

A Child-Informed Affordance Framework for Malaysia's Social Housing Neighbourhoods: Insights from Marginalised Children

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Abstract

The neighbourhood environment plays a vital role in supporting children's well-being and holistic development. However, in urban settings where planning tends to be adult-centric, access to safe and inclusive neighbourhoods remains unequal. Children living in poverty are particularly vulnerable, as they depend heavily on their immediate surroundings to meet developmental needs. In Malaysia, those residing in Program Perumahan Rakyat (PPR), a low-cost housing initiative, face compounded challenges, including spatial constraints and limited access to safe, child-friendly spaces. Their lived experiences are often overlooked, and their rights to participation and development, as outlined in the UN Convention on the Rights of the Child (UNCRC), remain unfulfilled. This study investigates the neighbourhood experiences of children aged 7 to 12 living in three PPR communities in Kuala Lumpur, using a multi-method qualitative approach, including child-led walks and mental mapping. This study identified six key dimensions of children's perceptions, including Safety, Nature, Spatial Choices, Comfort, Accessibility, and Sensory Amenities. These themes reflect children's barriers and aspirations for more supportive neighbourhoods. The findings provide a child-informed affordance framework for urban planners, housing authorities, and policymakers to better design inclusive environments that prioritise the needs and rights of marginalised children.

1.0 INTRODUCTION

Children's everyday environments play a fundamental role in shaping their activities, health, and well-being. Neighbourhoods are particularly important because they support physical, cognitive, social, and emotional development through opportunities for exploration, play, social interaction, and increasing independence (Hornberg & Pauli, 2007; Bessell, 2019; Egli et al., 2019; Chan & Li, 2022). As one of the earliest public environments encountered beyond the home, the neighbourhood allows children to engage with the social, cultural, and physical world, develop environmental awareness, build relationships, and establish a sense of belonging (Loebach & Gilliland, 2019).

However, access to safe, inclusive, and stimulating neighbourhood environments remains unevenly distributed (UN-Habitat et al., 2022). Opportunities for unstructured outdoor play and independent mobility have declined as children's activities become increasingly regulated, supervised, and displaced by sedentary indoor entertainment (Egli et al., 2019; Cano-Hila, 2020). Parental concerns regarding traffic, crime, and other perceived risks further restrict children's use of public space (Luo, 2022). These conditions reduce opportunities for children to explore their surroundings, interact with peers, and develop meaningful relationships with their neighbourhoods.

Such challenges are particularly evident in Malaysia's *Program Perumahan Rakyat* (PPR), a federal social housing programme established to provide affordable urban housing for former squatter communities and households within the B40 income group, representing the lowest 40% of household earners (Khazanah Research Institute, 2023). Although PPR developments address an urgent housing need, their planning has often prioritised residential capacity, density, and functional efficiency over communal, recreational, and child-responsive environments. Consequently, many PPR neighbourhoods provide limited or inadequately maintained play areas, green spaces, pedestrian routes, and informal social settings that support children's everyday activities (ThinkCity, 2022; Kusumo Dewi et al., 2020).

The practical problem is therefore not simply the limited provision of neighbourhood facilities, but the extent to which existing environments enable children to access, use, and experience them safely and meaningfully. A playground, pathway, courtyard, or green area may be physically present yet remain unusable because of vehicle intrusion, poor maintenance, restricted access, thermal discomfort, or competing adult activities. Children are especially affected because their daily mobility is generally concentrated within the immediate residential environment, unlike adults who may access a wider range of urban destinations. Deficiencies in local safety, accessibility, comfort, and social inclusiveness may therefore constrain children's play, mobility, participation, and emotional security (Institute for Health Behavioural Research, 2023; Ning et al., 2026).

Existing Malaysian PPR studies and policy reports have predominantly addressed housing provision, density, facility adequacy, maintenance, and broader community conditions (Mohit et al., 2009; Goh & Yahaya, 2011; Khazanah Research Institute, 2023). While this work establishes the environmental disadvantages associated with social housing, children's own accounts of how neighbourhood spaces are perceived, negotiated, and used remain insufficiently incorporated into planning and design frameworks. PPR environments consequently continue to be evaluated largely through adult-defined standards, despite children possessing detailed knowledge of the opportunities and constraints encountered in their everyday surroundings.

This omission also represents a theoretical gap. Affordance theory explains environmental quality through the relationship between spatial attributes and the possibilities for action perceived and actualised by users (Gibson, 1979; Heft, 1989). However, its application to Malaysian social housing has rarely been developed through children's situated experiences. Generic child-friendly planning principles and facility-based standards may identify what should be provided, but they do not adequately explain whether children can independently reach, use, adapt, and derive meaning from those provisions. A child-informed affordance framework is therefore required to connect physical provision with children's actual experiences of safety, movement, play, comfort, social interaction, and environmental attachment.

This study focuses on children aged 7–12 living in three PPR neighbourhoods in Kuala Lumpur: PPR Gombak Setia, PPR Raya Permai, and PPR Pantai Ria. This age group was selected because children are sufficiently able to communicate spatial experiences through verbal and visual methods while remaining strongly dependent on their immediate neighbourhood for daily play and interaction (Erikson & Meyer, 1961; Piaget, 1964). The three sites provide contextually comparable cases of low-cost social housing while allowing shared patterns and site-specific variations to be examined. In this study, the term marginalised children refers to children whose opportunities are structurally constrained by low-cost housing conditions, limited spatial resources, and restricted participation in decisions affecting their everyday environments; it does not imply that marginalisation is an inherent characteristic of the children themselves.

Accordingly, this study aims to develop a child-informed affordance framework for PPR neighbourhoods based on the lived spatial experiences of children aged 7–12 in Kuala Lumpur. The study pursues three objectives:

- i. To examine how children perceive neighbourhood spaces within PPR environments.
- ii. To identify the environmental affordances and constraints revealed through child-led walks and mental mapping.
- iii. To develop a conceptually relevant and practically applicable child-informed affordance framework.

The study contributes to knowledge by foregrounding an underrepresented group of children as knowledgeable users of low-cost social housing environments. Its originality lies in integrating situated verbal accounts from child-led walks with visual and spatial evidence from mental mapping, interpreting the combined findings through an affordance perspective, and translating them into an expert-informed planning framework. This evidence-to-framework approach provides planners, designers, housing authorities, and policymakers with a context-sensitive basis for assessing and improving neighbourhood environments with children, rather than relying solely on adult-defined facility standards.

2.0 LITERATURE REVIEW

2.1 Children in Low-Cost Social Housing

Social housing is intended to provide adequate and affordable accommodation for households with limited financial resources. In Malaysia, the *Program Perumahan Rakyat* (PPR) constitutes a major form of social housing for urban low-income households, particularly those within the B40 income group, representing the lowest 40% of household earners (Khazanah Research Institute, 2023). Government housing initiatives have increased access to basic shelter; however, the planning of many low-cost developments continues to prioritise housing quantity, land efficiency, and construction costs over the qualitative conditions of everyday neighbourhood life (Ministry of Local Government Development, 2019; Dewan Bandaraya Kuala Lumpur, 2023; Ministry of Economy, 2025).

These priorities have particular implications for children. In compact housing environments, limited internal living space increases children's dependence on shared outdoor and semi-public settings, including playgrounds, streets, corridors, courtyards, and residual open spaces (Castonguay & Jutras, 2010; Hanapi & Sh Ahmad, 2017). Unlike children from more affluent households, PPR residents may have limited access to private gardens, paid recreational programmes, or purpose-built indoor play facilities. Neighbourhood spaces therefore become essential settings for recreation, peer interaction, exploration, and informal learning.

Nevertheless, low-cost neighbourhoods are frequently characterised by overcrowding, limited open space, deteriorated recreational facilities, traffic exposure, and poorly defined communal areas (Goh & Yahaya, 2011; Kim & Lim, 2020; Bessell, 2019). Rapid urbanisation has further encouraged the construction of high-rise residential blocks on constrained sites, often leaving residual spaces with limited functional, social, or environmental value (Cano-Hila, 2020; Ning et al., 2025b). Consequently, children may spend considerable

time within their immediate neighbourhoods while having access to fewer safe and developmentally supportive opportunities (Loebach & Gilliland, 2019; Kusumo Dewi et al., 2020).

The issue is therefore not limited to whether communal facilities are formally provided. It also concerns whether these facilities are maintained, accessible, comfortable, socially inclusive, and responsive to children's everyday practices. Examining children's lived experiences is necessary to determine how low-cost social housing functions from the perspective of its younger residents rather than relying solely on adult-defined standards of provision.

2.2 Neighbourhood Environments and Child Development

Neighbourhood environments influence children's physical, cognitive, emotional, and social development. Through everyday exploration, children acquire spatial awareness, environmental competence, confidence, autonomy, and a sense of identity (Moore & Young, 1978; Villanueva et al., 2016). Neighbourhoods are therefore not merely residential settings but developmental landscapes in which children interpret environmental cues, negotiate risks, form relationships, and develop attachments to place.

The quality of these experiences is shaped by neighbourhood-level conditions, including walkability, traffic, perceived safety, access to amenities, public-space quality, and the configuration of the built environment (Chetty et al., 2016; Chan & Li, 2022). Accessible and supportive environments can encourage physical activity, peer interaction, informal learning, and gradually increasing independence. These opportunities are consistent with children's rights to development, play, participation, and an adequate living environment under the United Nations Convention on the Rights of the Child (United Nations, 1989).

Unstructured outdoor play further contributes to physical fitness, motor development, problem-solving, creativity, and emotional resilience (Högskolan & Kytä, 2003). Shared neighbourhood spaces also enable children to establish friendships, negotiate conflict, cooperate with others, and participate in community life (Egli et al., 2019). Contact with vegetation, animals, weather, and other natural processes can strengthen sensory awareness, environmental knowledge, and place attachment (Qi et al., 2019). Such opportunities are especially important in disadvantaged communities where neighbourhood spaces may constitute children's principal settings for recreation and social interaction (Castonguay & Jutras, 2010).

Conversely, unsafe traffic, inadequate maintenance, poor sanitation, limited greenery, and restricted access to public space may reduce outdoor activity and independent mobility. These environmental constraints can limit children's opportunities to explore, socialise, and exercise autonomy (Weir, 2023; Ning et al., 2025a). The developmental value of a neighbourhood therefore depends not only on the presence of facilities but on the conditions that enable children to use them meaningfully.

2.3 Children's Participation in Neighbourhood Planning

Research and planning concerning children's environments have historically relied on adults, including parents, academics, professionals, and policymakers, to interpret children's needs. This reliance reflects assumptions that children lack the competence to contribute meaningfully to research and decision-making (McLaughlin & Coleman-Fountain, 2018). Although adult perspectives provide useful contextual information, they may filter children's experiences through adult expectations, risk perceptions, and normative assumptions (Clark & Moss, 2017). Consequently, environments that appear adequate to adults may remain inaccessible, uncomfortable, or socially restrictive from children's perspectives.

Child-centred scholarship challenges this approach by recognising children as knowledgeable social actors and legitimate users of urban space. Their routes, play practices, preferred places, avoidance behaviours, and sensory observations reveal micro-scale opportunities and constraints that may be overlooked in conventional planning assessments (Egli et al., 2019). In high-density neighbourhoods, such knowledge is particularly important because children's use of shared spaces is frequently negotiated against traffic, parking, commercial activities, surveillance, and adult occupation.

Participatory methods can make these experiences more visible. Child-led walks capture immediate, embodied, and location-specific encounters, while mental mapping can reveal remembered routes, emotional

associations, spatial priorities, and desired environmental changes (Clark & Moss, 2017; Egli et al., 2019). Their combination enables children to communicate through both verbal and visual modes, accommodating differences in age, confidence, linguistic ability, and preferred forms of expression. However, participation should extend beyond consultation. Short-term “voice” exercises have limited value when children’s contributions are not translated into planning criteria or institutional decisions.

This limitation is especially significant for children living in low-income communities, whose experiences of environmental risk and spatial inequality remain underrepresented. Effective child-responsive planning requires mechanisms that connect children’s knowledge with design practice, governance, and implementation (Arnstein, 1969; Sanoff, 1988). The continued difficulty of incorporating child-friendly objectives into formal planning systems further demonstrates that participation must be linked to operational tools and decision-making processes.

2.4 Affordance Theory and Actualised Affordances

Affordance theory provides a relational basis for examining how children experience neighbourhood environments. Gibson (1979) conceptualised affordances as possibilities for action that emerge through the relationship between environmental properties and an individual’s capabilities. A feature does not possess a fixed meaning independently of its user; rather, its value depends on what a person perceives and is able to do within a particular setting.

Applied to children’s environments, this perspective shifts attention from the formal provision of facilities to their actual usability. A playground may afford play, a tree may afford shade or climbing, and a pathway may afford movement. However, these opportunities remain potential rather than actualised when children cannot safely reach, perceive, or use them. Högsökan and Kytä (2003) therefore link child-friendliness to the availability of environmental affordances and the freedom children have to actualise them through independent interaction.

This distinction is particularly relevant to PPR neighbourhoods. A playground may be present but rendered unusable by damaged equipment, heat, waste, or vehicle intrusion. A courtyard may provide potential space for social interaction but be occupied by motorcycles or adult activities. Similarly, a pedestrian path may exist formally but fail to afford movement when it is narrow, obstructed, disconnected, or exposed to traffic. Facility-based standards alone cannot capture these relational conditions.

Affordances are also multidimensional (Qi et al., 2019; Guo et al., 2023). Safety determines whether children feel sufficiently secure to enter and remain in a space (Castonguay & Jutras, 2010). Nature provides opportunities for shade, exploration, sensory engagement, and emotional restoration (Chan & Li, 2022). Spatial Choices influence where activities can occur and whether children can appropriate spaces for play and interaction (Guo et al., 2023). Comfort affects the duration and quality of use through shade, ventilation, seating, cleanliness, and aesthetic conditions (Gu et al., 2022). Accessibility concerns the continuity, legibility, and independence of movement between neighbourhood destinations (Ning et al., 2025a). Sensory amenities, including food, drink, smells, and informal rest points, support children’s bodily needs and everyday social routines (Özdemir & Kanbur, 2022).

These dimensions should not be treated as isolated variables. Their interaction determines whether an affordance can be actualised. For example, a playground may offer suitable equipment but remain underused if access is unsafe, shade is absent, or adults dominate the surrounding space. Affordance theory therefore enables neighbourhood quality to be understood as an interaction among environmental provision, children’s capabilities, social permissions, sensory conditions, and spatial governance.

2.5 Conceptual Synthesis and Research Gap

Existing research demonstrates that neighbourhood environments influence children’s development and that children in low-cost social housing depend heavily on shared communal spaces. It also establishes the value of engaging children directly in research and planning. Nevertheless, three limitations remain.

First, Malaysian PPR research has largely focused on housing provision, physical adequacy, maintenance, and community conditions, with limited attention to how children perceive and use neighbourhood spaces. Second, child-friendly planning commonly emphasises the provision of facilities without examining whether children can actualise their intended affordances. Third, participatory studies do not always translate children's verbal and visual accounts into operational planning and design criteria.

The present study addresses these limitations by integrating child-led walks and mental mapping to examine children's situated, cognitive, emotional, and spatial experiences across three Kuala Lumpur PPR neighbourhoods. The findings are interpreted through six interconnected affordance dimensions: Safety, Nature, Spatial Choices, Comfort, Accessibility, and Sensory Amenities. These dimensions provide the conceptual basis for developing a child-informed affordance framework that links children's lived experiences to attributes, indicators, and criteria relevant to PPR planning and design.

The framework does not assume that environmental provision automatically produces positive outcomes. Instead, it evaluates whether neighbourhood features can be safely accessed, meaningfully experienced, and practically used by children. This evidence-to-framework synthesis offers a context-sensitive basis for moving from adult-defined facility provision towards planning that responds to children's everyday realities.

3.0 METHODOLOGY

3.1 Research Design

This study adopted a child-centred qualitative design to investigate how children perceive, use, and attach meaning to neighbourhood spaces within Malaysia's *Program Perumahan Rakyat* (PPR). A qualitative approach was appropriate because the study sought to understand children's situated experiences and emotional relationships with their everyday environments rather than to produce statistically representative estimates (Tenny et al., 2022). Consistent with the United Nations Convention on the Rights of the Child, children were approached as knowledgeable participants with the right to express views on matters affecting their lives (United Nations, 1989).

The study employed two complementary participatory methods: child-led walks and mental mapping. Child-led walks captured embodied, location-specific experiences, whereas mental maps revealed remembered routes, spatial priorities, emotional associations, and places not encountered during the walks. Combining verbal, visual, and observational evidence supported methodological triangulation and enabled a more comprehensive interpretation of children's neighbourhood experiences (Clark & Moss, 2017; Arnstein, 1969).

3.2 Study Sites and Site Selection

The sampling frame comprised 72 PPR neighbourhoods located across Kuala Lumpur's 11 parliamentary constituencies. Sites were initially approached sequentially by parliamentary constituency, moving from one constituency to the next until a participating site was secured. Within each constituency, community representatives or Heads of Village were approached as gatekeepers, and participation depended on their agreement and willingness to facilitate fieldwork. This process continued iteratively until three sites consented to participate: PPR Gombak Setia in Wangsa Maju, PPR Pantai Ria in Lembah Pantai, and PPR Raya Permai in Bandar Tun Razak (Figure 1).

The three cases were selected because they shared the principal characteristics of Kuala Lumpur PPR housing, including multi-block, high-density residential development exceeding five storeys, while allowing contextual variation in facilities, circulation, parking, maintenance, and communal-space conditions to be examined. The sequential selection process across parliamentary constituencies until three consenting sites were obtained aligns with Yin's (2014) logic of multiple-case design, supporting literal replication whereby similar patterns can be examined across comparable contexts rather than generalising to all Malaysian PPR developments.

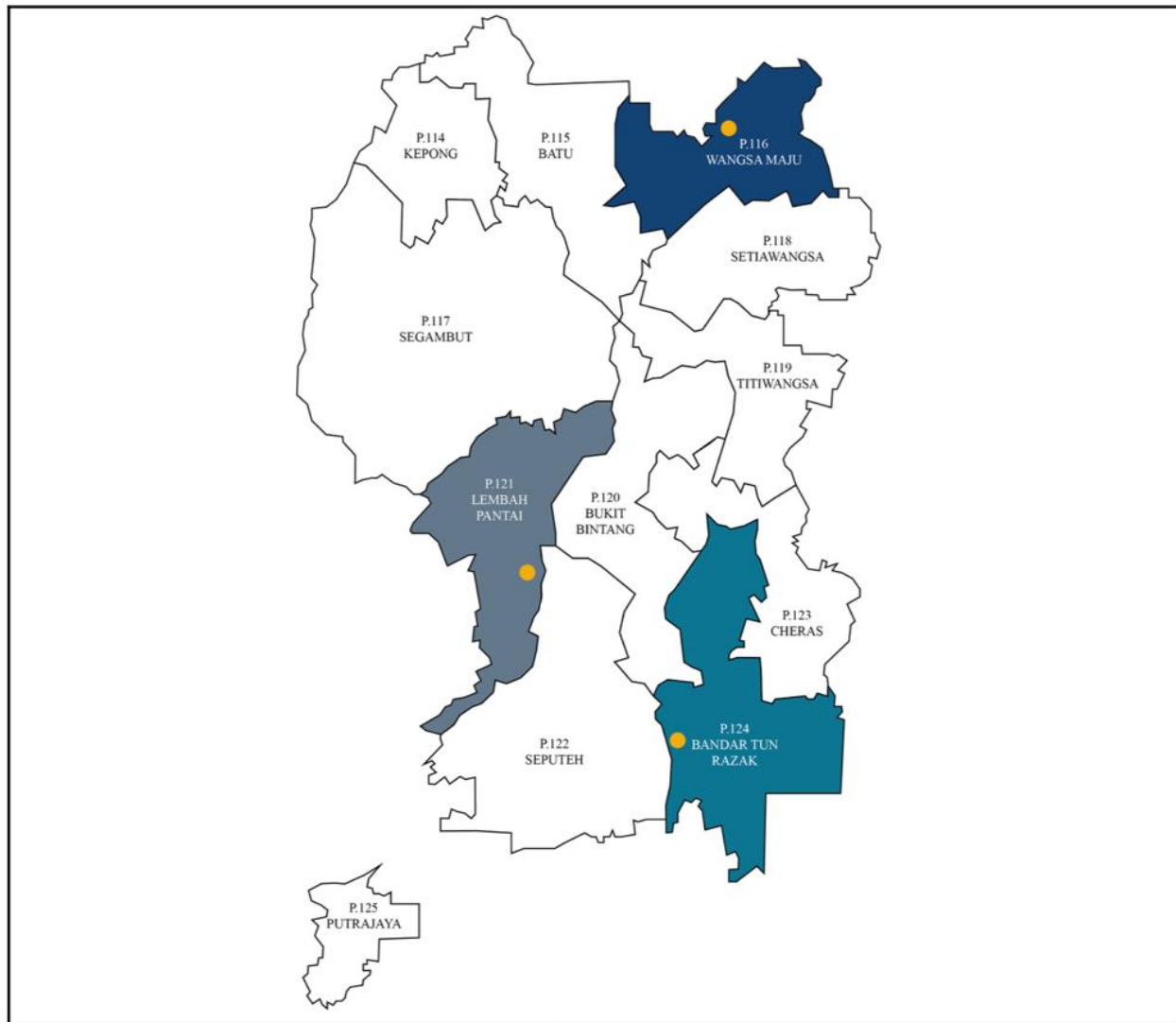


Figure 1. Map of Participated PPR Neighbourhoods in Kuala Lumpur.
(Source: Authors)

3.3 Participant Recruitment and Profile

Participants were recruited through gatekeeper-mediated purposive volunteer sampling. Community representatives informed eligible families about the study, after which interested parents or guardians provided written consent and children provided assent. Inclusion criteria were: (a) aged 7–12 years; (b) able to speak in either Malay, English or Chinese; and (c) able and willing to participate in the walk and drawing activities. Children outside the specified age range, those not residing at the selected sites, or those without guardian consent or personal assent were excluded.

A total of 23 child participants participated (Figure 2). The sample comprised 14 girls and nine boys. Thirteen participants were aged 7–9 years, and ten were aged 10–12 years. By individual age, participants included four aged seven, six aged eight, three aged nine, five aged ten, four aged eleven, and one aged twelve. The ethnic composition comprised 16 Malay, five Chinese, and two Indian children. Participant distribution was six from PPR Gombak Setia, seven from PPR Pantai Ria, and ten from PPR Raya Permai.

This sample was intended to provide in-depth, context-specific accounts rather than demographic or statistical representation of children living in Malaysian PPR housing. Differences associated with age, gender, ethnicity, site conditions, group dynamics, and guardian presence were treated as potential sources of experiential variation.

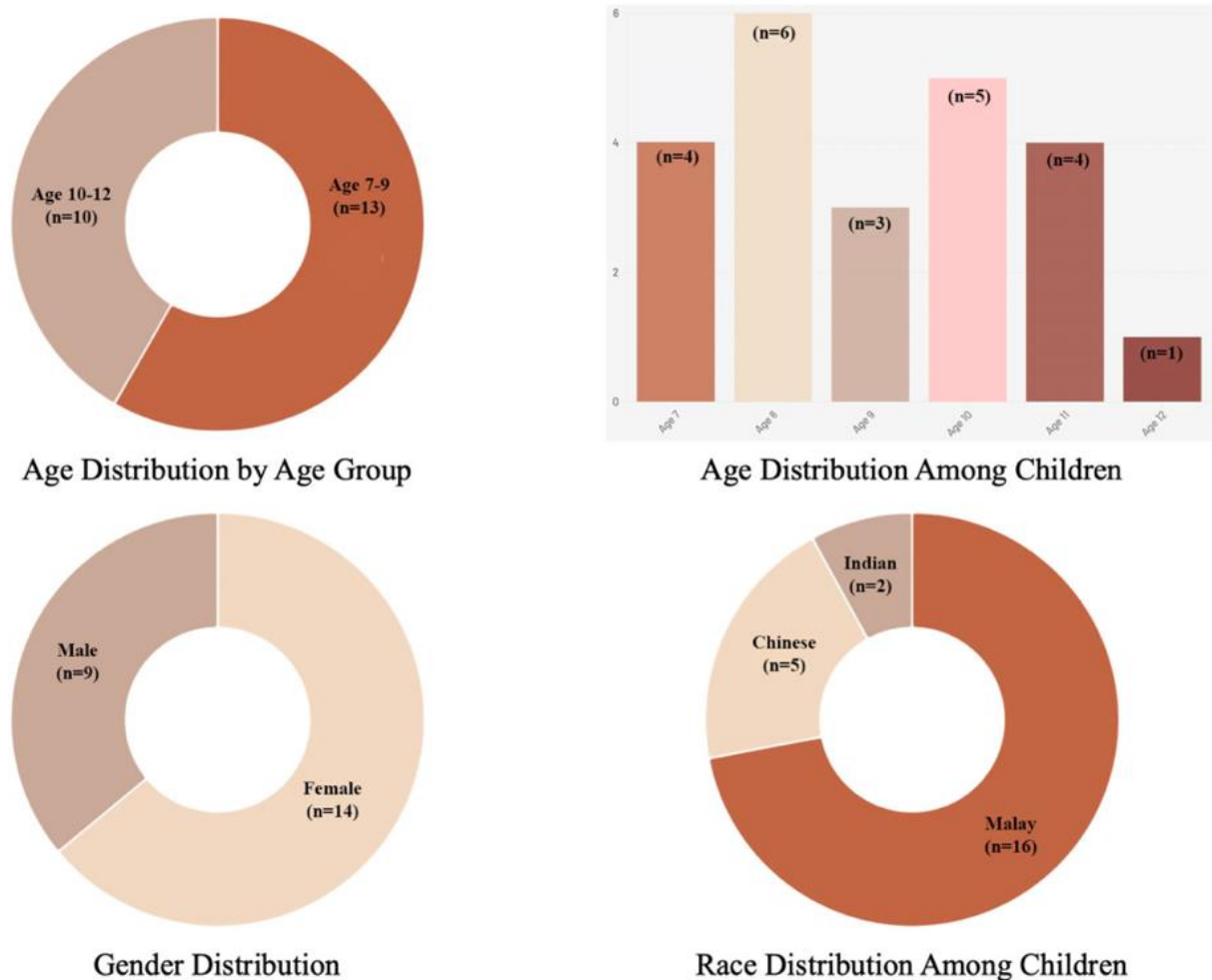


Figure 2. Demographic Profile of Child Participants in the Study.
(Source: Authors)

3.4 Data Collection

3.4.1 Child-led Walk

Children participated in small-group walks involving three to four participants. Each walk lasted approximately 30 minutes and covered an approximate 400-m habitual range around the children's residential blocks. Children guided the route and identified places they frequently used, preferred, disliked, or avoided. Prompts included: "Where is your favourite place to go?", "What do you like or dislike along this route?", and "Are there places where you feel safe or unsafe?"

The field team comprised the principal researcher, two trained enumerators, a parent or guardian, and a community representative. The researcher facilitated discussion without determining the route, while the enumerators documented environmental conditions, children's comments, spatial behaviour, and relevant non-verbal responses. Guardians and community representatives remained present for safeguarding but were requested not to answer questions on the children's behalf or direct their responses. Walk conversations were audio-recorded with permission and supplemented by structured field notes.

3.4.2 Mental Mapping

Following the walks, children completed an individual mental-mapping activity lasting approximately 40 minutes. Using A3 paper, pencils, and colouring materials, they were asked to draw their neighbourhood, including usual routes, play spaces, meaningful locations, environmental features, and places perceived as safe or unsafe. For children who were not confident in drawing, they were allowed to use a bubble map.

After completing the drawing, each child explained the represented features and their placement. Researchers used non-leading prompts, such as “Can you tell me about this place?” and “Why did you draw this feature here?”, to reduce adult interpretation of visual content. These explanations were recorded and considered alongside the drawings and field notes. Mental mapping therefore functioned as a visual-elicitation method rather than treating drawings as direct or self-explanatory representations of children’s internal experiences.

3.5 Data Management and Analysis

All data were organised and analysed using NVivo. Audio recordings from the child-led walks were transcribed verbatim. Malay- and Chinese-language accounts were translated into English by the first author and cross-checked by the other authors to retain culturally specific meanings and children’s original expressions where possible.

Child-led walk data were analysed thematically. Initial open codes were generated from children’s statements, observed conditions, and field notes. Related codes were then compared, merged, and organised into categories and higher-order themes. For example, references to speeding vehicles, absent crossings, and fear of road traffic were grouped under traffic-related risk and subsequently incorporated within the Safety theme. A codebook documented code definitions, inclusion criteria, exclusions, and representative examples.

Mental maps were scanned and imported into NVivo, while children’s verbal explanations and field notes were entered as linked transcripts and analytic memos. Interpretative phenomenological analysis was used to examine recurring spatial elements, symbolic representations, emotional meanings, and the relative positioning of neighbourhood features. For example, drawings of trees accompanied by explanations concerning breeze, shade, or happiness informed both Nature and Comfort interpretations. Visual elements were not coded independently of children’s explanations unless their meaning was supported by field observations or accompanying narratives.

A coded reference refers to a distinct textual passage, observed incident, or interpreted visual element assigned to a theme. A single passage or drawing feature could receive more than one code where it represented interconnected meanings. Coding frequencies therefore indicate recurrence within the dataset rather than the number of participants or the relative importance of a theme. Results are reported using both coded-reference counts and, where available, the number of children and sites contributing to each theme. Frequency was interpreted alongside quotations, visual evidence, intensity, cross-site consistency, and divergent cases.

3.6 Trustworthiness, Triangulation, and Reflexivity

Methodological triangulation was conducted through a structured comparison of child-led walk and mental-mapping findings. A triangulation matrix documented: (a) convergence, where both methods supported the same interpretation; (b) complementarity, where one method added information not captured by the other; and (c) divergence, where verbal and visual evidence differed. Cross-site comparisons were also undertaken to distinguish shared patterns from site-specific conditions.

Existing literature was used to contextualise and critically interpret the empirical findings, but was not treated as an independent source of participant data. An audit trail comprising transcripts, translated files, field notes, drawings, coding decisions, codebook revisions, and analytic memos was maintained throughout the analysis. Primary coding was undertaken by the first author, while the other authors reviewed the coded material. Disagreements were resolved through discussion.

Data collection continued until later sessions produced no substantially new codes or conceptual categories across the combined dataset. Saturation was assessed across the full sample rather than claimed separately for each site. Given the small and heterogeneous sample, saturation was treated cautiously, recognising that additional participants or PPR settings could reveal further variations.

The research team remained reflexive regarding the influence of researcher prompts, translation, group composition, guardian presence, weather, and route conditions. Researchers used age-appropriate language, avoided leading questions, and allowed children to direct routes and explain drawings in their own terms.

Nevertheless, the resulting interpretations remained mediated by the research process and the researchers' analytical judgement.

3.7 Ethical Considerations and Data Availability

Ethical approval was obtained (UM. TNC2/UMREC_3336). Written consent was secured from parents or guardians, and age-appropriate assent was obtained from each child. Participation was voluntary, and children could decline questions or withdraw without consequence. Participant names were replaced with anonymised codes, and identifiable information was removed from transcripts, drawings, photographs, and publications.

Safeguarding measures included adult accompaniment, community oversight, risk assessment of walking routes, and procedures for responding to distress or the disclosure of unsafe conditions. Adults were instructed to maintain sufficient distance during interviews and drawing explanations to minimise influence while remaining available for safety. Raw audio recordings, identifiable drawings, and location-sensitive data are not publicly available because participant consent did not extend to unrestricted data sharing.

4.0 RESULTS

The results are presented in four stages: children's experiences during the child-led walks, their neighbourhood representations through mental mapping, cross-method integration, and expert appraisal of the resulting framework. A coded reference denotes a distinct passage, observed incident, or interpreted visual feature assigned to a theme. A single item could receive more than one code where meanings overlapped. Frequencies therefore indicate recurrence within the dataset rather than the number of children expressing a theme or its relative importance. Participant prevalence and site occurrence are reported separately where available. Figure 3 shows the pictures of the participating PPR and the location maps of the PPR (Figure 4-6).

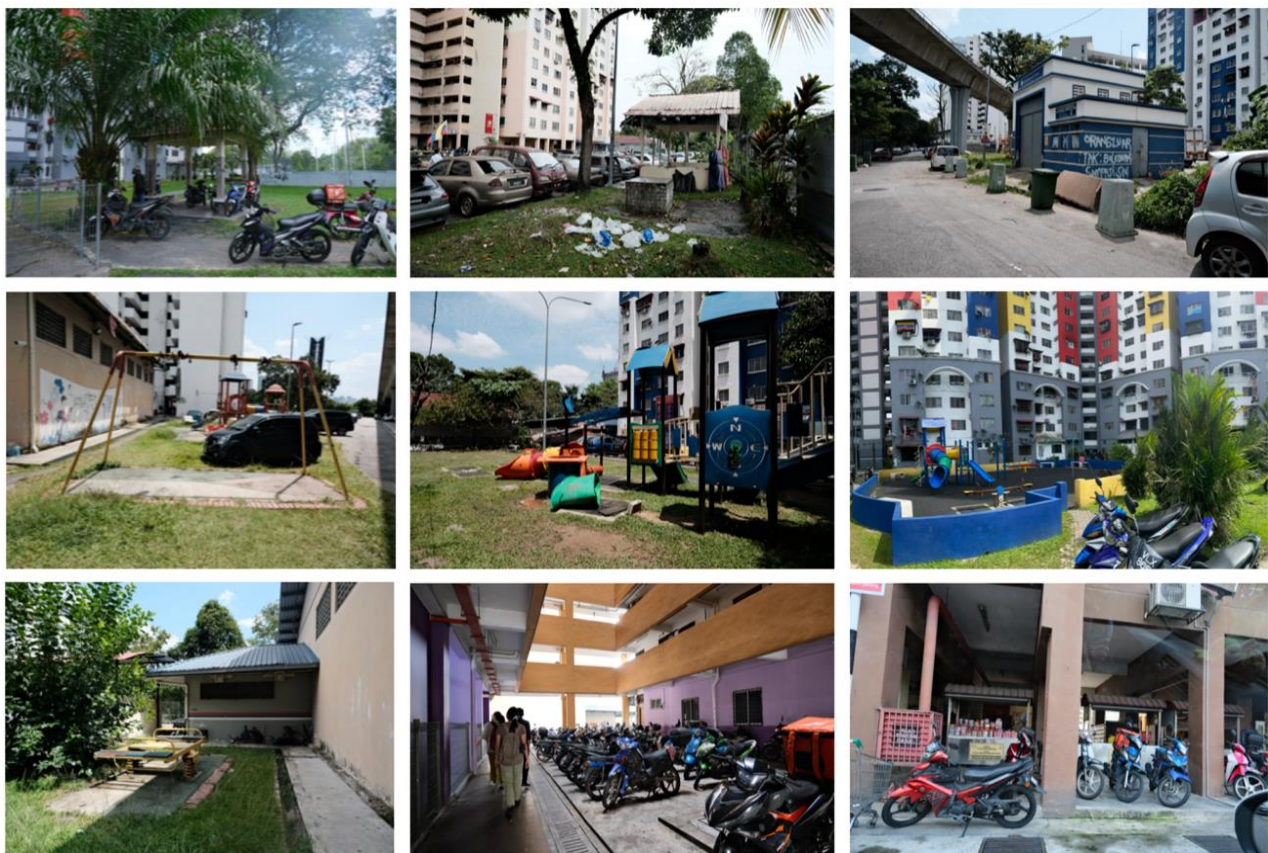


Figure 3. Pictures of participating PPR sites.
(Source: Authors)

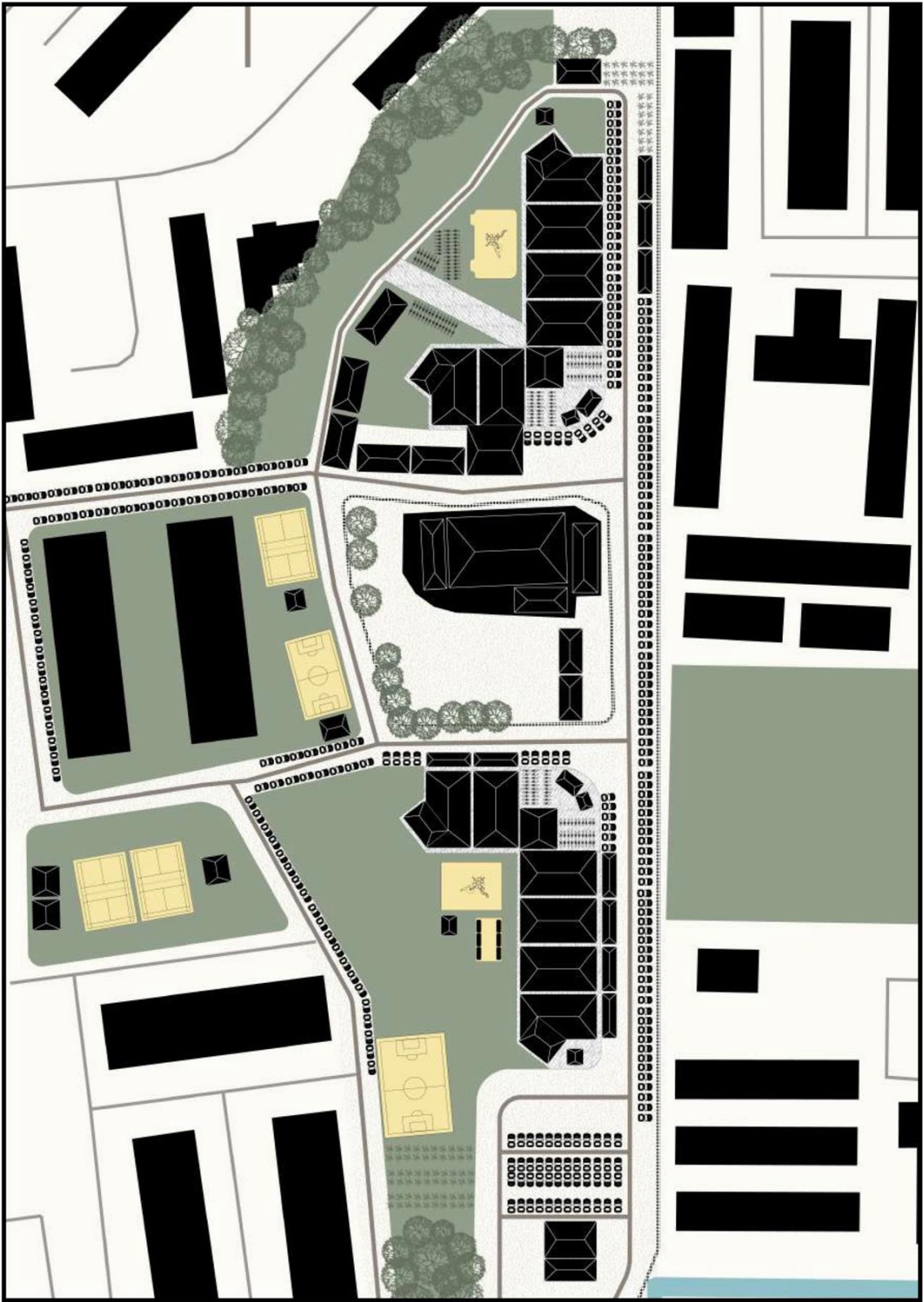


Figure 4. Map of PPR Gombak Setia.
(Source: Authors)

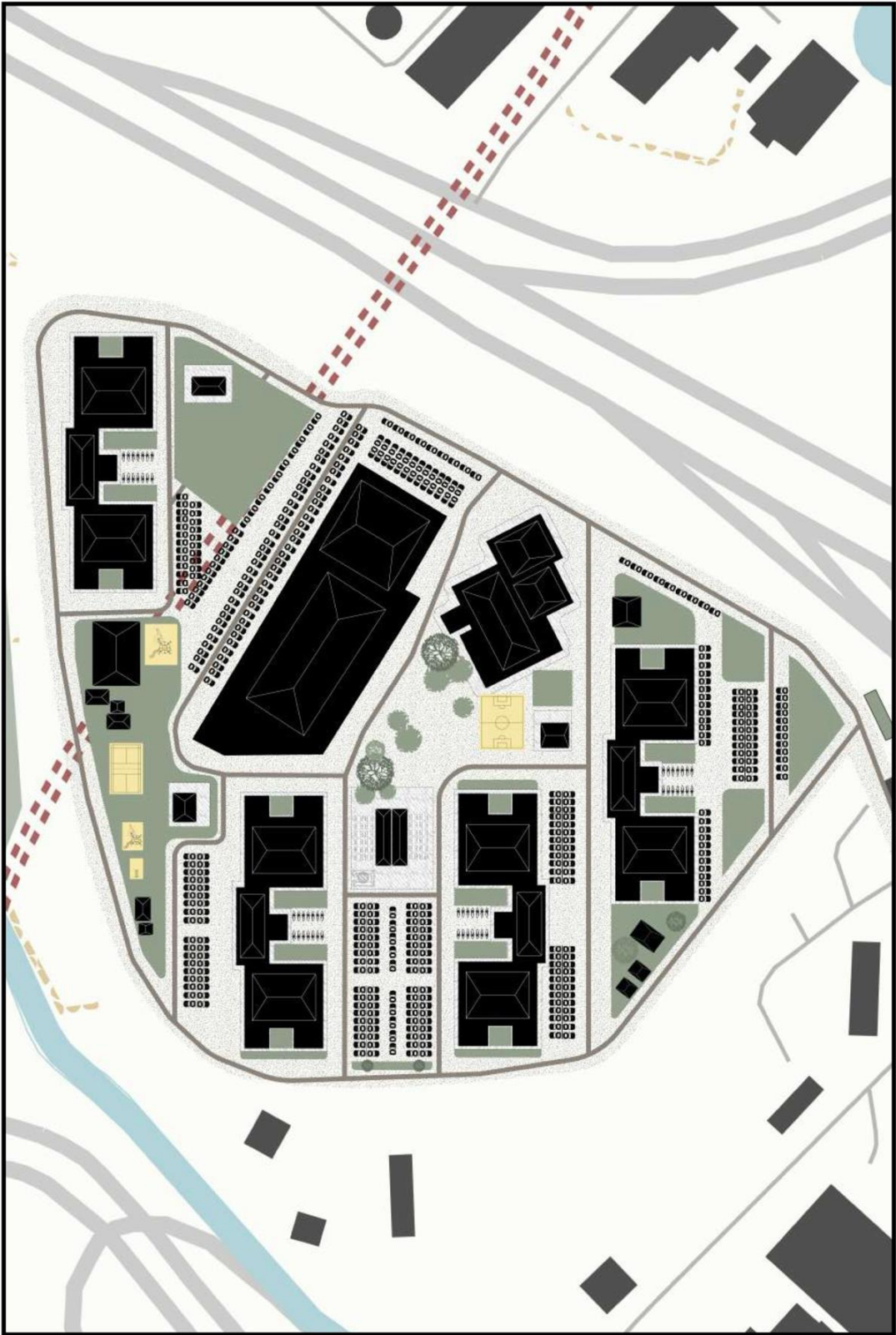


Figure 5. Map of PPR Raya Permai.
(Source: Authors)

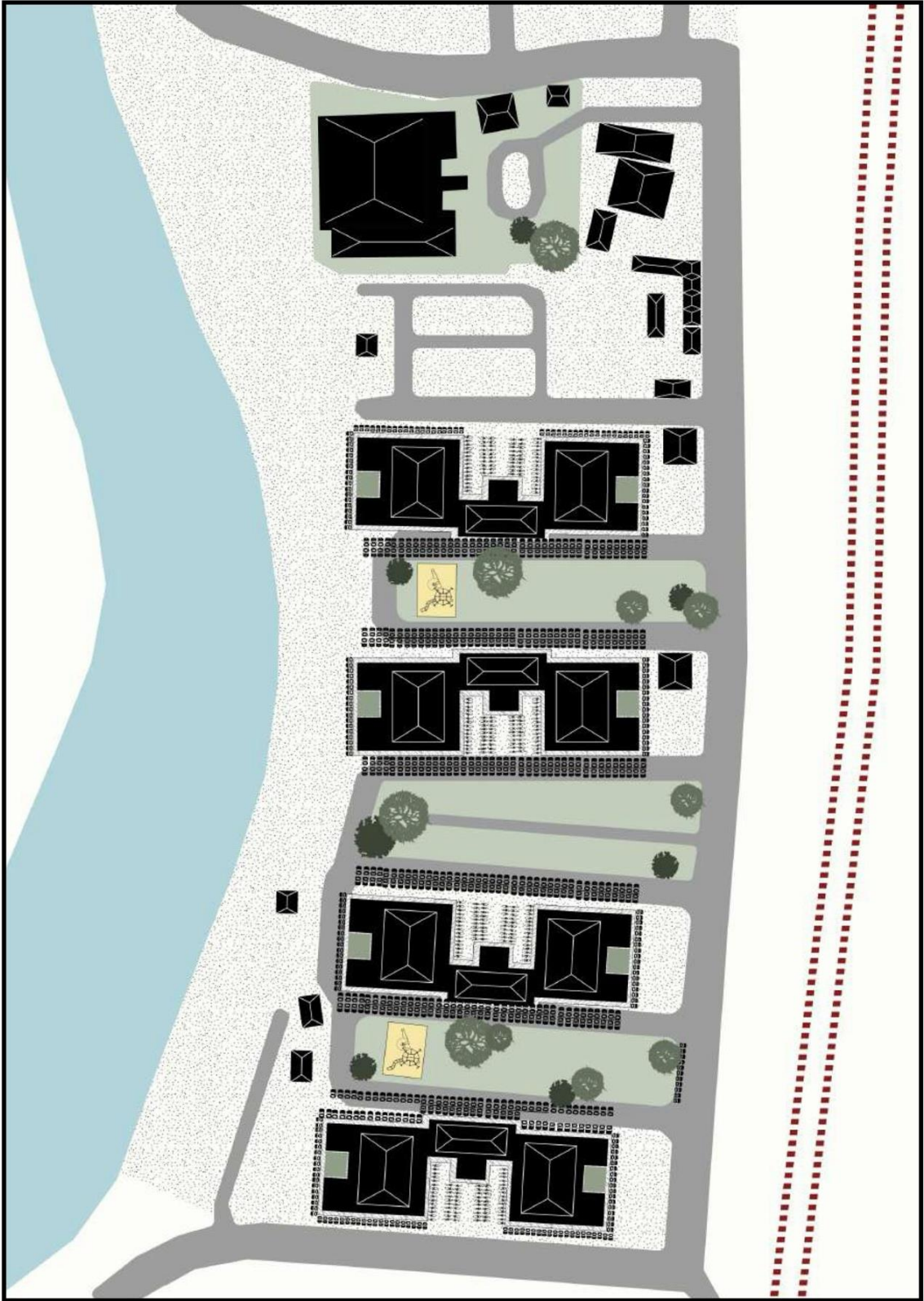


Figure 6. Map of PPR Pantai Ria.
(Source: Authors)

4.1 Children’s Experiences from Child-led Walks

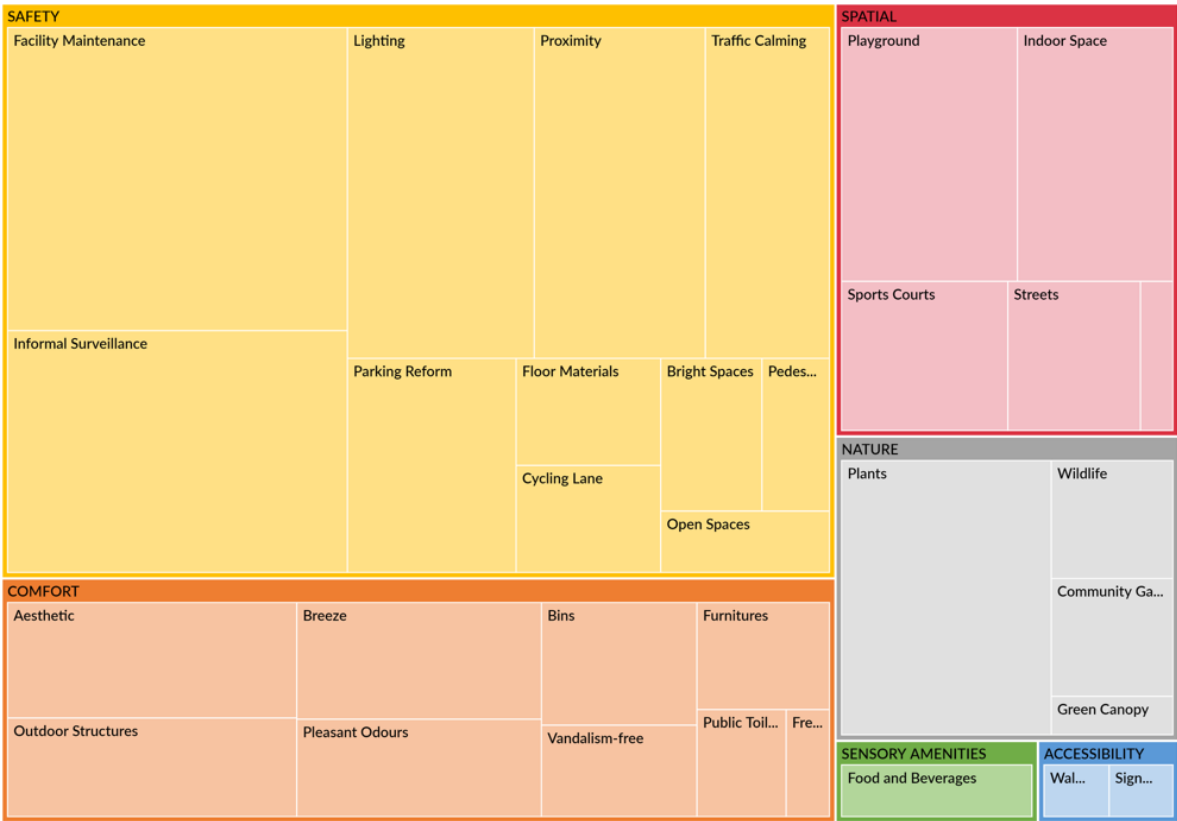


Figure 7. Distribution of coded references from the child-led walks across the six themes.
(Source: Authors)

The child-led walks demonstrated how children perceived, navigated, and emotionally evaluated their immediate neighbourhoods. Figure 7 presents the distribution of 173 coded references across six themes: Safety (87), Comfort (37), Spatial Choices (27), Nature (17), Sensory Amenities (3), and Accessibility (2). These counts were generated from the thematic coding of walk transcripts, field observations, and accompanying notes.

Within the Spatial Choices theme (27 references), children most commonly identified playgrounds (9 references), followed by indoor spaces (8), sports courts (5), streets (4), and open fields (1) as places where they spent time. Their descriptions suggest that neighbourhood spaces were perceived positively when they were close to home, visually attractive, and socially active. Under the Comfort theme, children referred to aesthetic qualities (7 references), breezes (6), outdoor structures (6), pleasant odours (5), bins (4), furniture (3), vandalism-free environments (2), public toilets (2), and fresh air (1), indicating that visual quality, environmental cleanliness, and physical comfort contributed to enjoyable outdoor experiences. Encounters with neighbours, peers, food vendors, and other familiar people further enhanced children's sense of comfort and belonging.

Safety accounted for 87 coded references, making it the most prominent theme across all three neighbourhoods. The most frequently coded safety concern was facility maintenance (21 references), followed by informal surveillance (16), proximity (11), lighting (12), traffic calming (8), parking reform (7), bright spaces (3), cycling lanes (3), floor materials (3), pedestrian crossings (2), and open spaces (2). Children frequently described damaged playground equipment, broken pavements, poorly maintained recreational facilities, and inadequate lighting as factors that reduced their willingness to use outdoor spaces. They also highlighted the widespread occupation of playgrounds, internal courtyards, and pedestrian routes by parked vehicles, indicating a need for parking reform and traffic-calming measures to improve safety and independent mobility.

The Nature theme comprised 17 references, primarily related to plants (12 references), followed by community gardens (3), green canopies (1), and animals (1). These elements were associated with shade, fresh surroundings, and opportunities to interact with nature, suggesting that even limited greenery positively influenced children's neighbourhood experiences. Although Sensory Amenities received only 3 references, all related to food and beverages, reflecting children's appreciation of nearby places to buy refreshments during outdoor activities. Accessibility was represented by only 2 references, consisting of walkways (1) and signposts (1), indicating that while movement and wayfinding were discussed less frequently, they remained relevant aspects of children's everyday navigation.

Overall, the child-led walks demonstrate that children evaluate their neighbourhoods through interconnected spatial, environmental, and social experiences. The predominance of safety-related references (87), particularly those concerning facility maintenance (21), informal surveillance (16), and lighting (12), indicates that children's use of neighbourhood spaces depends not only on the availability of play areas but also on whether these spaces are well maintained, socially active, and protected from vehicle conflicts. These findings highlight the need for safer, better-maintained, and more child-responsive neighbourhood environments within PPR housing developments.

4.2 Children's Representations of Neighbourhoods through Mental Mapping

The mental maps provided visual and spatial evidence of children's remembered routes, meaningful locations, environmental concerns, and neighbourhood priorities. Interpretations were based on the drawings together with each child's verbal explanation and the corresponding field notes; visual elements were not treated as self-explanatory. Analysis of the children's mental maps revealed a set of recurring themes that offer insight into how they perceive and prioritise different aspects of their neighbourhood environments (Figure 8). Figures 9–13 present selected examples chosen to illustrate recurring themes, contrasting representations, and site-specific conditions.



Figure 8. Children's Representations through Mental Mapping.
(Source: Authors)

Nature was the most prominent theme in the children's mental maps, accounting for 67 coded references, comprising plants (42 references), animals (18), and community gardens (7) (Figure 9). Plants were the most frequently illustrated natural element across all three neighbourhoods, increasing from 9 references in PPR Gombak Setia, to 13 in PPR Pantai Ria, and 20 in PPR Raya Permai, indicating that greenery was consistently recalled as part of children's everyday neighbourhood experience. Children commonly drew trees, flowers, lawns, and gardens alongside play spaces or residential blocks rather than as isolated features, suggesting that natural elements formed part of how they cognitively organised and recognised their neighbourhood environment. Animals, represented by 18 references, were typically placed near gardens or open spaces, indicating that children associated these locations with everyday encounters with nature. The repeated inclusion and prominent placement of natural elements suggest that greenery was a memorable environmental feature that contributed to children's positive perceptions of their neighbourhoods and reinforced the emotional significance of natural spaces within high-density PPR environments. Figure 9 supports these findings by illustrating recurring representations of trees, gardens, shaded areas, and animals across children's drawings, demonstrating that natural features consistently appeared as recognisable components of their mental representation of the neighbourhood rather than isolated objects.

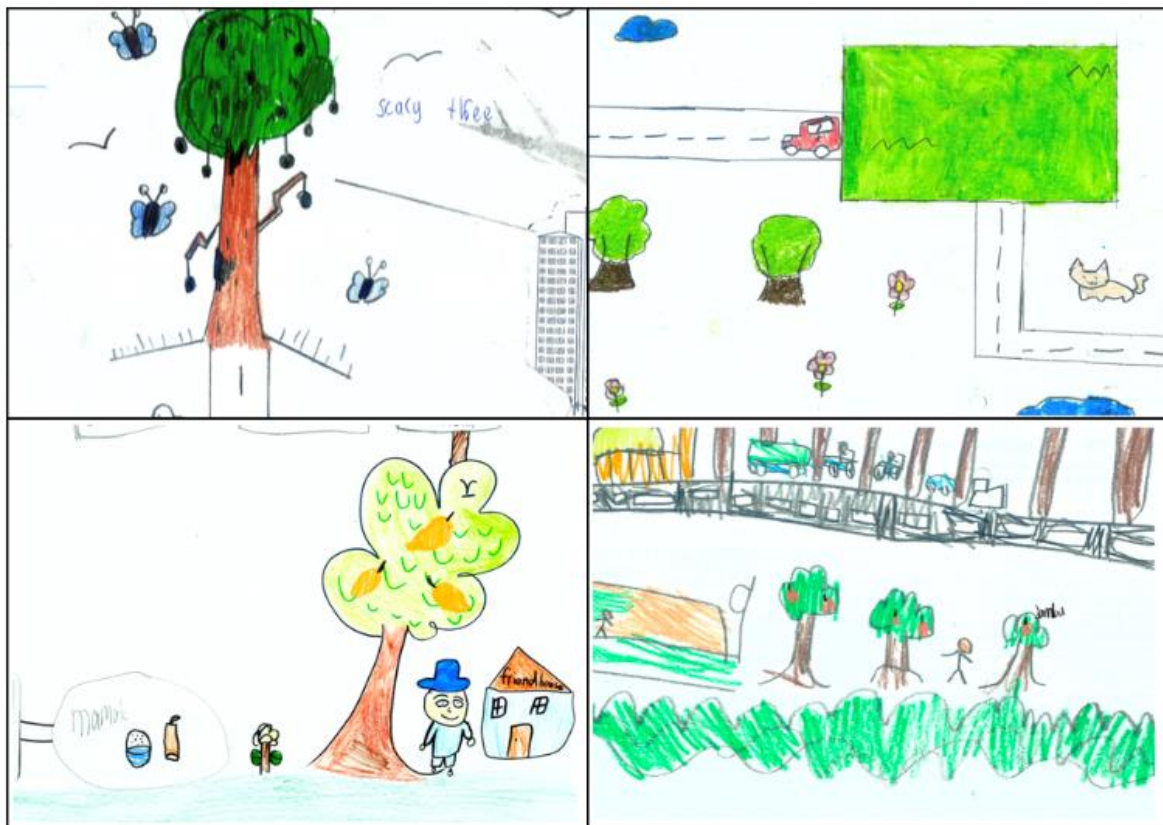


Figure 9. Representations of natural affordances, including greenery, animals, shade, and community gardens.

(Source: Authors)

Children also emphasised Spatial Choices, which accounted for 39 coded references (Figure 10). The most frequently illustrated spaces were playgrounds (21 references), followed by sports courts (14) and open fields (4). While playgrounds dominated the drawings in PPR Gombak Setia (6) and PPR Pantai Ria (8), children from PPR Raya Permai illustrated sports courts (8) slightly more frequently than playgrounds (7), reflecting differences in the activity spaces that were most meaningful in their daily lives. These spaces were commonly positioned near the centre of neighbourhood layouts and connected to residential blocks or routes of movement. Their spatial prominence suggests that they functioned as important reference points within children's mental maps, representing places they regularly visited and associated with outdoor play and social interaction. This

pattern complements the child-led walk findings, where playgrounds and other recreational spaces were repeatedly identified as significant destinations within children's habitual range. Figure 10 demonstrates this interpretation by showing playgrounds, sports courts, and open fields occupying prominent positions within many drawings, indicating that these locations served as key spatial anchors in children's mental representations of their neighbourhoods.



Figure 10. Representations of neighbourhood activity spaces and constraints on their use.
(Source: Authors)

Safety emerged as another dominant theme, with 58 coded references (Figure 11). The most common safety-related element was lighting (27 references), followed by parking reform (15), informal surveillance (14), surveillance (1), and pedestrian crossings (1). Children frequently highlighted streetlights, organised parking areas, and places where adults or neighbours were visible, indicating that these environmental features were strongly associated with feeling safe when moving around the neighbourhood. Lighting was commonly drawn along pathways, playgrounds, or communal spaces, suggesting that visibility was an important aspect of children's spatial understanding. Parking reform appeared most prominently in PPR Pantai Ria (8 references) and PPR Raya Permai (5), where vehicles were shown as occupying or separated from activity spaces, reflecting children's awareness of conflicts between traffic and play. Similarly, repeated references to informal surveillance indicate that the presence of familiar people formed part of children's perception of safe neighbourhood environments. These patterns demonstrate that safety was embedded within children's mental understanding of neighbourhood space and influenced how they interpreted different locations. Figure 11 supports these findings by illustrating streetlights, parking arrangements, surveillance features, and pedestrian crossings repeatedly appearing in children's drawings, highlighting the environmental features they associated with safe movement and outdoor activity.

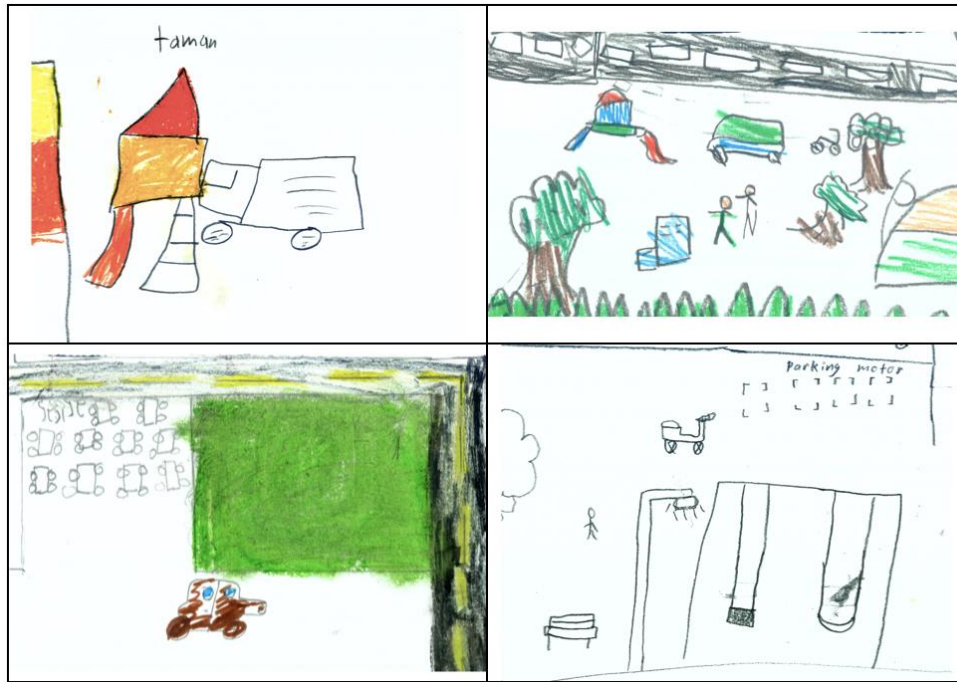


Figure 11. Representations of perceived safety, traffic risk, visibility, and surveillance.
(Source: Authors)

Accessibility accounted for 22 coded references, consisting primarily of landmarks (21 references) and signposts (1) (Figure 12). Rather than illustrating complete street networks, children organised their drawings around familiar landmarks such as playgrounds, sports courts, community facilities, and distinctive buildings. This suggests that children's mental maps were structured around recognisable destinations instead of formal spatial layouts, reflecting how they navigated the neighbourhood through familiar places encountered in their everyday routines. The single reference to signposts further indicates that orientation relied primarily on environmental familiarity rather than formal wayfinding infrastructure. Figure 12 illustrates this pattern by showing neighbourhood layouts centred on prominent landmarks that functioned as reference points within children's mental representation of their everyday movement.



Figure 12. Representations of routes, landmarks, crossings, and barriers to movement.
(Source: Authors)

The remaining themes received comparatively fewer references but provided additional insight into children's everyday experiences (Figure 13). Sensory Amenities accounted for 13 references, all relating to food and beverage facilities, with 8 references recorded in PPR Raya Permai, 4 in PPR Gombak Setia, and 1 in PPR Pantai Ria. Their inclusion indicates that places to obtain food and drinks were memorable destinations encountered during children's daily neighbourhood activities. Comfort comprised 8 references, including aesthetic qualities (5), furniture (2), and bins (1). These elements were commonly illustrated near playgrounds or communal gathering spaces, suggesting that children noticed environmental qualities that influenced the comfort and attractiveness of places they regularly used rather than treating them as independent destinations. Figure 13 supports this interpretation by showing food stalls, seating, waste bins, and aesthetically maintained recreational spaces located alongside children's commonly used activity areas, demonstrating how sensory and comfort-related features formed part of their cognitive representation of the neighbourhood.



Figure 13. Representations of sensory amenities and environmental comfort.
(Source: Authors)

Taken together, the mental maps demonstrate that children cognitively organised their neighbourhoods around nature (67 references), safety (58), spatial choices (39), accessibility (22), sensory amenities (13), and comfort (8). The prominence, placement, and repeated inclusion of these elements indicate which environmental features were most memorable and meaningful in children's everyday experiences. Rather than simply recording physical layouts, the drawings reveal how children perceived, navigated, and interpreted their neighbourhoods, identifying places that supported play, movement, safety, and social interaction. Collectively, Figures 9–13 substantiate these findings by visually demonstrating the recurring environmental features and spatial relationships identified through the NVivo coding, complementing the child-led walk narratives and strengthening the triangulation between children's verbal accounts and their mental representations of the neighbourhood.

4.3 Triangulation of Child-led Walks and Mental Mapping

The findings from the child-led walks and mental mapping were triangulated to compare children's verbal experiences with their cognitive representations of the neighbourhood. While the child-led walks captured children's immediate observations, behaviours, and emotional responses during everyday movement, the mental maps revealed the environmental features that were sufficiently meaningful to be recalled and spatially represented. The convergence of these two methods strengthens the credibility of the findings by demonstrating that environmental attributes identified during neighbourhood exploration were also retained within children's cognitive understanding of place.

Across all three PPR neighbourhoods, six overarching attributes consistently emerged from both methods: Safety, Nature, Spatial Choices, Comfort, Accessibility, and Sensory Amenities (Table 1). Although the frequency and emphasis of individual indicators differed between sites, the same environmental dimensions were repeatedly identified, providing evidence of literal replication across the three case studies.

Table 1. Cross-case Matrix of Study Sites. (Source: Authors)

Attribute	PPR Gombak Setia	PPR Pantai Ria	PPR Raya Permai	Cross-site Interpretation
Safety	Parking conflicts, maintenance, lighting	Maintenance and parking most prominent	Informal surveillance and lighting dominant	Safety consistently emerged as the highest priority, although different environmental problems were emphasised at each site.
Nature	Plants and animals common	Strong emphasis on plants	Highest number of plant references	Greenery was valued across all sites and functioned as both recreational and cognitive landmarks.
Spatial Choices	Playground dominant	Playground and indoor activity spaces	Sports courts and playgrounds	Recreational spaces consistently formed children's activity centres despite different facility availability.
Comfort	Aesthetics and breeze	Outdoor structures and pleasant surroundings	Breeze and aesthetics	Comfort reflected environmental quality rather than specific facilities.
Accessibility	Walkways and landmarks	Landmarks	Landmarks and signposts	Children navigated primarily through familiar landmarks rather than formal street networks.
Sensory Amenities	Food vendors present	Limited reference	Food vendors highly memorable	Everyday destinations contributed to neighbourhood familiarity and social activity.

Safety was the strongest point of convergence. During the child-led walks, safety generated 87 coded references, with facility maintenance (21), informal surveillance (16), lighting (12), proximity (11), traffic calming (8), and parking reform (7) dominating children's narratives. The mental maps similarly highlighted 58 safety references, primarily through lighting (27), parking reform (15), and informal surveillance (14). The two methods therefore captured different dimensions of the same phenomenon. The child-led walks documented children's direct experiences of broken facilities, vehicle conflicts, and poorly maintained spaces, whereas the drawings demonstrated that lighting, visible adults, and organised parking had become embedded within children's mental representation of safe neighbourhood environments.

Nature also demonstrated strong convergence. During the walks, children verbally described plants, trees, community gardens, and shaded areas (17 references), while the mental maps expanded this theme with 67 references, particularly plants (42) and animals (18). The greater frequency in the drawings suggests that natural elements function not only as appreciated environmental features but also as prominent spatial landmarks that children use to remember and organise their neighbourhoods. The consistency between spoken experiences and visual representations indicates that nature contributes simultaneously to environmental preference, place identity, and spatial cognition.

Spatial Choices likewise showed substantial agreement. Child-led walks generated 27 references, with playgrounds (9), indoor spaces (8), sports courts (5), streets (4), and open fields (1) representing children's preferred destinations. Mental mapping recorded 39 references, with playgrounds (21) and sports courts (14) becoming even more prominent. Rather than indicating disagreement, this difference reflects methodological complementarity. During the walks, children discussed the variety of places they actually used throughout the day, including transitional spaces such as streets and indoor courtyards. In contrast, the drawings emphasised the destinations that were most memorable within their cognitive maps, explaining why playgrounds and sports courts became visually dominant.

Comfort displayed partial convergence between methods. Child-led walks produced 37 references, reflecting children's immediate sensory experiences of aesthetics, breezes, outdoor structures, furniture, pleasant odours, cleanliness, and maintenance. Mental mapping generated only 8 references, mainly aesthetics and furniture. This discrepancy is expected because many comfort-related experiences, such as wind, temperature, smells, or cleanliness, are experienced directly during movement but are less easily translated into drawings. Consequently, the walk data provide richer evidence of experiential comfort, while the mental maps primarily capture tangible physical features.

Accessibility demonstrated a similar complementary relationship. During the walks, accessibility received only 2 references, comprising walkways and signposts, because children rarely discussed navigation explicitly while moving through familiar environments. However, mental mapping generated 22 references, almost entirely landmarks (21), indicating that children mentally organise neighbourhoods around recognisable destinations rather than formal circulation networks. Together, these findings suggest that accessibility for children is primarily cognitive, relying on familiar places instead of street hierarchies or signage.

Sensory Amenities also differed between methods. Child-led walks recorded 3 references, whereas mental mapping produced 13 references, all related to food and beverage facilities. During neighbourhood exploration, children briefly mentioned nearby vendors as convenient places to buy refreshments. Their repeated appearance within the mental maps indicates that these everyday destinations are memorable components of children's neighbourhood routines and contribute to their understanding of place.

Overall, the triangulation demonstrates a complementary relationship between the two methods (Table 2). Child-led walks captured children's lived experiences, immediate environmental interactions, and emotional responses, whereas mental mapping revealed which places and environmental characteristics were sufficiently meaningful to become embedded within children's mental representation of the neighbourhood. The consistency of the six attributes across all three PPR neighbourhoods, despite local variation in specific indicators, confirms that these environmental dimensions are robust characteristics of children's neighbourhood experiences within Malaysian PPR housing.

Table 2. Triangulation Matrix of Methods (Source: Authors)

Attribute	Child-led Walks	Mental Mapping	Triangulated Interpretation
Safety	Experienced hazards, maintenance, traffic conflicts	Remembered lighting, surveillance, parking	Safety is both experienced physically and cognitively organised.
Nature	Appreciated shade, plants, gardens	Plants and animals repeatedly recalled	Nature supports environmental preference and place identity.
Spatial Choices	Places children actually use	Places children most strongly remember	Recreational spaces are both behavioural destinations and cognitive anchors.
Comfort	Experienced through temperature, smell, cleanliness	Represented through physical amenities	Comfort combines sensory experience with environmental quality.
Accessibility	Movement barriers	Landmark-based navigation	Children navigate using familiar destinations rather than formal infrastructure.
Sensory Amenities	Brief stops for food	Food vendors remembered as neighbourhood landmarks	Everyday amenities reinforce neighbourhood routines and social life.

4.4 Expert Validation

The integrated findings informed the initial child-informed affordance framework, which was subsequently appraised by six experts: three town planners, one architect, and two UNICEF-affiliated child experts and specialists. The appraisal examined its child-centred focus, conceptual relevance, correspondence with PPR conditions, implementation feasibility, and compatibility with local governance (Table 3).

All six experts (6/6) agreed that the framework foregrounded children's voices, reflected conditions identified in the empirical data, and contained relevant attributes, indicators, and criteria. They also considered the framework potentially supportive of children's physical, cognitive, emotional, and social needs; however, these developmental outcomes were not directly measured in the present study.

Implementation received more qualified support. Four experts (4/6; 66.7%) considered the framework readily applicable in practice and compatible with existing governance structures. The remaining concerns related to budget limitations, fragmented institutional responsibilities, maintenance capacity, inter-agency coordination, and the integration of additional criteria into established planning procedures.

Expert feedback resulted in four principal revisions. First, overlapping attributes and indicators were consolidated to improve clarity. Second, the framework terminology was simplified and standardised. Third, implementation criteria were reorganised into a practical assessment structure for planners, designers, and housing authorities. Fourth, recommendations were added for inter-agency collaboration and periodic post-occupancy evaluation involving children.

Table 3. Validation Results of the Child-Informed Affordance Framework (Source: Authors)

Group	Feedback	Expert Agreement
Child-Centered Focus	Children's Voices & Experiences	6/6
	Support Children's Development	6/6
	Significance of child-friendly framework	6/6
Conceptual Validity	Attributes, Indicators & Criteria	6/6
	Reflect Realities	6/6
Practicality & Implementation	Real-world Implementation	4/6
	Accommodate in Local Governance & Policy	4/6

These results provide preliminary professional support for the framework's relevance while also identifying institutional conditions that require further testing. The appraisal should therefore be understood as expert-informed refinement rather than evidence of comprehensive validation or demonstrated implementation effectiveness.

5.0 DISCUSSIONS

5.1 From Facility Provision to Actualised Affordances

The triangulation of child-led walks and mental mapping demonstrates that facility provision alone does not ensure a child-friendly neighbourhood. Across the three PPR sites, children identified playgrounds, sports courts, courtyards, streets, pathways, and green spaces as important settings for play, movement, and social interaction. However, poor maintenance, vehicle encroachment, inadequate environmental quality, and competing adult use frequently constrained these spaces. Children's neighbourhood use therefore depended not only on the presence of destinations, but also on whether they could reach and use them safely and independently (Egli et al., 2019; Loebach & Gilliland, 2019).

This distinction was especially evident in recreational spaces. During the walks, children valued playgrounds and sports courts but reported damaged equipment, poorly maintained surfaces, parked motorcycles, and adult occupation. Mental mapping confirmed their cognitive significance, with playgrounds receiving 21 references and sports courts 14. Their prominence in the drawings suggests that they remained important neighbourhood anchors, despite not consistently functioning as accessible and usable play environments. This supports evidence that the quality and condition of children's activity spaces are as important as their physical provision (Hanapi & Sh Ahmad, 2017; Kusumo Dewi et al., 2020).

From an affordance perspective, environmental opportunities arise through interactions between environmental characteristics and users' capabilities and intentions (Gibson, 1979; Heft, 1989). In the PPR context, playground usability depended on interconnected conditions such as maintenance, safe access, shade, visibility, and protection from vehicles. Traffic exposure, poor environmental quality, and restricted independent mobility may therefore limit children's use even when recreational facilities are available (Castonguay & Jutras, 2010; Högskolan & Kytä, 2003). Greenery was similarly valued for shade, airflow, exploration, sensory stimulation, and play, consistent with research linking vegetation to environmental comfort and outdoor activity (Gu et al., 2022; Özdemir & Kanbur, 2022).

The two methods provided complementary insights. Walks captured embodied experiences of heat, airflow, odour, and cleanliness, while mental maps revealed memorable recreational spaces, landmarks, and spatial relationships. Participatory and visual methods can therefore illuminate different dimensions of children's environmental experience when interpreted alongside their own explanations (Clark & Moss, 2017; McLaughlin & Coleman-Fountain, 2018).

Accordingly, facility inventories may overestimate children's actual opportunities for play and independent mobility. Neighbourhood quality should instead be assessed by whether children can perceive, reach, and meaningfully use available environmental opportunities. The gap between provision and actualisation was particularly evident where communal spaces were contested by vehicles, adults, and informal commercial activities.

5.2 Spatial Competition and the Governance of Shared Space

The limited actualisation of affordances was not attributable solely to poor physical conditions; it also reflected how restricted communal space was distributed among children, adults, vehicles, and commercial activities. Across the three PPR neighbourhoods, children's use of shared spaces was continually negotiated alongside vehicle movement, parking, adult activities, and informal commercial uses. These competing demands frequently displaced children from settings intended for play, movement, and social interaction. Previous studies similarly indicate that children's independent use of neighbourhood space is shaped by traffic conditions, social controls, competing users, and the organisation of the built environment (Loebach & Gilliland, 2019; Luo, 2022; Ning et al., 2025b). Child-friendliness is therefore also influenced by spatial allocation and the management of shared environments.

Vehicle encroachment represented the clearest form of spatial conflict. Children described cars and motorcycles occupying playground surroundings, courtyards, pathways, and open spaces, sometimes forcing them to play in streets or residual areas. Mental maps similarly positioned vehicles and parking close to recreational spaces, indicating that these conflicts had become embedded in children's spatial understanding of their neighbourhoods. Concerns regarding lighting, parking arrangements, and informal surveillance further suggest that safe play depended not only on recreational provision, but also on the organisation and management of surrounding space. This reflects research showing that traffic exposure, environmental deterioration, and perceived safety can restrict children's outdoor activity and independent mobility in disadvantaged neighbourhoods (Castonguay & Jutras, 2010; Loebach & Gilliland, 2019; Ning et al., 2026).

The present findings further indicate that vehicle dominance extends beyond accident risk. Parking and circulation reduced the usable communal area available to children, meaning that recreational provision could remain underutilised when vehicle access and storage were prioritised over play and movement. This is particularly significant in high-density public housing, where children already depend on a limited range of communal and circulation spaces for everyday activities (Goh & Yahaya, 2011; Hanapi & Sh Ahmad, 2017).

Spatial competition was also evident in adult occupation of sports courts and the use of communal or circulation spaces by informal vendors. Food stalls supported refreshment, rest, and social interaction, but could obstruct movement or introduce slippery surfaces and fire risks when poorly located. Likewise, sports courts offered recreational opportunities but became less accessible when predominantly used by adults. These examples demonstrate the relational character of affordances: environmental features are not inherently enabling or constraining, as their meaning and usability emerge through interactions among physical conditions, users, activities, and context (Gibson, 1979; Heft, 1989).

Improving child-friendliness therefore requires more than additional infrastructure. Parking control, traffic management, maintenance, shared-use arrangements, and the coordination of informal commercial activities influence whether children can safely and independently use neighbourhood spaces. Spatial management should consequently be understood as a central condition of affordance actualisation. Its effects are also interconnected with the six affordance dimensions examined in the following section.

5.3 Interdependence of the Six Affordance Dimensions

The findings indicate that Safety, Nature, Spatial Choices, Comfort, Accessibility, and Sensory Amenities operate as an interdependent system rather than as separate environmental attributes. Children's opportunities for play, movement, and social interaction emerged when several enabling conditions worked together. Recreational spaces, for example, supported children's activities only when they were accessible, adequately maintained, visible, shaded, and protected from vehicle intrusion. This reflects the relational character of

affordances, in which environmental opportunities arise through interactions between physical settings, users' capabilities, and the conditions surrounding their use (Gibson, 1979; Heft, 1989).

Nature was closely connected to both Comfort and Spatial Choices. Children associated trees and vegetation with shade, airflow, visual quality, exploration, and play, while their mental maps frequently positioned greenery near recreational and communal spaces. In low-cost PPR environments, even modest natural elements may therefore improve outdoor usability when integrated with everyday activity areas rather than treated as isolated landscape features. Previous studies similarly identify greenery, ecological play elements, and environmental quality as important for children's comfort, sensory engagement, and outdoor activity (Gu et al., 2022; Kusumo Dewi et al., 2020; Özdemir & Kanbur, 2022).

Accessibility was likewise shaped by its relationship with Safety and Spatial Choices. Children navigated through familiar landmarks and meaningful destinations, yet narrow or obstructed pathways, poor lighting, and parked motorcycles weakened both movement and perceived safety. Accessibility therefore involved more than physical connectivity; routes also needed to be legible, unobstructed, comfortable, and connected to places valued by children. This interpretation is consistent with research showing that children's independent neighbourhood use depends on the interaction among route conditions, destination accessibility, environmental safety, and mobility opportunities (Egli et al., 2019; Loebach & Gilliland, 2019; Ning et al., 2025a).

Sensory Amenities also generated conditional affordances through their relationship with Accessibility, Comfort, and Safety. Food and beverage vendors supported rest, social interaction, and longer periods outdoors, but could become constraints when stalls obstructed circulation or introduced slippery surfaces and fire risks. These findings reinforce the view that environmental elements are neither inherently supportive nor restrictive; their affordances depend on location, management, surrounding activities, and patterns of use (Gibson, 1979; Heft, 1989).

The interdependence of the six dimensions suggests that isolated interventions may yield limited improvements. Upgrading a recreational facility is unlikely to substantially increase children's use if access remains obstructed, shade is inadequate, traffic risks persist, or maintenance is neglected. The six dimensions should therefore be understood as mutually reinforcing conditions that collectively determine whether neighbourhood opportunities can be perceived, accessed, and actualised. This relational interpretation provides the conceptual basis for the planning implications and child-informed affordance framework developed in this study.

5.4 Implications for Planning and Governance

As the six affordance dimensions operate relationally, their actualisation depends on coordinated planning, design, maintenance, enforcement, and management rather than on isolated physical interventions. Conventional standards may record the presence of playgrounds, pathways, green spaces, or sports courts, yet children's experiences show that provision alone does not determine usability. Opportunities for play and independent mobility also depend on connectivity, environmental quality, maintenance, accessibility, and the relationship between spaces and competing uses. This is consistent with research showing that children's neighbourhood use is shaped by the combined effects of destination quality, mobility conditions, safety, and environmental accessibility (Castonguay & Jutras, 2010; Guo et al., 2023).

Many constraints identified across the three sites were therefore not solely design-related but also reflected limitations in ongoing coordination and spatial management. Child-responsive planning requires continued attention after facilities are provided. Housing authorities, local councils, facility managers, and community organisations need clearly defined and coordinated responsibilities for maintenance, parking control, traffic management, shared-use arrangements, and informal commercial activities. Without sustained coordination, even well-designed spaces may not provide children with consistently usable affordances. This is particularly relevant in PPR settings, where limited communal areas must accommodate multiple users and activities (Goh & Yahaya, 2011; Hanapi & Sh Ahmad, 2017).

The findings also demonstrate the value of incorporating children's perspectives into neighbourhood assessment and improvement. Child-led walks revealed embodied experiences of heat, airflow, obstruction, safety, and environmental quality, while mental maps identified memorable destinations, landmarks, and spatial relationships. Together, these methods highlighted visibility, familiarity, comfort, greenery, social presence, and route legibility, qualities that may be overlooked by facility-based or adult-led assessments. Participatory methods can therefore strengthen planning and post-occupancy evaluation by revealing how children actually perceive and use neighbourhood environments (Clark & Moss, 2017; McLaughlin & Coleman-Fountain, 2018).

Children's participation should complement professional expertise, community knowledge, and institutional decision-making. Their observations can be translated into feasible design and management actions through collaboration among residents, practitioners, and responsible agencies, positioning children as legitimate stakeholders rather than sole decision-makers. Although derived from three low-cost, high-rise PPR neighbourhoods in Kuala Lumpur, the consistency of the findings supports the six dimensions as a structured basis for examining how design, environmental quality, social use, and neighbourhood management jointly shape affordance actualisation. These insights informed the child-informed affordance framework presented in the following section.

5.5 Development of the Child-informed Affordance Framework

The child-informed affordance framework was developed through the systematic integration of findings from child-led walks and mental mapping across the three PPR neighbourhoods. The walks captured children's immediate and embodied experiences of play, movement, comfort, safety, and social interaction, while the mental maps revealed places, landmarks, and environmental features that were cognitively and spatially significant. Using these complementary participatory methods enabled the study to combine children's situated experiences with their spatial memories and representations (Clark & Moss, 2017; McLaughlin & Coleman-Fountain, 2018). Through triangulation, recurrent findings across both methods and sites were consolidated into six attributes: Safety, Nature, Spatial Choices, Comfort, Accessibility, and Sensory Amenities.

The indicators within each attribute were derived from environmental conditions that children identified as enabling or constraining their activities. Traffic exposure, lighting, visibility, surveillance, and vehicle separation informed Safety, while trees, vegetation, shade, airflow, and exploration informed Nature. Spatial Choices addressed the availability, condition, location, and shared use of recreational and communal spaces. Comfort incorporated thermal, visual, olfactory, and physical conditions; Accessibility included route connectivity, legibility, obstruction, and proximity to valued destinations; and Sensory Amenities reflected features supporting rest, refreshment, social interaction, and prolonged outdoor use. This translation of lived experience into assessable attributes and indicators is consistent with child-centred approaches that use children's environmental experiences to inform planning and evaluation (Egli et al., 2019; Guo et al., 2023).

The framework organises these attributes as relational and mutually reinforcing components rather than as independent planning categories. The findings showed that an environmental opportunity could be actualised only when several enabling conditions operated together. A recreational space, for instance, required not only physical provision but also safe access, adequate maintenance, environmental comfort, visibility, and protection from competing uses. Similarly, a route became meaningful when it was unobstructed, legible, perceived as safe, and connected to destinations valued by children. The framework therefore evaluates not simply whether facilities are present, but whether children can perceive, reach, and meaningfully use the opportunities they offer.

Figure 14 synthesises these relationships in the child-informed affordance framework, positioning affordance actualisation as the outcome of interactions among the six attributes and their associated indicators.

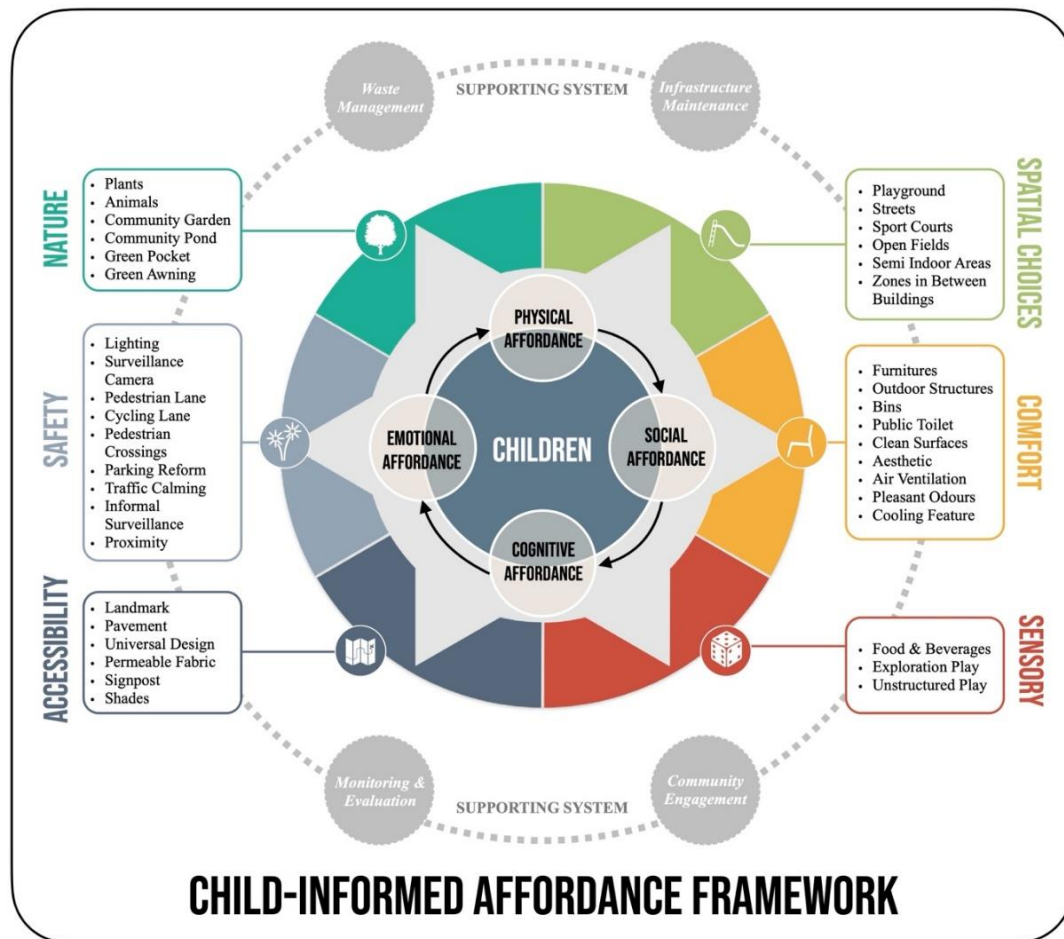


Figure 14. Child-Informed Affordance Framework for Social Housing Neighbourhood.
(Source: Authors)

As illustrated in Figure 14, the framework connects physical design with environmental quality, social use, spatial management, and children's everyday experiences. It contextualises affordance theory within high-density Malaysian social housing by recognising that children's opportunities are shaped not only by built form, but also by maintenance, comfort, social presence, competing activities, and neighbourhood governance. It is therefore intended as a context-sensitive structure for evaluating and upgrading PPR neighbourhoods rather than as a universal or prescriptive design model. The child-derived structure was subsequently reviewed and refined by experts, as discussed in the following section.

5.6 Expert-informed Refinement, Applicability and Limitations

Expert review assessed the framework's child-centred focus, conceptual validity, and practical applicability. Unanimous agreement on child-centredness and conceptual validity indicates that the six dimensions and their associated indicators were considered consistent with both children's reported experiences and professional understandings of child-friendly neighbourhoods. This supports the framework's conceptual relevance while confirming that its structure remained grounded in the empirical findings.

The experts did not substantially alter the six child-derived dimensions. Instead, their feedback refined the wording, organisation, clarity, and professional usability of the indicators. The revisions made strengthened the alignment between the framework and existing planning and assessment processes without displacing the perspectives from which it was originally developed. The review therefore functioned as a process of clarification and practical refinement rather than a reformulation of the framework's empirical structure.

Agreement on practical implementation was lower, at 66.7%, demonstrating that conceptual validity does not automatically translate into institutional adoption. Experts identified long-term maintenance, parking

management, financial constraints, inter-agency coordination, and unclear responsibility for communal spaces as potential barriers. This lower level of agreement does not necessarily challenge the content of the framework; rather, it highlights the operational and governance conditions required for its application. Effective implementation would therefore depend on clearly assigned responsibilities, sustained maintenance, appropriate resourcing, and coordination among housing authorities, local councils, facility managers, and community organisations.

The framework is most applicable as a context-sensitive tool for neighbourhood assessment, upgrading, and post-occupancy evaluation within low-cost PPR environments. It can help practitioners examine whether existing facilities and spaces provide children with perceivable, accessible, and usable opportunities for play, movement, social interaction, exploration, and rest. However, it should not be interpreted as a fixed design standard or a universally transferable model. Its indicators may require adaptation to different housing forms, demographic conditions, institutional arrangements, and local planning contexts.

Several limitations should also be acknowledged. The framework was developed from three PPR neighbourhoods in Kuala Lumpur and reviewed by a relatively small expert group; consequently, the validation remains preliminary and context-specific. Further testing is required across a wider range of housing types, locations, age groups, and governance settings to assess its transferability and practical reliability. The study also did not measure developmental, behavioural, or health outcomes. The framework identifies environmental conditions that may support children's play, mobility, comfort, and participation, but it does not establish causal relationships between these conditions and children's development.

Overall, the framework provides a structured means of connecting children's lived neighbourhood experiences with planning, design, and governance considerations. Its primary contribution lies in supporting context-sensitive evaluation and improvement while preserving children's perspectives as the empirical foundation of the assessment process.

6.0 CONCLUSIONS

This study examined how children aged 7–12 perceive, experience, and envision the habitual range of three PPR social housing neighbourhoods in Kuala Lumpur. The findings answered the research objectives by identifying six interdependent affordance dimensions, Safety, Nature, Spatial Choices, Comfort, Accessibility, and Sensory Amenities, and demonstrating how these dimensions shape children's opportunities for play, movement, social interaction, exploration, and rest. Although playgrounds, sports courts, courtyards, pathways, streets, greenery, and informal social spaces were valued, their affordances were frequently constrained by poor maintenance, vehicle encroachment, obstructed routes, inadequate lighting and shade, competing adult use, and weak spatial management. Child-friendliness therefore depends not only on facility provision, but on whether children can safely perceive, access, and actualise the opportunities available.

The study's principal novelty lies in combining child-led walks and mental mapping to connect children's immediate embodied experiences with their longer-term spatial memories and aspirations. Scientifically, it extends affordance theory into the context of low-cost Malaysian social housing and demonstrates that affordances are relational outcomes shaped by interactions among physical design, environmental quality, social use, and governance. These findings were translated into a child-informed affordance framework that organises children's experiences into six attributes and associated indicators. Practically, the framework may support neighbourhood assessment, upgrading, post-occupancy evaluation, and more coordinated decisions concerning maintenance, traffic, parking, shared facilities, and children's participation.

The study also has limitations. Its findings were derived from three sites, and voluntary participation may have introduced selection bias. The sample was uneven by gender, age, and site, while guardians, community representatives, and researchers may have influenced children's routes or responses. Translation from Malay and Chinese into English, interpretative analysis of drawings, and researcher-led coding may also have affected meaning. Although thematic saturation was reached within the study, it does not guarantee wider

representativeness. The research examined perceived rather than objectively measured environmental conditions, relied on cross-sectional data, and involved preliminary validation by a small expert group.

Future research should implement and test the framework across more PPR neighbourhoods and housing contexts, undertake longitudinal studies, combine children's perceptions with measured environmental data, and evaluate interventions through post-occupancy studies and participatory pilot projects. Despite its limitations, the study is strengthened by its child-centred, multimodal, and triangulated design. The framework should therefore be understood as a context-specific, evidence-informed planning tool rather than a universally validated model.

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