuan et al., 2018; Mehta, 2006). This is a practical strategy that combines top-down public governance and bottom-up public participation (He Xiaohan, 2022). However, on the whole, urban micro-renewal based on public activities is still in its infancy.

Urban public space has meaning because of human activities (Franklin C et al., 2003), and micro-spaces are no exception. Factors affecting the site design of micro-spaces include fitness facilities, children's activity facilities, and lawns for rest (Han Xili, 2020). Accessibility, environmental quality, and place atmosphere are essential aspects that affect vitality (Li Qing et al., 2014), so vitality improvement strategies need to be classified based on the usage of the population (Wang Lijun et al., 2018).

Based on research at home and abroad, it can be seen that under the impact of global sustainable development, cities are facing multiple and complex issues such as resource allocation, social equity, environmental pollution, and social isolation (Liao Qingqing et al., 2020). The power of self-renewal is the key to sustainable development. It can be made clear that public participation is the internal requirement and mechanism of space micro-renewal, and micro-renewal provides a practical platform for public participation, and its core goal is to promote the sustainable development of negative space. However, the micro-renewal practice based on public participation has strong local characteristics and diversity, and is still in the rising stage in China. The current research basically focuses on the summary and enlightenment of foreign experience, the development process and current situation of domestic public participation, and community participation in a few developed regions. Practical exploration, there is a lack of research that uses educational landscapes and activities as a means to promote social participation to realize the reuse of idle space. This paper aims to fill this gap.

After more than 30 years of rapid urban construction, with the high degree of urbanization and disorderly expansion, China's urban public space is shrinking exponentially. In 2016, the first batch of 11 micro-renewal pilot projects in Shanghai were fully launched. Urban renewal has gradually shifted from extensive construction dominated by urban land redevelopment to refined governance that focuses on improving the quality of micro-spaces and revitalizing functions. As the ancient capital of the Six Dynasties, Nanjing is developing rapidly. A variety of settlement patterns have emerged in the center of Nanjing, coupled with the lack of public natural facilities, resulting in uneven distribution of residents' public spaces. Compared with large-scale public spaces, these gradually formed micro-spaces present typical characteristics such as large number, diverse sources of land use, scattered layout, and strong accessibility. Micro-spaces are closely related to and interdependent with all urban life trajectories and production resources such as communities, transportation, and commerce. They are usually derived near the boundaries of plots of different functional divisions in the city, partly due to the natural change of urban planning and design models in different eras, partly due to changes in the social behavior of some public groups, people subconsciously choose to stay away from such The place.

At the same time, the per capita activity area of students in primary and secondary schools in Nanjing is extremely limited, resulting in the lack of nature, activity areas and nature courses for children. With the onset of the new crown epidemic, the time and scope of children's activities are also limited to the community in a small area, regular teaching courses are also affected. Before September 2020, the land where the project is located is a typical "negative land" type. (Figure 1) The sunken site covers an area of less than 1614 sq ft and is located on the south side of a two-story glass curtain wall building with an area of about 129,167 sq ft. The user is the Children's Education Club in Jianye District, Nanjing. The minimum winter sunshine time at the site is less than three hours. Many children come to our school every weekend. "The teachers of the Children's Education Club said, "We hope to take the children outside sometimes, but there is neither a suitable venue nor a suitable course at present. "A tidy but barren environment does not provide opportunities to help build positive connections between children, nature and social groups. Even already in the Nanjing Greenery Theme Park, a large urban green space, the teachers feel that the surrounding area lacks an ideal place , can provide a convincing basis for action for year-round "activity" outside the building.

In this paper, we conduct a research investigation on Edible Garden, which aims to improve the reuse of urban micro-spaces by constructing a natural environment that supports sensory experience and inspiring learning, aiming to study whether landscape practice driven by educational concepts It can provide an ideal place for children, parents and the community to participate widely and integrate them into the development plan of this special site. China is a large agricultural country, so it is essential to know when to plant crops. So for thousands of years, working people have created the "twenty-four solar terms" according to the climate and weather patterns of the year, as a calendar to guide farming during the year, most of the traditional Chinese festivals are set according to the "twenty-four solar terms". Some of these festivals have both natural and humanistic connotations, and are both natural seasonal points and traditional festivals. Today, Chinese urban residents are still keen on agricultural practices. The "twenty-four solar terms" contain a body of knowledge (such as astronomy, physics, calendar, geography, biology, art, and other disciplines) that goes far beyond basic traditional cultures such as agriculture and food. The close connection between the 24 solar terms and crop cultivation, using edible crops as a medium for cultivation, increases the readability of the site and new possibilities for using abandoned community spaces (Figure 1).

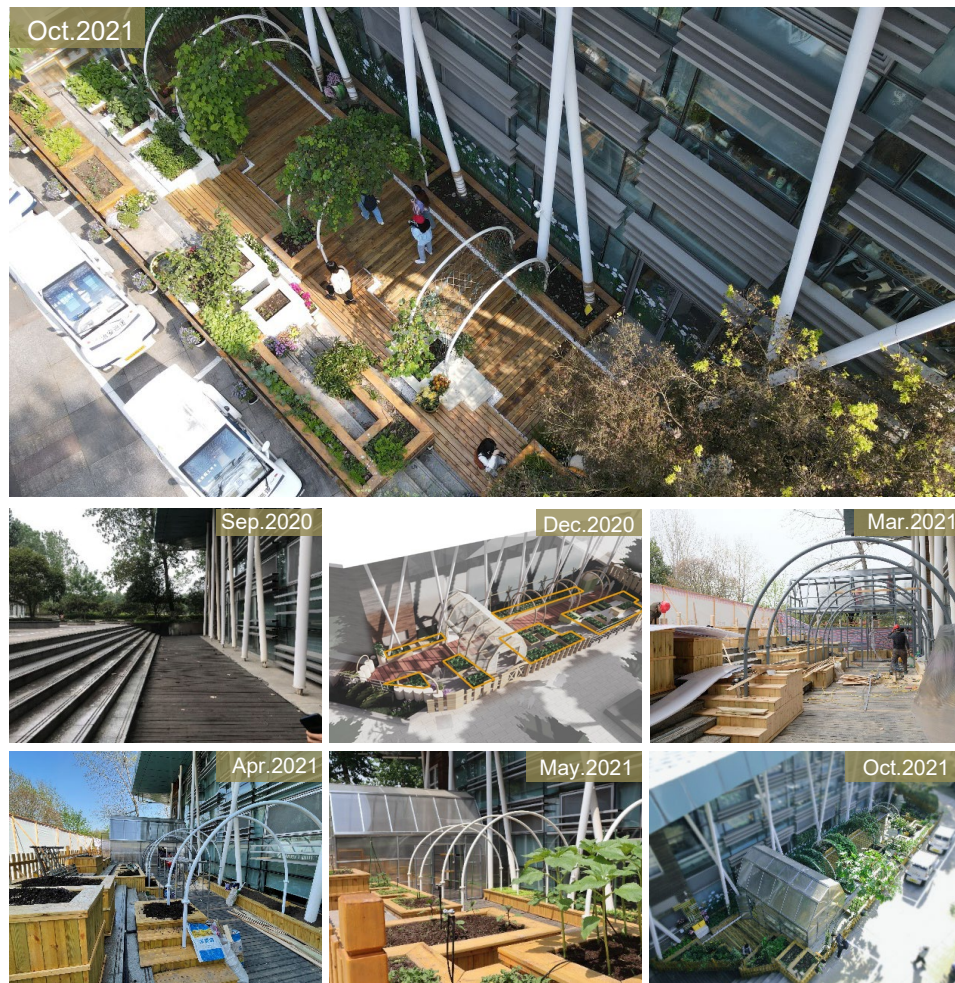


Figure 1. Before site development, design plans and after garden completion. Photo by the Qi, Shaomin and Shi, Yihui.

Considering the lost potential of space reuse in high-density urban buildings and the general perception of traditional Chinese farming culture, the teachers finally reached an agreement with the design team: "Using food education as a medium, this sunken space is designed to be an outdoor classroom. Children who come to the Children's Palace to study and play can carry out various observation, experiment and interactive cooperation environmental education courses here, which provides them with opportunities to participate in natural experiments, artistic perception and group activities." These relatively independent "accidental" "Space has natural advantages to support educational functions—flexibility in physical space and connectedness in social space. We hope to develop and utilize idle community public spaces, build outdoor gardens that allow children to move freely and learn, and introduce systematic, food-related natural courses, so that children can get in touch with nature, understand nature, and learn and grow in nature vision, and then provide an effective way for the development and utilization of idle micro-spaces. The annual garden planting plan of the Children's Education Club selects the required fruit and vegetable materials according to the traditional Chinese 24 solar terms. It formulates the annual natural course plan according to the diet and planting customs corresponding to each solar term. Each course includes farming operations, traditional diet made part. A year and a half later, when the landscape infrastructure driven by the educational concept was completed on this vacant lot, it could support regular and creative outdoor science courses and create many extraordinary places through extensive participatory renewal—formal social cognitive experience.

2 RESEARCH OBJECTIVES

Taking the Edible Garden of Nanjing Children's Palace as a case study, we aim to study the reuse of idle space with potential for redevelopment, thereby ensuring that the updated place occupies a local cultural and social node in the complex external urban structure in which it is located vital position in. To this end, this study addresses the following research questions:

1. Explore the existence of key elements in the design site and the mechanism of action in stimulating the participation of a wide range of social groups.
2. Evaluate the resiliency of the design site and its path to continuous vitality.

3 METHODS

3.1 Study area

The research object of this paper is a sunken small garden, which was initially a vacant lot on the edge of a car park that no one cares about. The floor-to-ceiling windows of a large meeting room in the building frame this long and empty space. The owner of the meeting room is the Children's Education Club in Jianye District, Nanjing. Various small classrooms surround the meeting room. The teachers there wanted to provide a small outdoor garden for the children taking classes in the building, and to have outdoor lessons related to nature education, in addition to science, music and art and craft lessons.

In this study, to prove that the educational landscape can positively affect the activation of micro-spaces in the city and transform them into places with a real sense of self-identity, we collected Edible Garden by sorting photos and tracking records throughout the course. Evidence of the use case, the following is a detailed description of the method.

3.2 Semi-structured interviews and ethnographic observations

Methodologically, our research at this site focuses on the impact of scientific planting programs on-site participant resilience and social attractiveness. We conducted a series of unstructured and semi-structured interviews with participating actors entering the site, as well as ethnographic observations. Interestingly, the twenty-four solar terms originated from the cultural laws and activities that ancient Chinese residents summed up the laws of local nature and crops within a year. Therefore, the researchers conducted a year-long interview and observation near the field based on the time nodes of the 24 solar terms. (5 of them were forced to stop due to the temporary control of the epidemic). Finally, the text was finally generated through interview records, field notes, activity scene descriptions, and activity records (Table 1). Then we conducted a thematic analysis of the text, and finally identified three themes: sustainable construction, extensive community participation, and self-expression of user space. Specifically, different texts were thematically categorized through iterative feedback between twenty-four solar terms concept learning, empirical observation, and broader literature analysis. Finally, we conducted a second automated search to ensure that all relevant content was noticed.

In terms of the research process, it is essential to compare and analyze the snapshots and processes of this kind of life ritual. Because it is impossible to be in the garden at every moment, we took many photos and video recordings of the site at the beginning of the design and the construction stage to ensure that we could intuitively observe the subtle changes in the site (Figure 2). We collected photos with three main themes, including activities, environment, and portraits (a photo can be stored in multiple subject categories), stored them, and sorted these photos according to the time development. After a survey, the content of the photos will be supplemented. The different categories of photos collected according to the timeline reflect some imperfections in the design and the corresponding adjustments in the actual use process. In addition, some users' behavioral logic clues are hidden in the details of the screen, providing the core content for subsequent interviews.



Figure 2. Scenario-based courses around the twenty-four solar terms. Photo by the Qi,Shaomin and Shi, Yihui.

Table 1. Types and quantity of research data. Diagram by the authors.

Theme	Quantity	Unit
Number of visits to the site for research	19	Time
Number of photos taken at the venue	1548	Piece
Number of people involved in the interview	98	Person
Total interview time	20	Hour

4 RESULTS

We conducted a comparative study by sorting the photos according to the timeline, conducted analysis and research based on the interview results to form the research results, and discussed whether the design goals were achieved, and whether the strategy should be adjusted in the future.

4.1 Sustainable creation

According to the photo records and the description of the design team, it can be known that the research and design phase of the project began in September 2020, and the construction was completed from January to April 2021. Educational literacy runs through every link, and such a vibrant environment obviously cannot be built overnight (Figure 3). From the completion of the project to the first phenology course that started in October, the site has not interrupted the process of self-adjustment within half a year.

Thanks to the same team for construction and maintenance, when the first batch of small pumpkin and chayote seeds were sown in the planter box, the galvanized steel shelf that was too wide in the initial design was climbed by hemp rope in time Net filling. From late spring to midsummer, leafy vegetables such as water spinach, coriander, and milk cabbage mature earlier, and the teachers of the Children's Education Club became the earliest high-frequency users. In the original design plan, due to limited funds, the unreplaced anti-corrosion wood floor was overwhelmed, and damage began to appear one after another. In mid-July, the anti-corrosion wood pavement of the light steel keel replaced the original wooden keel structure. Moreover, a month ago in June, the custom-stepped wooden shelves and outdoor tool cabinets in the greenhouse classrooms were also completed one after another. Sunflowers and corn grow quickly to over 5 feet, and the leaves of the elephant ear taro grow superimposed on the vines of the sweet potatoes, covering the bare soil on the surface of the planting box. Considering that the garden is located in the Nanjing Greenery Theme Park, and Chinese people have the habit of walking at night, at the end of August, in the evening of midsummer, the teachers of the Children's Education Club installed a lighting system according to the completed external landscape environment, which made the night have a similar atmosphere, a completely different landscape effect during the day. In addition, plants also provide materials for sustainable construction. During the interview, the garden maintenance staff once said that the crops planted regularly in the Edible Garden and the annual castor plant at the garden entrance are more than 3 meters high, which can provide rich and highly plastic ecological materials for various courses of the Children's Education Club.

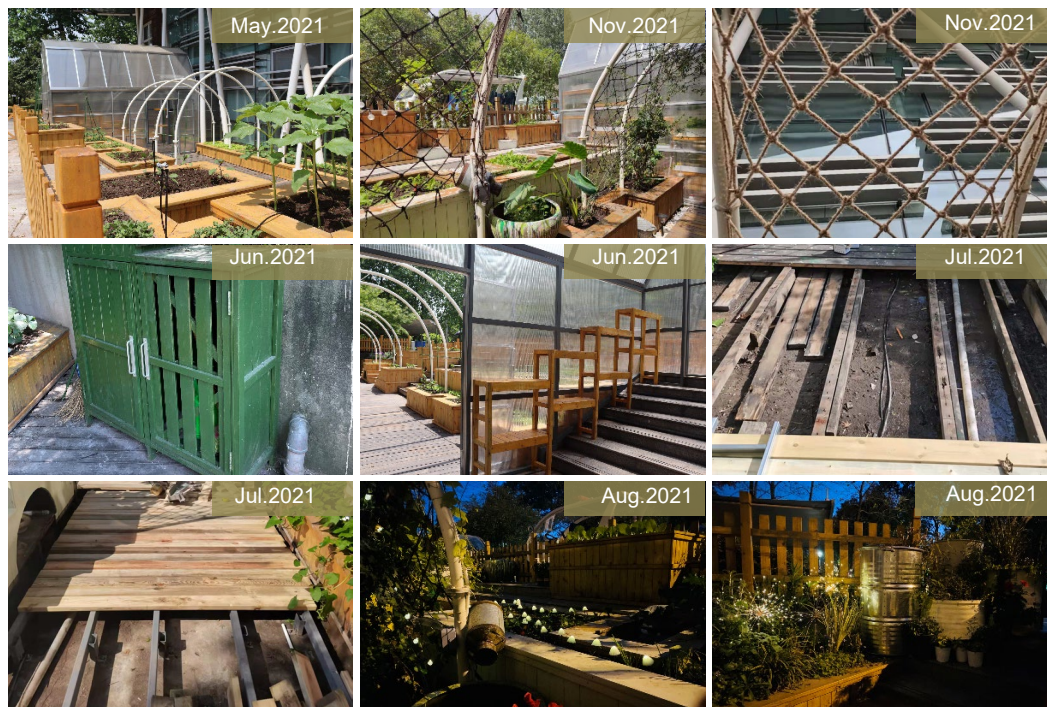


Figure 3. The garden is continuously updated within six months of completion. Photo by the Qi,Shaomin and Shi, Yihui.

4.2 Extensive social participation

Even at the school-scale scale, support for creative play continues to decline. Children need more freedom of movement to create a "creative mess," but in many schools and neighborhoods in today's cities, such behaviors that disrupt "tidiness" are severely restricted. From the beginning of the design, adults' aesthetic preference for a clean and orderly landscape has not been considered as one of the updated values of this micro-spaces. Uncluttered, relaxed, and unconstrained garden forms create more prosperous, more diverse learning spaces. Including modifying the daily maintenance plan combining simple gardening and agricultural maintenance with environmental science course, such as collecting fallen branches and leaves for compost and remaining branches after harvesting, the purpose is to use them as

handmade materials for courses in nature education classes, while saving costs, children's classroom behavior is matched with natural cognition.

The landscape of the Edible Garden not only encourages children to participate, but its design also sincerely invites all adult community residents, including the teachers of the Children's Education Club. The garden is not only a place for teachers to conduct environmental science course, but also a place for them to conduct social activities. According to the Chinese lunar calendar, the second day of the autumnal equinox is the Mid-Autumn Festival, a traditional Chinese festival that symbolizes reunion. On the day of the Mid-Autumn Festival, September 21, 2021, the teachers of the Children's Education Club held the first Mid-Autumn Festival outdoor dinner here. The positive sense of ceremony conveyed their identity to the existing venue, and the old tires, tin buckets and water tanks scattered on the side stated their work plan for the next stage. Before the Frost Festival, the teachers will complete the planting of tires and flowers on the fence, graffiti ecological water tanks and other support uncertainties landscape elements for teaching objectives (Figure 4). After the dinner, a teacher shared on the social platform: "I am very lucky to work with everyone in Edible Garden, and I can experience the natural after work."

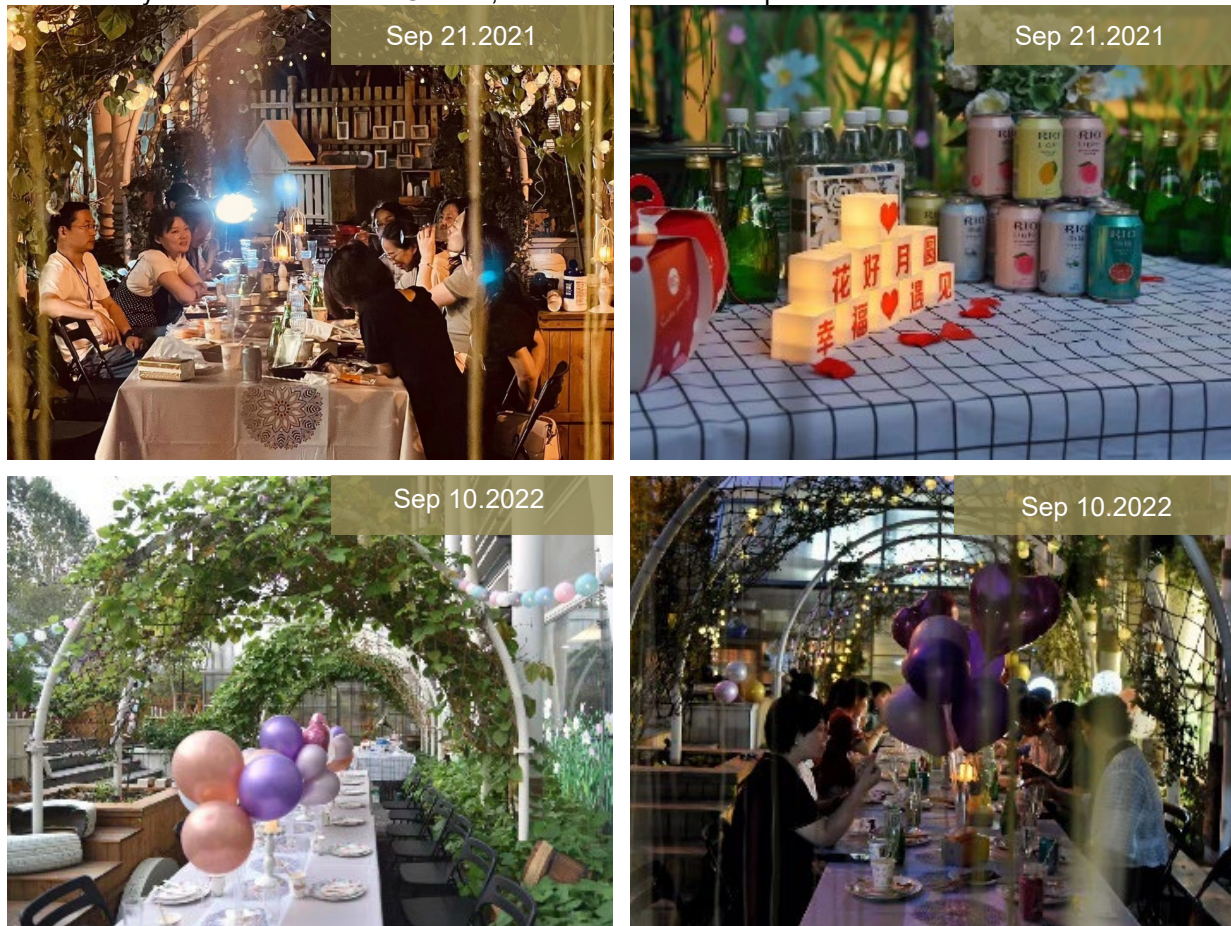


Figure 4. Mid-Autumn Festival in the Garden for two consecutive years. Photo by the Qi,Shaomin and Shi, Yihui.

During the pavement renewal construction stage in July 2021, the crops in the planting tanks at that time were already incredibly lush after a three-month growing season. During the cleaning process, the security guards of the Nanjing Greenery Theme Park went from silently watching outside the railings to stepping in to participate in the harvesting, and the interval was only a few words of conversation. (Picture 5) "When I was young, I lived in a farm and often helped my parents with farm work. Now I can participate in farming activities in the city. This reminds me of my childhood." The security guard expressed the joy of harvesting to us. Since then, the patrol cars of the Security Center of the Nanjing Greenery Theme Park have also parked on the outer edge of the garden from time to time, and the number of passers-by who stop and watch in their leisure time has gradually increased. The interview results show that most of these

stays are irrational and unexpected visitors, and their random travel plans are temporarily changed when they perceive the situation in this public space. Moreover, sudden accidents can even promote the occurrence of different forms of well-intentioned social behaviors. At the end of June 2021, there was a typhoon overnight, and the climbing fruits such as corn and sunflowers in the garden all fell to varying degrees. While cleaning up the site, teachers, maintenance staff and strangers randomly shared a messy but fun public space. Thanks to this process, all random participants get an opportunity for an environment that fosters cooperation, belonging, respect, and responsibility.

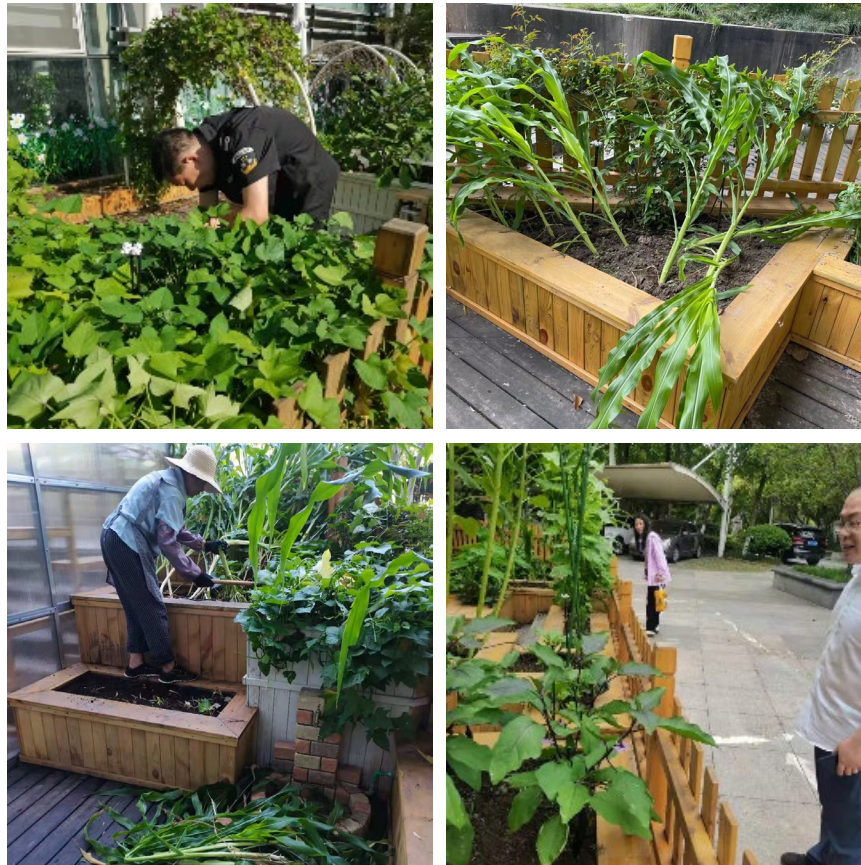


Figure 5. Fallen castor and site cleaning. Photo by the Qi,Shaomin and Shi, Yihui.

4.3 The user's self-expression of the space

As the landscape development level of Edible Garden becomes more and more stable, the continuous unfolding of the landscape and space within the site creates an objective complexity, with the details in the landscape elements constantly changing, there are entirely different environmental experiences in different seasons. The complexity of this environmental change combines the participants' individual needs and aesthetic expressions, and the resultant force acts on the site, resulting in a random and open design, which is entirely unpredictable and imaginable by the designers. The ever-changing and ever-derived landscape space provides children with more real environmental revelations (such as living and non-living, biodiversity, life cycle, food chain and carbon cycle). The security guard of the Nanjing Greenery Theme Park mentioned in the interview that the customized toolbox in 2021 was originally green, but it was repainted white half a year after completion. In addition, three sets of planting boxes in the natural color of pine at intervals, and even the gasoline barrels used as compost barrels, were painted white at different times. No matter where the motivation for such changes comes from, the behavior of change itself is the most apparent positive feedback provided by participants to environmental maintenance, and it is also an aesthetic expression to meet their own needs.

5 CONCLUSIONS

Inspired by the "Twenty-Four Solar Terms", the scientific curriculum system proposed by the team guides the continuous construction activities of the site (sowing, composting, harvesting, agricultural festivals, traditional food production), in addition, the daily maintenance and management of users, the growth of plants Provides a steady stream of nature education materials. All of these form an ongoing connection between humans and nature, contributing to the flexibility and dynamism of the site. The open façade along the street is like a stage play, showing the connection between users and nature, closely watched by passers-by, children and parents. Collective emergencies have further promoted the extensive participation of community members.

In addition, its research connotation also has a higher level of inspiration for landscape research. Engaging the design with local parks departments, other open space agency managers, community streets and non-profit organizations creates a sustainable partnership between the community's children, parents, and local ecosystems. Specifically, users' self-expression and professional consulting support are not contradictory in actual operation; on the contrary, they complement each other. The spontaneous design in the garden is not only derived from the direct users of the site, but the space is gradually out of the control of the design and more random events begin to occur. Subtle changes are slowly superimposed to generate the unique physical characteristics of the site. After the garden is completed, although the design team will conduct research and return visits regularly, due to the large number of teams, the follow-up personnel are not fixed, and the instability of personnel has not established a relatively stable communication and cooperation relationship between the two parties. In addition, regular financial support is also missing in this cooperation. Based on the above reasons, various stakeholders did not establish a necessary and clear communication and care mechanism at first. The owner gradually developed a different design concept for the garden from the design team, so they began to repair the garden and plant it by themselves. The result is that the food materials for some courses come from white lies: the property owners buy them in the market in advance and bury them in the soil for the students to harvest. Such problems stem from the owner's lack of guidance and consultation on planting laws. Therefore, we recommend clear, necessary communication mechanisms as an important factor influencing garden resilience. This helps various stakeholders express their own situations more naturally. This is beneficial for all stakeholders to express their situation and ask for help more naturally.

"Edible Garden" is a practical project as well as a research project. The design team has been participating in the project's design, construction and operation for more than two years, exploring a kind of differentiated design mode for urban micro-spaces renewal. The project illustrates how to design better and utilize "educational landscapes" to improve public participation in urban micro-spaces. This study is of great significance when the urban core area is facing a stock development stage of space shortage and resource saturation, and the public's increasing material and spiritual demands on the daily social life of the city.

6 DISCUSSION

Recognizing the pedagogical possibilities of landscape resources, the renewal mission of urban micro-spaces acquires a whole new dimension. If the learning environment accepted by the city is not only the concept of buildings, new alternative spaces will also be added to the public's concept collection of educational scenes.

In the joint construction of the garden, the local characteristics of the micro-spaces are combined with the natural education process. Through empowerment and cultivation, the endogenous force of the site is used to complete the spontaneous renewal of the space environment.

Substantial and complex issues are involved at various stages in the research process. In the preliminary planning and design stage, the participants' power resources, influence, and activity will lead to unequal participation status. How to avoid the planning stage being affected by personal interest struggles? When professional knowledge and local participation conflict, how should they be reconciled? Therefore, we encourage designers to consider the design quality and use function of each space, whether it is to improve the activation effect of the space or to improve the educational performance of the space. In addition, the communication between the design team and the site owner before the design is also a condition for the garden to develop positively. Many design projects in China usually focus on the design and construction stages of the site, ignoring the subsequent use, operation and maintenance, resulting in a decline in the sense of experience, which in turn leads to the secondary idleness of the site. Therefore, after the operation of the space, the designer should keep in touch with the owner, but conflicts and differences in different design concepts may exist. However, we encourage the owner to propose different

design concepts actively. In this case, the design team can choose to continue to communicate, or delegate power to the owner, and withdraw from the operation and maintenance cycle of the garden.

Edible garden is a new type of community renewal project born in the late stage of China's rapid urbanization process. This project provides a new idea for the frequent small-scale community renovation projects in big cities in recent years. By increasing the content of regular activities in the garden, stimulates the regular and substantive connection between the garden and the surrounding people. With the help of this continuously strengthened link achieves a stable frequency of use and maintains the landscape effect of the garden. It provides a brand-new design and long-term maintenance and management strategy for many similar urban community renewal projects that are abandoned 1-2 years after completion.

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