

Linking Site Evaluation with Point-Line-Plane Intervention: Urban Acupuncture for the Renewal of Leftover Spaces in Aging Primary School Campuses

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Received: 17 March 2026; **Accepted:** 31 March 2026; **Published:** 30 April 2026

Abstract:

This study examines how urban acupuncture can inform the renewal of leftover spaces in aging primary school campuses. Based on field investigations in five aging primary schools in Wuxi, China, 34 leftover spaces were identified and evaluated using a four-dimensional framework covering structural potential, environmental baseline, user demand, and implementation feasibility. The results show that these spaces are not merely residual fragments but localized nodes where functional ambiguity, circulation disruption, and environmental underperformance tend to accumulate. Rather than using evaluation only for ranking, this study links site conditions to intervention decisions by considering both system-level leverage and dominant problem structure. Accordingly, urban acupuncture is operationalized as a point–line–plane intervention logic: point-based actions address localized functional deficits; line-based actions repair disrupted movement and interface relations; and plane-based actions improve environmental foundations in larger underperforming areas. Therefore, this study proposes a more targeted framework for renewing leftover spaces in aging primary school campuses.

Keywords:

Urban Acupuncture, Aging Primary School Campuses, Leftover Spaces, Spatial Diagnosis, Intervention Selection

1. Introduction

Aging primary school campuses are increasingly confronted with the task of stock-based renewal. After years of incremental construction, spatial densification, and changing educational demands, many campuses contain small, fragmented, and weakly connected spaces embedded in their built fabric. Because these spaces are limited in size and their role is unclear, they are often treated as secondary or residual areas. However, their significance exceeds their marginal physical status. In everyday school life, they often coincide with weakened circulation, declining environmental quality, and insufficient support for children's learning, movement, and informal activities. Primary school campuses are no longer understood simply as containers for teaching but as environments that support growth, behavior, interaction, and everyday

experience [1,2,3]. Against this background, leftover spaces should not be read simply as accidental remnants but as places where the campus spatial system performs least effectively.

1.1. Urban Acupuncture as a Selective Renewal Logic

Urban acupuncture offers a useful perspective for addressing this condition because it emphasizes selective, precise, and system-oriented interventions rather than comprehensive reconstruction. Its value lies in the premise that carefully chosen local actions can improve broader spatial relationships. In the Chinese context, urban acupuncture is often associated with the identification of key spatial “acupuncture points” and the use of small-scale interventions to generate wider urban effects, rather than relying on large-scale, disruptive redevelopment that erases existing texture and everyday continuity [4]. This logic also resonates with more prudential and incremental renewal traditions, in which adaptation to existing spatial structures and gradual reorganization are prioritized over wholesale replacement [5]. This perspective is particularly relevant to aging primary school campuses. While ‘aging’ implies a chronological metric, specifically schools built more than 20 years ago, this study defines ‘aging campuses’ as those exhibiting both physical deterioration and functional misalignment with contemporary pedagogical standards. Renewal in such environments is usually constrained by limited budgets, compact layouts, continuous daily use, and strict safety requirements. Large-scale restructuring is therefore difficult to implement, whereas fragmented beautification measures often produce only short-lived effects. What matters under these conditions is not how much space is redesigned, but where the intervention is introduced, what type of problem it addresses, and whether limited action can generate a wider spatial influence.

1.2. Leftover Spaces as Underperforming Spatial Units

Leftover spaces commonly appear in interstitial, marginal, and transitional locations in aging primary school campuses, such as narrow gaps between buildings, platform corners, stair undersides, route edges, wall-side strips, and residual open pockets formed through long-term spatial adjustment. Although physically embedded in the campus, many of these spaces remain weakly used, functionally unclear, or environmentally inadequate. This understanding is consistent with broader discussions of lost or leftover spaces, where such spaces are not regarded as neutral by-products of form but as places where spatial relations, use value, and environmental support have weakened [10].

Their problem lies not simply in irregular shape or limited size. More fundamentally, they often fail to support the operational logic of the campus. Some lack a clear role in teaching support, informal activity, or short-term staying. Others interrupt movement because routes narrow, detour, or lose continuity. Still others are constrained by poor visibility, low comfort, limited accessibility, or weak safety conditions. Similar conditions have been identified in studies of fragmented residual spaces and small leftover sites, where functional confusion, weak organization, low vitality, and a mismatch between spatial availability and actual use frequently coexist [11,12,13,14]. In older built environments, such spaces are often produced not by a single design error, but by long-term adjustment, management neglect, circulation compression, and the piecemeal occupation of edges and gaps [13,14]. At the same time, the value of such spaces cannot be judged by form alone, since everyday use and perception may change substantially depending on how they are recognized, structured, and supported [15].

This issue is more significant in the context of primary school campuses because children's behavior requires spatial support. Cognitive, emotional, social, playful, and exploratory development all depend on appropriate environmental settings rather than standardized classrooms alone [2]. Children also experience space through sensing, hiding, moving, exploring, and interacting; apparently marginal or transitional locations may still carry behavioral meaning if the environment can support them [16]. Many existing primary school campuses, however, still show limited flexibility, weak comfort, and insufficient responsiveness to students' dynamic needs [1].

Recent research on school public spaces and diversified learning environments reinforces this point. Public spaces in urban primary schools require attention not only to functional allocation but also to scale, interface, form, and the organization of shared use [17]. Learning is no longer confined to classrooms alone, and non-classroom spaces increasingly need to support temporary, exploratory, student-led, and loosely structured forms of occupation through accessibility, openness, and layered spatial organization [18]. Existing urban school environments also need to be reconsidered as long-term educational landscapes that support learning, play, social interaction, and community connection, rather than merely serving as background spaces [3].

Taken together, these studies suggest two things. First, leftover spaces in primary school campuses should be understood as underperforming spatial units rather than neutral residual fragments. Second, not all such spaces carry the same urgency or require the same mode of response. Many existing studies and design practices focus on what may be added to underused spaces but give less attention to how different leftover spaces should be comparatively recognized and strategically distinguished. It is precisely this gap that makes a more explicit evaluative and intervention framework necessary. To address this issue, this study investigates leftover spaces in five aging primary schools in Wuxi, China, and identifies 34 representative sites for comparative evaluation. The evaluation framework covers four dimensions: structural potential, environmental baseline, user demand, and implementation feasibility. Its purpose is not to foreground evaluation as an end in itself but to provide a clearer basis for later design judgment. On this basis, the study links site evaluation with a point–line–plane intervention logic informed by urban acupuncture. Rather than assigning intervention by form alone, the framework interprets site conditions in relation to the dominant problem structure and intervention scale. In this way, evaluation becomes the analytical basis from which renewal priorities and design responses can be more precisely developed.

2. Materials and Methods

This study combined site investigation, comparative evaluation, and intervention translation to examine leftover spaces in five aging primary school campuses in Wuxi, China. The overall workflow is shown in Figure 1.

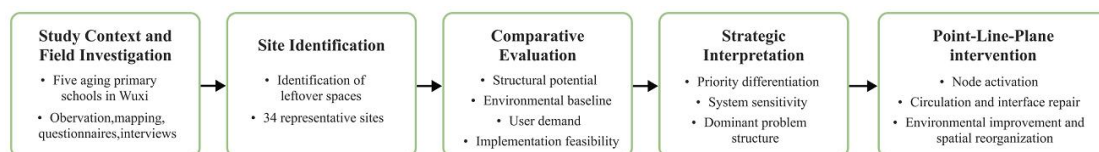


Figure 1. Analytical workflow from site identification to point–line–plane intervention.

2.1. Study Area and School Sample

The study was conducted in Wuxi, China, where many long-established primary schools are facing the practical challenge of stock-based spatial renewal. Compared with newly planned campuses, aging urban primary schools often present a more complex spatial fabric shaped by prolonged use, repeated adjustment, and pressure on limited land resources. Under such conditions, leftover spaces are not isolated anomalies but recurring outcomes of campus evolution. Five aging primary schools in Wuxi were selected as the empirical sample. The purpose was not statistical representativeness, but rather to serve as a focused qualitative exploration of comparable campuses, allowing for an in-depth analysis of typical conditions that shared typical conditions of long-term use, compact spatial organization, and visible leftover-space problems, while retaining differences in layout and site context. Fieldwork combined on-site observations, spatial mapping, photographic documentation, and comparative recording of everyday site conditions. Attention was given not only to the physical form but also to the relationship between space, circulation, environmental quality, user behavior, and the practical feasibility of renewal. The five sampled schools and the fieldwork basis are summarized in Table 1.

Table 1. Primary school samples and fieldwork basis

School	Urban location	Campus characteristics	Leftover-space condition	Fieldwork basis
Meiyuan Primary School	Wuxi urban area	Long-established campus with compact spatial organization	Leftover spaces along building edges, corners, and circulation transitions	Observation, mapping, photographic documentation
Shanbei Central Primary School	Wuxi urban area	Aging campus shaped by repeated spatial adjustment	Residual strips, route-side spaces, and underused pockets	Observation, mapping, photographic documentation
Xuelang Central Primary School	Wuxi urban area	Dense campus with constrained open-space resources	Transitional and interstitial leftover spaces near teaching and circulation areas	Observation, mapping, photographic documentation
Yuhong Primary School	Wuxi urban area	Long-term use with complex edge and interface conditions	Marginal spaces with weak functional integration	Observation, mapping, photographic documentation
W'ai Primary School	Wuxi urban area	Compact aging campus with intensive daily occupation	Corner spaces, edge fragments, and small underperforming open areas	Observation, mapping, photographic documentation

2.2. Identification of Leftover-Space

Based on field investigations, 34 representative leftover spaces were identified across the five campuses for comparative evaluation. Site identification did not rely solely on irregular geometry or visual marginality. A space was included when it showed one or more of the following conditions: weak integration into daily campus operations, ambiguous or unstable use, disrupted circulation, poor environmental performance, or a visible mismatch between spatial availability and actual demand. This selection logic follows a broader understanding of lost and leftover spaces, in which such sites are recognized through weakened relations, low use value, or incomplete environmental support rather than through shape alone [10,11,12,15]. The identification process followed a comparative logic. First, initial observations located

interstitial, marginal, and transitional spaces in relation to buildings, routes, and activity zones. These spaces were then examined in terms of their everyday operations. A site was retained only when it showed both clear deficiencies and meaningful renewal potential. Residual areas that were too incidental, too inaccessible, or too detached from campus use were excluded because they could not function as realistic intervention nodes. The final 34 sites included building-edge pockets, corner waiting areas, narrow route-side strips, stair-adjacent spaces, platform margins, wall-side zones, and underused open fragments between functional areas. Despite their visual diversity, they shared a common characteristic: each marked a location where the relationship between space, use, and campus operations had weakened. Their distribution across the five sampled campuses is shown in Figure 2.



Figure 2. Distribution of the identified leftover space across the five sampled campuses.

2.3. Evaluation Dimensions and Indicators

To compare the 34 sites in a structured manner, a four-dimensional evaluation framework was established, covering structural potential, environmental baseline, user demand, and implementation feasibility. These dimensions were selected because leftover-space renewal in aging primary school campuses cannot be judged by the physical form alone. A space may appear available but may still be unsuitable for intervention if the environmental conditions are poor, user demand is weak, or implementation constraints are severe. Conversely, a modest-looking site may deserve priority because of its position within the campus system and its capacity for improvement. This broader reading is necessary because spatial use depends not only on visibility and access but also on whether a site can support waiting, temporary

occupation, informal interaction, and the extension of learning-related activities beyond the classroom [1,15,16,17,18].

Structural potential refers to the spatial basis that enables a site to function as a potential intervening node. It concerns its position within the campus layout, relationship with surrounding buildings and routes, degree of enclosure or openness, and capacity to accommodate clarified use or spatial reorganization. The environmental baseline refers to the existing quality of the site as an everyday setting. It includes visibility, accessibility, comfort, safety, and interface continuity. In primary school environments, weak environmental support can directly limit use and reduce the effectiveness of light-touch interventions. User demand refers to the relevance of a site to actual patterns of occupation and perceived need. It reflects how a leftover space relates to children's movement, short-term staying, informal interaction, route-based use, or unmet demand in adjacent areas. Implementation feasibility refers to the practical conditions under which renewal can be carried out. It includes construction difficulty, potential disruption to the teaching order, clarity of site control, and compatibility with school management.

These four dimensions were further translated into 12 indicators to evaluate sites on a common basis. The framework was not intended as a rigid scoring exercise detached from design reasoning. Its role was to make site differences clearer and more comparable before they were translated into intervention strategies. The four-dimensional framework and its 12 indicators are shown in Table 2.

Table 2. Four-dimensional evaluation framework and indicator matrix.

Dimension	Code	Indicator	Operational meaning	Main evidence source
Structural potential	S1	Node/locational sensitivity	Degree to which the site occupies a spatially sensitive or leverage-bearing position within the campus system	Field measurement; spatial relationship records
	S2	Usable size and activity-carrying capacity	Extent to which the site provides sufficient usable area and basic spatial capacity for occupation or intervention	Field measurement; site observation
	S3	Boundary clarity and spatial organizability	Degree to which site edges, enclosure, and internal order support spatial definition and future organization	Field measurement; site observation
Environmental baseline	E1	Perceived safety risk	Level of perceived safety concern associated with visibility, enclosure, conflict, or other environmental conditions	Observation; questionnaire-informed feedback; interviews
	E2	Circulation conflict / detour pressure	Degree to which the site disrupts movement continuity, causes conflict, or creates inefficient detours	Observation; behavioural recording; questionnaire-informed feedback
	E3	Comfort for	Extent to which the site	Observation;

		staying	provides acceptable comfort for short-term occupation, pause, or informal use	questionnaire-informed feedback; interviews
User demand	U1	Actual use frequency	Frequency with which the site is used in everyday campus operation	Behavioural observation; questionnaire-informed feedback
	U2	Intensity of negative experience	Degree of dissatisfaction, inconvenience, or negative perception associated with the site in use	Questionnaire-informed feedback; interviews
	U3	Consensus on mixed use / demand consistency	Extent to which different users show convergent demand or shared recognition of the site's renewal need	Questionnaires; interviews
Implementation feasibility	F1	Construction disturbance	Degree to which intervention would interfere with teaching order, circulation, or daily campus operation	School management conditions; implementation judgment
	F2	Managerial controllability	Extent to which the site can be practically controlled, coordinated, and managed during and after intervention	School management conditions; site judgment
	F3	Maintenance convenience	Degree to which the renewed site can be maintained with reasonable effort and long-term operational stability	School management conditions; maintenance judgment

In addition to spatial observations and mapping, the user-demand dimension was supported by questionnaire surveys, semi-structured interviews, and behavioral observations. A total of 444 valid questionnaire responses were collected, and 15 semi-structured interviews were conducted to clarify recurring complaints, perceived dissatisfaction, and unmet demand associated with leftover spaces. Behavioral observations during routine school periods were used to verify actual patterns of occupation, short-term staying, and behavioral inactivity. Together, these sources provided the empirical basis for assessing actual use frequency (U1), intensity of negative experience (U2), and consensus on mixed use or demand consistency (U3).

2.4. Scoring, Weighting, and Priority Structuring

To ensure comparability across sites, all 12 indicators were evaluated on a 1–5 anchored scale, with higher values indicating stronger renewal relevance after calibration. Before scoring, indicator definitions, anchor settings, and reverse-coded variables were aligned to maintain a consistent evaluative logic across the 34 sites. Structural indicators were judged mainly through field measurements and spatial relationship records; environmental and user-demand indicators were assessed through site observations, questionnaire-informed feedback, interviews, and

behavioral observations; and feasibility indicators were judged primarily in relation to management conditions, implementation disturbance, and maintenance requirements.

After scoring, the indicator values were aggregated to generate comparative priority results. Reverse-coded indicators were adjusted before aggregation, and the relative contribution of indicators was differentiated through entropy weighting. The weighted results were then used to produce composite priority scores for the 34 identified sites and to distinguish first-, second-, and third-priority groups. Priority structuring, however, was treated as an intermediate analytical result rather than a final decision rule. The later determination of intervention orientation was further interpreted in relation to system-level leverage and dominant problem structure.

2.5. Interpreting Evaluation Results for Intervention Decision

Evaluation should not be equated with intervention decisions. Comparative assessments clarify site differences; however, they do not automatically determine how renewal should proceed. On aging primary school campuses, a site with a higher evaluation result is not necessarily the first or most suitable location for action if its role within the broader campus system remains limited or if its main problem does not correspond to a feasible scale of intervention. Therefore, evaluation functions here as a basis for strategic interpretation rather than as an endpoint in itself.

Therefore, leftover-space renewal cannot be reduced to selecting the “best” sites in descending order. A more meaningful decision logic must also consider how each site relates to broader patterns of campus operations. Two additional interpretive criteria were introduced after composite ranking: system-level leverage and dominant problem structure. System-level leverage refers to the extent to which intervention at a given site is likely to improve broader relationships of movement, activity distribution, or spatial organization beyond the site itself. Unlike the site-level indicator of node/location sensitivity used in the evaluation matrix, system-level leverage is applied here as a post-evaluation criterion to judge whether intervention at a site is likely to generate wider campus effects. Dominant problem structure refers to the principal mode of underperformance that defines the site, such as localized functional deficiency, circulation disruption, or broader environmental weakness. This additional reading is consistent with the broader logic of urban acupuncture, in which the significance of a local action lies not only in its local fit but also in the wider relations it may activate [4,6,9].

Based on this, the evaluation results were translated into a point–line–plane intervention logic. Sites in which problems are concentrated at a local node and can be addressed through limited insertion are more suited to point-based interventions. Sites in which the main difficulty lies in broken connections, weak transitions, or interface discontinuities are addressed more appropriately through line-based intervention. Sites requiring broader improvements in environmental conditions or spatial carrying capacity are more likely to call for plane-based interventions. In this framework, points, lines, and planes do not simply describe geometric conditions; they indicate differentiated modes of response shaped by the relationship between site conditions, campus relevance, and intervention scale. System-level leverage was assessed qualitatively through expert consultation and iterative discussion, informed by predefined criteria such as the site’s proximity to major circulation nodes, its potential to connect previously isolated activity zones, and its visibility from key campus pathways. This judgment determined whether the intervention at a site was likely to

influence broader campus operations beyond the site itself, such as improving overall circulation continuity or enhancing shared activity distribution, particularly in relation to circulation continuity, shared activity distribution, interface coordination, and environmental continuity. This step was introduced after composite ranking to distinguish site-level renewal relevance from broader strategic leverage.

3. Results

The comparative evaluation of the 34 sites moves the analysis beyond general recognition and toward a more differentiated reading of leftover-space underperformance in aging primary school campuses. The results do not point to a single shared condition. Instead, they reveal clear variations in structural potential, environmental support, user relevance, and implementation feasibility. This variation matters because it confirms that leftover spaces cannot be approached through a uniform renewal response. More importantly, the evaluation helps identify recurring problem structures that shape how different sites should be interpreted and addressed.

3.1. Overall Differentiation of the 34 Sites

The evaluation results clearly differentiated among the 34 sites. Rather than clustering around one common condition, the sites are distributed across a noticeable range of performance. This suggests that leftover spaces in aging primary school campuses do not constitute a homogeneous category of marginal areas. Even spaces that appear similar in plan, scale, or location may differ substantially in renewal relevance once their structural position, environmental condition, user demand, and implementation feasibility are considered together. The results also indicate that renewal significance is rarely produced by a single factor. Some sites were notable because they occupied structurally sensitive positions within the campus system. Others become prominent because of severe environmental weaknesses or because they are closely related to unmet daily demands. In most cases, site importance emerges from the interaction of several dimensions rather than from any single indicator. Underperforming leftover spaces were found across multiple campus situations, including building-edge pockets, route-side strips, corner waiting areas, and residual open fragments between functional zones. This confirms that the issue is not limited to isolated defects but reflects a recurring spatial imbalance embedded in everyday campus organization.

Table 3. School-level mean scores across the four evaluation dimensions

School	No. of sites	Structural potential	Environmental baseline	User demand	Implementation feasibility
Yuhong Primary School	7	3.110	3.495	2.952	4.010
Meiyuan Primary School	7	3.462	3.324	3.119	3.657
Xuelang Central Primary School	7	3.367	3.548	3.195	3.757
Shanbei Central Primary School	7	3.405	3.357	2.690	3.919
W'ai Primary School	6	3.572	3.344	3.011	3.983

3.2. Recurring Problem Patterns of Leftover Spaces

Although the 34 sites differed in specific conditions, the evaluation revealed three recurring problem patterns across campuses: ambiguous function, circulation interruption, and negative environmental experience. These patterns are not intended to reduce all leftover spaces to fixed types. Their purpose was to clarify the principal modes of underperformance that repeatedly appeared in aging primary school environments. Ambiguous function refers to spaces that are physically available but lack a clearly defined role in everyday campus use. Such spaces are not entirely unusable. Rather, they remain weakly programmed, poorly identified, or insufficiently connected to meaningful activities and are therefore more often passed through than intentionally occupied. Spaces close to children's daily routes or learning environments may still fail to support use if they do not provide recognizable invitations, pause conditions, or behavioral anchoring [16,17,18]. Circulation interruption refers to spaces where the continuity, legibility, or coexistence of movement has been weakened. This commonly appears in narrow transitional zones, route-side strips, turning corners, or spaces where path systems and adjacent edges no longer operate in a coordinated manner. The problem is not confined to movement efficiency; it also affects the broader quality of spatial relations and everyday use. On campuses where children's movement, waiting, and informal interactions overlap, even a small disruption in the route structure may alter how space is approached, shared, or avoided [2,16].

A negative environmental experience describes spaces with visibility, comfort, accessibility, safety, or overall environmental conditions that are too weak to support a stable occupation. Even when such sites have locational value or latent demand, they often remain excluded from everyday campus life because their basic environmental support is insufficient. These three patterns frequently overlapped. A site marked by an ambiguous function may also suffer from poor environmental support, whereas a circulation-related leftover space may discourage staying or informal use. However, identifying the dominant problem remains essential because later intervention decisions depend on recognizing which form of weakness is the most decisive at each site.

3.3. The Limits of Ranking in Intervention Decision

The evaluation results provide a necessary basis for comparison; however, they do not determine where intervention should begin or what form it should take. If renewal relied only on composite ranking, decision-making would become overly dependent on numerical priority while overlooking how a site operates within the broader campus system. A site with a relatively high score is not always the best first intervention point if its influence remains spatially limited. Conversely, a site with a lower overall score may deserve earlier attention because of its role in daily circulation, activity distribution, or environmental continuity. Therefore, ranking must be read together with system-level leverage and dominant problem structure. System-level leverage refers to the extent to which intervention at a site may improve broader relationships of movement, activity distribution, or spatial organization beyond the site itself. Dominant problem structure refers to the principal form of underperformance that constrains the site, whether it is a local functional vacancy, relational discontinuity, or broader environmental weakness. The effect of a local intervention depends not only on local fit but also on the wider relations it may activate or stabilize, which is consistent with the broader logic of urban acupuncture [4,6,9].

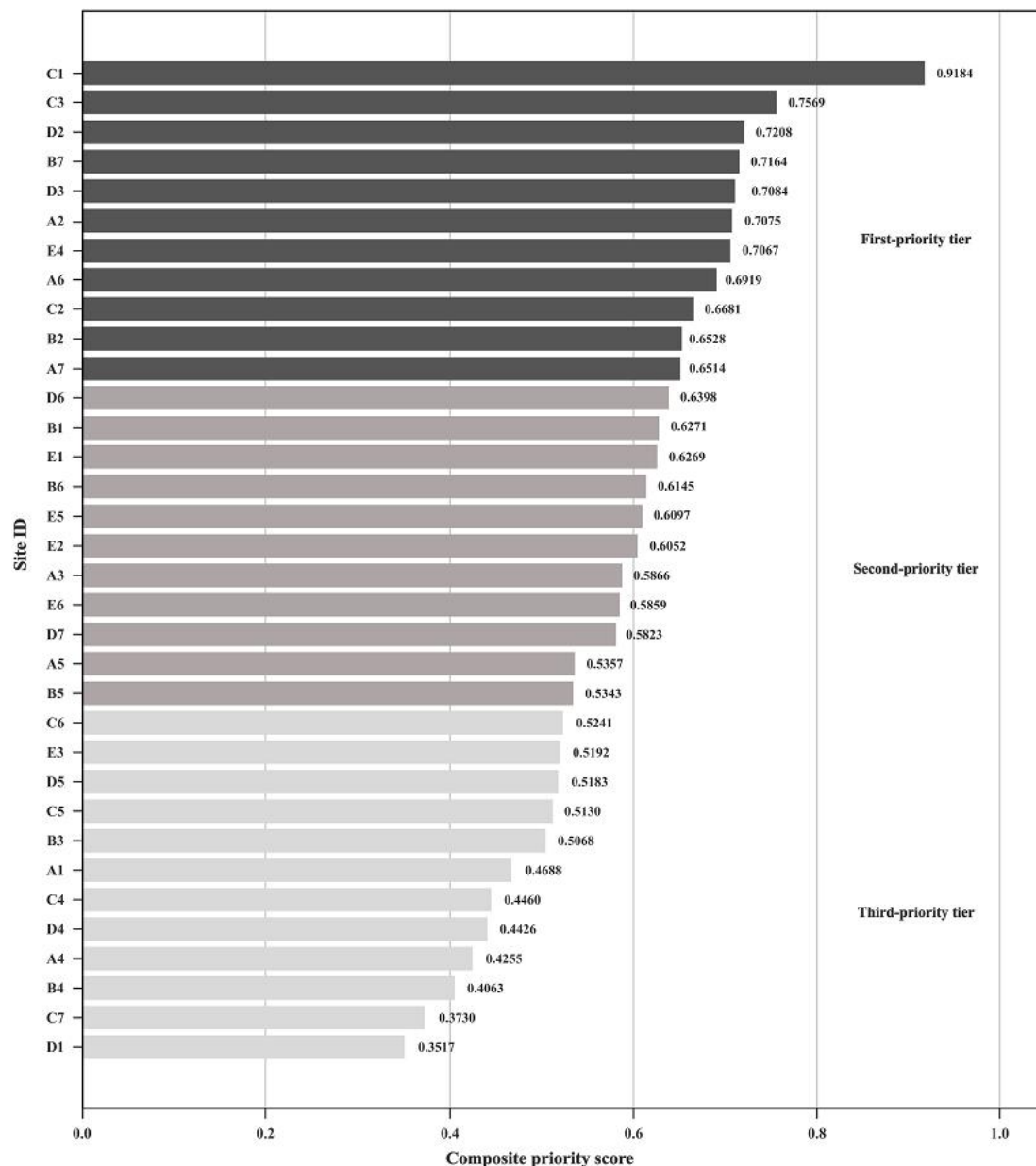


Figure 3. Priority structures of the 34 identified leftover spaces.

Ranking should therefore be treated as an analytical result rather than a final decision rule. It makes site differences visible and comparable; however, the transition from evaluation to intervention still requires further interpretation. Once the results are read through system-level leverage and dominant problem structure, they can be translated into point-, line-, or plane-based interventions. Figure 3 presents the composite priority scores of the 34 identified sites. These scores were generated through weighted aggregation of the 12 indicators after site-level scoring, reverse coding, and entropy-based weighting and were used to distinguish first-, second-, and third-priority groups.

To make this distinction more explicit, Table 4 presents a selected comparison between composite ranking and system-level screening. The table shows that high-priority sites do not automatically become the first system-level intervention targets, whereas some lower-ranked sites may still be retained because of stronger broader leverage.

Table 4. Comparison between composite ranking and system-level screening

Site ID	Priority result	System-level leverage	Dominant problem	Screening interpretation
C1	0.9184 (Rank 1)	Low	Structurally constrained / ambiguous function	A high score, but mainly local in influence, was retained as a representative point-oriented case rather than the first system-level starting point.
C3	0.7569 (Rank 2)	High	Circulation interruption	Selected as a first-round key candidate because improvement at the site is likely to influence broader circulation continuity and interface coordination
E1	0.6269 (Rank 14)	High	Circulation interruption	Retained despite a lower rank because the site occupies a critical circulation position and shows stronger systemic leverage
C6	0.5241 (Rank 23)	Low	Function mismatch / weak use definition	Deferred as a later-stage candidate because of its relatively limited priority result and system-level influence.

4. Discussion

4.1. Point–Line–Plane Renewal Logic for Leftover Spaces

It should clearly explain the main conclusions of the work highlighting its importance and relevance. This is where you describe the meaning of your results, especially in the context of what was already known about the subject. You can present general and specific conclusions, but take care not to summarize your article – that’s what the abstract is for. Building on the preceding evaluation and problem analysis, this chapter translates the results into a more explicit intervention logic. The aim is not to classify leftover spaces by geometric form alone, but to relate dominant problem structures to an appropriate scale of action. In aging primary school campuses, underperforming spaces do not require the same response simply because they are all marginal or underused. Some need precise local activation, some require repair of spatial relations, and others demand broader environmental improvement before meaningful use can be supported. This is especially important in school settings, where public spaces, non-classroom learning, and everyday activities depend on how scale, interface, access, and environmental support are organized rather than on the availability of open areas alone [3,17,18].

Within this framework, points, lines, and planes represent three distinct intervention scales. Point-based interventions address concentrated local deficits through targeted insertion. Line-based interventions respond to relation-based problems, especially when movement, transition, or interface continuity is weakened. Plane-based interventions are required when environmental weakness or limited carrying capacity affects a broader area. These three categories are not intended to rigidly divide every site. What matters is the dominant intervention orientation implied by the principal mode of underperformance, which is important. In this sense, the framework is less a formal classification than a way of connecting site failure, behavioral support, and design scale [16-22].

4.2. Point-Based Intervention: Node Activation through Functional Insertion

Point-based intervention is most suitable where underperformance is concentrated at a specific node and can be addressed through limited but precise actions. Typical examples include building corners, residual pockets beside entrances, compact interstitial spaces, and short-stay waiting edges. On primary school campuses, these spaces often lie close to classrooms, corridors, stair landings, or other shared public zones, yet still fail to support stable occupation. Their weakness usually lies less in complete inaccessibility than in the absence of recognizable occupation cues, a readable edge condition, or minimum support for brief use. In urban primary school public spaces, scale, interface, and edge organization already play a decisive role in whether a place can support pauses, exchanges, or lightweight shared uses [17].

The aim is not simply to add a function but to turn a vague leftover node into a small yet usable place within everyday campus life. Boundary articulation is therefore the first step. A space that is visually unresolved rarely becomes usable on its own, especially for children, whose spatial experience depends strongly on whether places can be sensed, approached, and informally appropriated [16]. Low planting edges, seat-height retaining borders, corner platforms, pavement insets, or changes in ground texture can define a usable zone without fully enclosing it; where visual definition is weak, low screens, rail-backed benches, display panels, or openwork partitions can help establish a clearer front and back [21].

Point-based interventions also depend on improving local comfort so that short-term stays become possible. In practice, this may involve adding shade where exposure is excessive, opening sightlines where corners feel compressed, introducing safer paving where ground conditions discourage occupation, and removing drainage residues, clutter, or equipment intrusion. Even minor adjustments, such as corner rounding, edge trimming, or relocating obstructive elements, may noticeably change how users stop, move, or remain on underused sites, which is consistent with the observation that small-scale design interventions can reshape everyday behavior patterns [7].

Short-stay support should therefore be made explicit. Rather than relying on abstract multifunctionality, the space needs concrete cues for brief occupation: a sit-able edge, a leaning surface, a small waiting platform, a reading ledge, a bag-rest surface, or a pause point linked to adjacent classrooms or shared activity zones. This is also in line with more recent school-space thinking, where non-classroom settings are expected to support temporary, student-led, and loosely structured forms of use rather than functioning only as circulation residue [18]. For this reason, point-based interventions are especially effective where the dominant problem is an ambiguous function. Such spaces usually do not require major reconstruction; they need a clearer spatial identity and a more direct connection between local form and everyday school behavior.

4.3. Line-Based Intervention: Circulation Repair and Interface Reorganization

A line-based intervention becomes necessary when the primary problem lies not in one isolated node but in disrupted relations across a spatial sequence. In aging primary school campuses, many leftover spaces emerge along routes, narrow transitions, passage edges, and building interfaces, where circulation has become compressed or poorly coordinated with adjacent uses. In such situations, improving a single point is rarely sufficient because the weakness lies in how movement, pauses,

and boundary conditions interact across the sequence. The first task was to restore movement continuity. This involves identifying locations where routes narrow, turning behavior becomes uncertain, through-movement overlaps with waiting, and circulation loses legibility at transition points. Practical design responses may include widening the effective passage width by removing edge encroachments, straightening fragmented movement lines, softening sharp turns through corner rounding or curved paving guidance, and separating through-movement from short-stay activities through subtle offsets rather than rigid barriers. In school environments, circulation cannot be reduced to passage efficiency alone because movement, stopping, observation, and interaction often occur within the same corridor or threshold zone [16]. Therefore, route-side leftover spaces can become disproportionately influential in everyday campus operations.

The second task is to clarify route hierarchy and directional reading. Many circulation-related leftover spaces become problematic because the primary and secondary movement paths are not clearly distinguished. A more legible route can be formed through continuous paving bands, ground-embedded directional markings, repeated edge elements, rhythmically spaced lighting or planting, and stronger visual links between origins and destinations. At the campus scale, route organization should be carried by the spatial language of the path itself rather than by signage alone. This corresponds closely to the way school public spaces have been discussed in design research, where circulation, interface, and spatial scale are treated as part of shared use rather than as merely technical passage conditions [17].

The third task is to reorganize the interface between movement and adjacent use. In many leftover zones, circulation conflicts intensify because path edges remain undefined, allowing waiting, display, storage, play, and passage to compete for the same strip of space. Interface reorganization may therefore involve setting back temporary objects, integrating waiting niches into recesses rather than into the circulation path, converting irregular edge fragments into continuous seating or planting strips, and using low-height edge elements to distinguish occupiable and pass-through zones. Where buildings meet routes abruptly, buffer strips, threshold platforms, or shallow transitional bands can help reduce friction between indoor-outdoor movement and corridor flow. These adjustments are particularly meaningful in school settings, where corridor edges, gray space, and courtyard thresholds often determine whether a place remains merely a passageway or begins to support pauses, exchanges, and observations [17,21]. Thus, line-based intervention is not simply about making movement faster. Its purpose is to repair the relationship among routes, edges, transitions, and uses. For this reason, it is especially suitable when the dominant problem is circulation interruption or interface discontinuity, rather than localized functional vacancy alone.

4.4. Plane-Based Intervention: Environmental Improvement and Spatial Reorganization

Plane-based interventions are necessary when underperformance stems from broader environmental shortcomings or insufficient spatial carrying capacity across an area. In some aging primary school campuses, leftover spaces remain underused not because they lack a specific function or route connection but because the wider spatial field fails to support stable occupation. Poor visibility, low comfort, fragmented surfaces, unsafe boundaries, and general environmental disorder can diminish the possibility of sustained everyday use.

The first priority is to restore the environmental baseline. This usually requires more than simply adding isolated elements. Where visibility is poor, visual obstacles should be reduced, blind corners opened, and the relationship between the area and surrounding classrooms, corridors, or activity grounds made more transparent. Where comfort is lacking, design interventions may need to address shading, drainage, wind exposure, excessive heat reflection, or glare from hard surfaces. Where safety is compromised, unstable edges, abrupt level changes, slippery paving, exposed roots, neglected corners, and conflict-prone boundary conditions should be systematically addressed rather than cosmetically concealed. In stock-campus environments, these are not merely technical repairs because outdoor settings are part of the long-term educational landscape through which learning, play, social interaction, and repeated everyday use take place [3].

The second task is to improve surface continuity and usability across the entire area. Many larger leftover zones fail not because of a single dramatic defect, but because their ground conditions are broken, their boundaries are unresolved, and their internal organization is too loose to support occupation. Practical responses may include leveling uneven surfaces, replacing incompatible paving patches with a more coherent ground treatment, integrating planting and open areas into a readable layout, and reducing abrupt leftover fragments that interrupt movement or occupation. On larger sites, it may also be necessary to reorganize the field into recognizable subzones, such as open activity patches, edge waiting belts, shaded pause corners, or low-intensity interaction areas. This wider reorganization also fits more recent school-space thinking, in which open and non-classroom areas are expected to support layered, flexible, and student-centered use rather than functioning only as residual circulation or visual buffers [18].

The third task is to establish a more supportive relationship between the open area and its surrounding boundaries. Plane-based intervention should not treat the site as an empty surface to be embellished; rather, it should shape how the space is observed, entered, traversed, occupied, and maintained. This may involve enhancing visual supervision from adjacent buildings, creating clearer edge transitions, introducing layered planting without obstructing sightlines, and positioning seating, low walls, or activity-support elements in ways that stabilize use rather than disperse it. This becomes especially relevant in school settings because environmental support affects not only whether a place looks improved, but also whether it can sustain learning, play, pausing, and low-intensity occupations over time [3]. Therefore, plane-based interventions are particularly appropriate when the dominant problem is a negative environmental experience. In such cases, the primary obstacle is not the absence of a specific function, but the weakness of the environment itself. Without improving this foundational condition, smaller insertions are unlikely to yield long-lasting effects.

4.5. Matching Problem Structure to Intervention Scale

The value of point–line–plane logic, which is uniquely integrated with urban acupuncture principles, lies in its capacity to systematically match the intervention scale to the dominant mode of underperformance, providing a more nuanced approach than traditional form-based classifications. This framework extends beyond generic spatial analysis by explicitly linking site-specific diagnostic evaluation with strategic intervention scales (point, line, plane) and system-level leverage, a synthesis not commonly found in existing urban design methodologies for school campus renewal. In practice, leftover spaces rarely present a single problem. Functional ambiguity,

circulation conflict, and environmental weakness often overlap. Therefore, the key task is to identify which problem most directly limits use and which scale of intervention is needed to address it. When a site is mainly constrained by the lack of recognizable use and basic support at a local node, point-based intervention is generally more suitable. When the main issue lies in a broken connection, unclear transition, or conflict between movement and adjacent occupation, line-based intervention becomes more appropriate. When broader environmental weakness prevents stable use across an area, plane-based intervention is required. This also helps explain the overlap between problems. A site may contain more than one weakness; however, the initial scale of action should be determined by the most restrictive condition and the intervention most likely to create the basis for further improvement.

Therefore, point, line, and plane should be understood as primary intervention orientations rather than fixed design labels. Their significance lies in identifying where the intervention should concentrate first, at what scale the dominant problem should be addressed, and how later design steps may unfold in sequence. This is particularly relevant in school environments, where the same leftover space may simultaneously affect circulation, brief learning-related use, and informal occupation; yet, one of these constraints usually remains more decisive than the others. Figure 4 shows the relationship between the dominant problem structure and intervention scale.

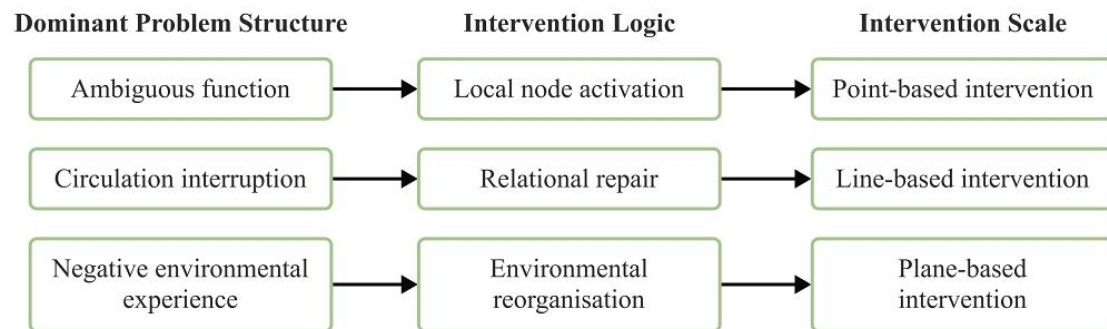


Figure 4. Relationship between dominant problem structure and intervention scale.

4.6. Typical Renewal Scenarios in Aging Primary School Campuses

The practical value of the point–line–plane framework depends on how it responds to recurring spatial situations in aging primary school campuses. Leftover spaces do not appear randomly. They are embedded in recognizable settings shaped by the daily organization of learning, circulation, and informal activities. These contexts influence not only how underperformance emerges but also which mode of intervention is more likely to be effective. In school environments, public spaces are closely tied to route structure, classroom adjacency, pause behavior, and non-classroom learning; therefore, the same marginal space may perform very differently depending on its location within everyday use [3,17,18]. For this reason, three typical renewal scenarios are discussed: learning-adjacent leftover spaces, circulation and transition leftover spaces, and informal activity leftover spaces. To keep the discussion from remaining purely conceptual, one representative site is used in each scenario to show more concretely how the priority result, dominant problem structure, and intervention orientation are translated into design action.

4.7. Learning-Adjacent Leftover Spaces

Learning-adjacent leftover spaces are located along the margins, backsides, corners, or side interfaces of teaching buildings and their nearby support areas. In aging primary school campuses, they often appear where buildings have been incrementally extended, narrow residual strips remain between built edges and boundaries, or small open pockets are left near entrances, stairs, or service interfaces. Although these spaces are close to the core learning environment, many remain weakly integrated into everyday use. Their location gives them potential relevance; however, their actual role is often uncertain.

This uncertainty is closely related to the traditional organization of school spaces. When classroom areas are treated too rigidly and circulation is separated from shared use, the spaces beside teaching buildings often become passive buffers rather than active extensions of everyday learning. However, contemporary school space research has increasingly moved beyond the assumption that learning is confined to the classroom. Short pauses, temporary discussions, waiting, observation, and loose forms of student-led occupation all rely on non-classroom settings that are accessible, open, and behaviorally supportive [17,18]. From this perspective, many learning-adjacent leftover spaces do not fail because they are too small to use, but because they are too weakly defined to support meaningful use.

Under these conditions, point-based intervention is often the most suitable response, especially in sites that already have basic accessibility and acceptable environmental conditions. The main task is to activate the node through local functional clarification and limited spatial support. Rather than introducing large or highly programmed installations, intervention should work through modest insertions that give the space a clearer role in everyday learning-related use, such as short pauses, informal waiting, or light behavioral extensions from adjacent classroom areas. C1 illustrates this condition well. Its dominant problem is not broad environmental failure or route-level disruption, but a weak definition of a small usable node close to the learning environment. Although the site scored highly in the composite evaluation, its influence remained mainly local. This makes it suitable as a representative case of point-based activation rather than the first system-level intervention target.

For a site such as C1, the design should begin by making the occupation legible. A low planting edge, seat-height border, or small pavement inset can define a micro-zone without interrupting adjacent circulation. Once the node becomes readable, brief occupation can be supported more directly through a sit-able edge, a leaning surface, or a small waiting platform. Local comfort should then be improved by opening sightlines, trimming obstructive corners, and replacing harsh or slippery paving with a safer ground treatment. What matters here is not heavy programming, but giving the site a stable everyday role. In school environments, even a modest spatial cue can change whether a child merely passes through, pauses briefly, or begins to appropriate the place for waiting, exchange, or light learning-related activity [16,22]. In some cases, learning-adjacent leftover spaces also affect the circulation around buildings. When this problem extends beyond the local vacancy to include weakened transitions or unclear interface conditions, line-based reasoning may also become relevant. However, node activation remains the dominant logic in many such situations because these spaces are often adjacent to important campus functions without being meaningfully absorbed into them.

4.8. Circulation and Transition Leftover Spaces

Leftover spaces resulting from circulation and transition include residual areas along paths, at route intersections, near directional changes, and within narrow connecting strips or transitional interfaces. They are especially common in aging primary school campuses, where circulation systems have often been repeatedly adjusted while surrounding built and open structures remain constrained. Consequently, leftover spaces along campus routes frequently have greater operational significance than their size alone would suggest. They influence children's movement, pauses, avoidance of conflict, and navigation between different campus zones.

The main weakness in such spaces is usually an interruption of circulation or weakened spatial relations. Routes may unexpectedly narrow, change direction abruptly, compete with short-term occupations, or lose continuity at critical transitions. In other cases, the path may still function, but the surrounding interface remains weakly articulated, resulting in ambiguous boundaries and reduced passage quality. This is important in school environments because movement rarely occurs in isolation; walking, waiting, observing, and brief exchanges are often superimposed in the same corridor, edge, or threshold condition [16,17]. Once these relationships become disordered, the space may still be passable, but it will not work well. C3 is the clearest representative case of this scenario. Its importance lies less in the node itself than in the sequence it affects. The site was retained as a first-round candidate because its dominant problem is circulation interruption and because improvement here is likely to enhance broader continuity and interface coordination. Therefore, what makes C3 significant is not its local deficiency alone, but the fact that it occupies a position where movement structure and edge organization have wider consequences.

For a site such as C3, the design response should begin with sequence repair. The passage width must be stabilized by clearing or setting back edge encroachments so that movement is no longer compressed at key points. Directional uncertainty should then be reduced through continuous paving bands, clearer turning treatment, or visual guidance that strengthens the connection between the origin and destination. Where waiting overlaps with through movement, shallow recesses or low edge offsets should be used to pull short-stay activity out of the main route rather than forcing both behaviors into the same strip. If the interface between the building and path is abrupt, threshold platforms, buffer bands, or continuous seating-and-planting edges can help reorganize the transition between the passage and adjacent use. In this type of space, design works less through object insertion than through the repair of route logic, interface hierarchy, and the sequence of everyday movement [17,21]. Some circulation and transition leftover spaces also contain highly concentrated local conflicts, especially at corners where route changes and waiting overlap. In such cases, point-based actions may work together with line-based reasoning. However, the dominant logic remains linear because the performance of these spaces depends primarily on connections rather than on independent spatial identities.

4.9. Informal Activity Leftover Spaces

Informal activity leftover spaces include residual areas near playground edges, courtyard margins, waiting zones, wall-side open fragments, and underused corners where children may gather, observe, pause, or engage in informal activities. Compared with learning-adjacent and circulation-related spaces, these sites are more directly linked to the non-classroom dimensions of campus life. They often accommodate fragmented behaviors that formal planning tends to overlook, such as

brief conversations, waiting, watching peers, quiet pauses, flexible play, or loose occupations during transitions between scheduled activities.

In many of these spaces, the dominant problem is negative environmental experience, although ambiguous functions may also be present. Some sites have clear locational relevance and behavioral potential but remain underused because their environmental base is weak. Poor visibility, low comfort, fragmented surfaces, unsafe boundaries, insufficient support, and general spatial neglect may all reduce the likelihood that children will stay or use the space meaningfully. In school environments, this matters because non-classroom activity does not depend only on formal programs. It also depends on whether the environment can sustain low-intensity, repeated, and informal occupations over time [22].

E4 can be considered a representative case of this scenario. Its main limitation lies not in local functional vacancy alone, but in broader environmental weakness. This makes it a useful example of a site where intervention must first improve the environmental field before more specific patterns of occupation can be stabilized. In other words, the key issue is not simply what activity should be inserted, but whether the site can first become legible, safe, comfortable, and supportable enough for any stable informal use to occur. For a site like E4, the first design priority is to restore the environmental baseline of the entire area rather than to insert a single object. Fragmented paving should be leveled and replaced with a more continuous and safer ground treatment, especially where surface conditions currently discourage staying. Visibility should then be improved by opening blind corners, reducing cluttered edge conditions, and strengthening visual connections to adjacent buildings or activity grounds. Broader comfort and safety conditions—such as shading, drainage correction, and edge stabilization—also need to be repaired before more specific uses can be anchored. Once this field condition is improved, the area can be reorganized into clearer subzones, such as a shaded pause corner, an open observation strip, or an edge waiting belt. In stock-campus environments, this kind of environmental reorganization is often more meaningful than immediate functional insertion, because the outdoor setting itself must first become capable of supporting long-term educational and everyday use [3,18].

In some cases, once broader environmental conditions have been improved, informal activity leftover spaces may later shift toward point-based logic. This layered possibility matters because it shows that points, lines, and planes are not rigid design labels but dominant intervention orientations that may also operate sequentially. Figure 5 presents selected representative sites drawn from the 34-site evaluation matrix. Each case is identified by school affiliation, campus position, dominant problem structure, and intervention orientation, making the process of strategy translation more concrete.

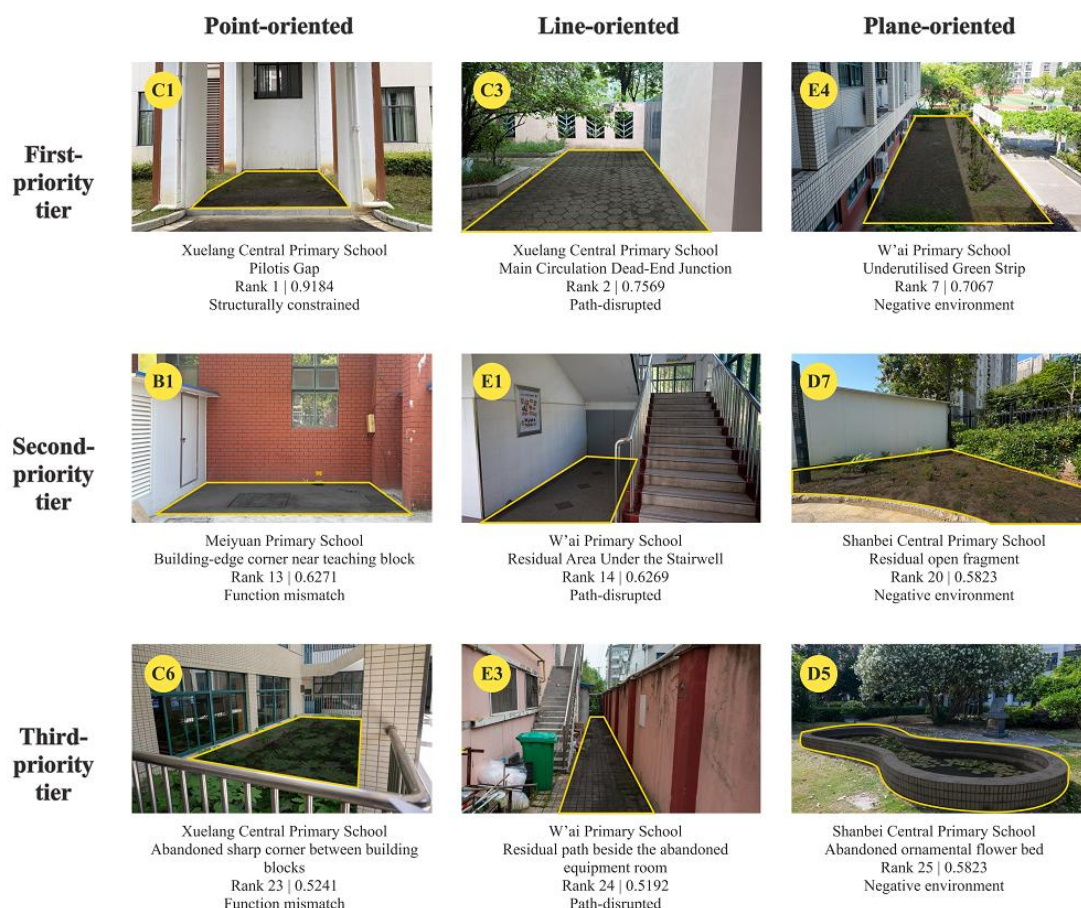


Figure 5. Representative leftover-space across priority tiers and intervention orientations.

5. Urban Acupuncture as a Design Decision Logic for School Renewal

The preceding analysis shows that leftover spaces in aging primary school campuses cannot be treated simply as minor residual fragments in need of generic improvement. Once compared and interpreted in relation to their position, condition, and mode of underperformance, they emerge as meaningful spatial units that call for different intervention priorities and scales. The contribution of this research lies not only in identifying problematic sites but also in clarifying how site evaluations can be translated into differentiated renewal logics from the perspective of urban acupuncture. One of the main implications of this study is that urban acupuncture can be understood as a design decision logic rather than merely a rhetorical reference to small-scale intervention. In aging primary school campuses, renewal usually proceeds under spatial constraints, continuous daily use, and limited tolerance for disruption. What matters under these conditions is not only how space should be improved but also how to determine where intervention should begin, what problem should be addressed first, and how limited action may produce effects beyond the immediate site.

In this way, urban acupuncture is valuable because it supports selectivity, precision, and staged responses [7]. Not every leftover space requires the same urgency, and not every site should be approached at the same scale. In primary school environments, even a small leftover space may influence circulation, waiting, informal interaction, or conflict avoidance. Renewal is therefore less a matter of generic beautification than of identifying where limited action can produce meaningful spatial leverage.

5.1. Beyond Morphology: Point–Line–Plane as a Relational Framework

A second implication concerns the meaning of the point–line–plane framework itself. Although points, lines, and planes may appear to describe simple geometric differences, the analysis suggests otherwise. Their value lies not in form alone, but in linking the dominant problem structure with the intervention scale.

Point-based intervention is appropriate where underperformance is concentrated at a node. Line-based intervention addresses broken connections, weak transitions, or discontinuous interface relations. Plane-based intervention responds to broader environmental weaknesses or limited carrying capacity across an area. This interpretation explains why leftover-space renewal cannot rely on standardized design formulas: sites of similar size may require different interventions, while visually different spaces may still call for a similar response if their dominant problems are alike. The point–line–plane framework is useful because it provides a strategic bridge between evaluation and design action.

5.2. Implications, Limitations, and Future Directions

Several practical implications follow from the analysis. First, leftover spaces should be brought into the scope of campus renewal as meaningful sites of system adjustment rather than being treated as secondary fragments. Second, renewal decisions benefit from an explicit comparative basis, especially where resources are limited and intervention must be prioritized. Third, evaluation should not stop at identifying important sites; it should also help clarify the intervention scale that is most appropriate for each condition. At the same time, this research has clear limitations. The empirical basis was drawn from five aging primary schools in Wuxi, and the 34 identified sites reflect the spatial, institutional, and managerial conditions of this specific context. Therefore, the results should not be treated as universally representative of all school campuses. Leftover-space conditions are likely to vary with climate, campus size, management practices, educational models, and historical development paths.

In addition, although the research proposed a framework linking evaluation with intervention logic, it did not include a post-implementation validation. The point–line–plane framework is grounded in comparative diagnosis and strategic reasoning; however, its longer-term effectiveness still needs to be tested through practice. Therefore, future research could move in three directions. First, while the specific findings are context-dependent, the framework itself offers a transferable methodology. Future research could investigate how four-dimensional evaluation indicators and criteria for assessing system-level leverage might be adapted or weighted differently to reflect varying climate conditions, educational philosophies, and community engagement models in other regional or national contexts. Second, the framework can be strengthened through more explicit quantitative evidence, such as pre- and post-renewal comparisons of use frequency, dwell time, route conflicts, user satisfaction, and environmental conditions, including visibility, thermal comfort, and surface safety. Third, longitudinal follow-up could be introduced to examine whether point-, line-, and plane-based interventions produce different short- and long-term effects and whether they operate more effectively as isolated actions or as sequential strategies over time.

6. Conclusions

From the perspective of urban acupuncture, leftover spaces in aging primary school campuses should be understood not as incidental residual fragments, but as underperforming parts of the campus system. Their renewal therefore depends on linking comparative site evaluation with post-ranking interpretation and intervention scale. Based on the analysis of 34 sites in five aging primary schools in Wuxi, this study develops a point–line–plane framework that connects site condition, dominant problem structure, and design response. Its main contribution lies in showing how selective, precise, and staged intervention can provide a more targeted basis for deciding where action should begin and how renewal should proceed in aging primary school campuses.

Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this article.

Funding

This research received no specific grant from any funding agency in the public, commercial or not-for-profit sectors.

References

- [1] Wang, Y.Y. Research on the design of primary school campus space to adapt to the growth of students. Master's Thesis, Nanjing Tech University, 2016.
- [2] Zhou, N. A study on primary school campus planning and children's behavioral development. *Architectural Journal*, 1998, 08, 53-57, 79-80.
- [3] He, S.Y.; Peng, Y.M.; Zhang, X.Q. et al. Design and Analysis of Environmental Education Landscape for Completed Urban Primary and Secondary School Campuses. *Zhuangshi*, 2022, 07, 35-43.
- [4] Wu, Z.P. The Acupuncture for Urban Fabric: Maximum Effect through Minimum Intervention. *New Architecture*, 2015, 03, 4-8.
- [5] Wu, L.Y. From “organic renewal” toward a new “organic order”: Approaches to the rehabilitation of residential districts in the old city of Beijing (II). *Architectural Journal*, 1991, 02, 7-13.
- [6] Gai, D.M. On the application of “urban acupuncture” in the redevelopment of urban villages: A case study of Dong'an Community in Xiamen. *Anhui Architecture*, 2016, 23(05), 82-85.
- [7] Wang, J.J.; Chen, Z.R.; Zhou, X.T. et al. A Study on Revitalization Modes of Public House Based on the Method of “Urban Acupuncture”: A Case Study of Guangzhou City. *Tropical Geography*, 2024, 44(07), 1249-1262.
- [8] Houghton, K.; Foth, M.; Miller, E. Urban Acupuncture: Hybrid Social and Technological Practices for Hyperlocal Placemaking. *Journal of Urban Technology*, 2015, 22(3), 3-19. DOI: <https://doi.org/10.1080/10630732.2015.1040290>.

- [9] Naghibi, M.; Faizi, M.; Ekhlassi, A. The role of user preferences in urban acupuncture: reimagining leftover spaces in Tehran, Iran. *Urbani Izziv*. 2020. DOI: <https://doi.org/10.5379/urbani-izziv-en-2020-31-02-005>.
- [10] Trancik, R. *Finding Lost Space: Theories of Urban Design*. New York, Routledge. 1986.
- [11] Chu, C.C. Exploration of leftover-space renewal strategies in old residential areas from the perspective of micro-renewal: A case study of Foshanyuan Community in Jinan. *Urban Architecture Space*, 2021, 28(06), 134-135.
- [12] Peng, R; Feng, T.J.; Pan, Y. Planning and Design of Fragmented Space of Yangjiawan area, Wuhan. *Planners*, 2019, 35(19), 39-44+53.
- [13] Wu, H.Z.; Zhang, H.J.; Wang, Y.S. Study on the Optimization Strategy of Distorted Spaces in Old Community: Case Study of Baihe Community in Ningbo. *Architecture & Culture*, 2023, 07, 157-160.
- [14] Gu, J. Research on Leftover Space Renewal Strategy in Old Residential Areas of Changzhou Under the Background of “Ecological Restoration and Urban Renovation”. *Jiangxi Building Materials*, 2022, 10, 372-374.
- [15] Farahani, L.M.; Maller, C. Investigating the benefits of ‘leftover’ places: Residents’ use and perceptions of an informal greenspace in Melbourne. *Urban Forestry & Urban Greening*, 2019, 41, 292-302. DOI: <https://doi.org/10.1016/j.ufug.2019.04.017>.
- [16] Xu, C.H. Sensation, Perception, Concealment, Action, Detection—— Studying on Children’s Behavioral Space. *New Architecture*, 2003, 02, 61-64.
- [17] Zhao, J. Research on public space design in modern urban primary schools. Master’s Thesis, Dalian University of Technology, 2014.
- [18] Ruan, H.; Guo, Y.L. Research on the Design of Complex Informal Learning Space in Elementary and Middle School Under the Trend of Diversified Curriculum. *New Architecture*, 2022, 03, 92-96.
- [19] Unt, A.L.; Bell, S. The impact of small-scale design interventions on the behaviour patterns of the users of an urban wasteland. *Urban Forestry & Urban Greening*, 2014, 13(1), 121-135. DOI: <https://doi.org/10.1016/j.ufug.2013.10.008>.
- [20] Naghibi, M.; Faizi, M.; Ekhlassi, A. Design possibilities of leftover spaces as a pocket park in relation to planting enclosure. *Urban Forestry & Urban Greening*. 2021. DOI: <https://doi.org/10.1016/j.ufug.2021.127273>.
- [21] Ashihara, Y. *Exterior design in architecture*. Van Nostrand Reinhold. 1981.
- [22] Gehl, J. *Life between buildings*. Van Nostrand Reinhold. 2003.



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