

Exploring the green space experiences of children living in high-density metropolitan areas in Melbourne, Australia during the COVID-19 period

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Abstract

Purpose – While there is some research on the effects of green spaces on children’s health, there is limited literature on shifts in children’s experiences when green access is reduced. This study, therefore, explored shifts in children’s experiences of UGS from pre-to post-pandemic circumstances in central Melbourne, Australia.

Design/methodology/approach – From 23 semi-structured interviews with experts in children’s outdoor play, nature-based education and well-being, several key insights are drawn regarding perceived shifts in children’s attitudes and behaviours, and perceived influences on these attitudes and behaviours.

Findings – The findings of this research established that acknowledging four shifting attitudes and behaviours that shape Melbourne children’s interactions with HDMA–UGSs is important to support service providers and policymakers to ensure local HDMA–UGS infrastructure is optimised in design and location.

Originality/value – The originality of the findings lies in the first-hand and evidence-based guidelines provided to policymakers and service providers, aimed at improving current approaches to Melbourne’s HDMA–UGS location and design, further cultivating urban settings that support the growth and well-being of children.

Keywords Children, Urban green spaces, Melbourne, COVID-19, Metropolitan

Paper type Research article

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1. Introduction

For children living in high-density metropolitan areas (HDMA), daily engagement with urban green spaces (UGSs) is an important part of their recreation and fitness needs (Costello, 2010; Twenge *et al.*, 2010). UGSs are areas of vegetation within urban environments, such as parks, gardens, street greenery and natural or semi-natural landscapes, that provide ecological, social and health benefits to city residents (Costello, 2010). As young people are increasingly losing their connection to urban nature (Aaron and Witt, 2011), access to HDMA–UGSs is crucial for improving the resident children’s well-being (Masten and Obradović, 2008). The decline of children’s direct, spontaneous contact with nature is a phenomenon termed “children’s extinction of experience” by naturalist Robert Michael Pyle (Gaston and Soga, 2020) and is fast becoming a critical dilemma in the ongoing viability of HDMA to maintain childhood wellbeing (Soga *et al.*, 2018).

Nature encompasses the physical world and its phenomena, providing diverse habitats essential for sustaining biological diversity (Ducarme and Couvet, 2020). The loss of biodiversity aggravates negative impacts for children in urban environments, stemming from isolation from nature common in HDMA–UGSs (Müller and Werner, 2010; Chakraborty *et al.*, 2025; Wu *et al.*, 2025). These challenges are known to be associated with the experience of poverty, malnutrition, poor sanitation and infectious diseases (Pronczuk and Surdu, 2008), further increasing the burden of environmental diseases upon children (Rahim and Cederblad, 1984). Furthermore, human-induced disasters, such as COVID-19, further threaten vulnerable children (Chawla *et al.*, 2014). Children in UGS-impooverished HDMA display vulnerability in their well-being and hence lowered resilience to future disasters (Dean *et al.*, 2011; Yoshikawa *et al.*, 2020; Kordi *et al.*, 2025).

Although studies highlight the importance of HDMA–UGSs for children’s well-being during COVID-19, strategies for enhancing these spaces under lockdown are still experimental (Noszczyk *et al.*, 2022). Key areas lacking practical strategies include insufficient exploration of informal HDMA–UGSs (Sikorska *et al.*, 2020), limited understanding of children’s adventurous play under movement restrictions (Oliver *et al.*, 2022) and inadequate research on technology’s role in children’s outdoor interactions with HDMA–UGSs (Walliss and Rahmann, 2016). Addressing these gaps is crucial for improving children’s well-being in urban settings, both daily and during COVID-19. A thorough examination within the broader context of existing research is needed but has been largely overlooked.

The research team selected inner districts in Melbourne, Australia’s most populous city, as the study context for conducting semi-structured interviews with practitioners who focus on children’s physical and psychological experiences with HDMA–UGSs during the COVID-19 period. Melbourne’s lockdowns between March 2020 and October 2021 were among the longest and most restrictive in the world, with residents spending a cumulative 262 days under stay-at-home orders (ABC News, 2021). Residents were rigidly confined to their homes with only one to two hours daily within 5 kilometres and often limited to a parent plus one child (ABC News, 2021). Playgrounds, skate parks and exercise equipment were closed (Macreadie, 2022). Daycare and childcare centres were closed to all but essential workers’ children and schools operated remotely for most students (Man of Many, 2020). Children’s interaction with outdoor spaces and their peers was rare and tightly supervised by adults (ABC News, 2021).

These restrictions led to widespread feelings of isolation and fatigue, particularly among families with young children, who struggled with the lack of outdoor play, peer interaction and routine. While many Melburnians initially complied with health directives, frustration mounted over time, leading to occasional protests, increased mental health concerns and rising demand for accessible UGSs (Howe, 2009). Therefore, this period allowed the team to examine children’s experiences with HDMA–UGSs under extreme conditions. Official reports provided in the Appendix outline Melbourne’s government restrictions in detail,

including the extent to which residents adhered to them, the duration of each restriction and how these restrictions evolved over time.

The findings of this research provide evidence-based knowledge for policymakers and service providers, such as urban planners, architects and landscape architects, regarding the potential of HDMA–UGSs in fostering children’s well-being during crises that limit movement and the interaction of children. The findings can inform projects and social programs aimed at improving urban childhood well-being, aligning with the United Nations Sustainable Development goal of “sustainable cities and communities” by planning and financing child-friendly public spaces (2023).

2. Background context

Before 2019, previous research demonstrated that exposure to UGSs can provide a variety of advantages for children across physical, psychological and cognitive realms. UGSs can benefit children by encouraging physical activity, addressing obesity and enhancing cardiovascular health in children (Bozkurt, 2021; Sugiyama *et al.*, 2010), alleviating stress, promoting mental rejuvenation and bolstering emotional well-being (Dadvand *et al.*, 2016; Narea *et al.*, 2022). Meanwhile, those spaces can also improve children’s imagination, creativity and problem-solving abilities (Almeida *et al.*, 2022; Kordi *et al.*, 2025; Reeve *et al.*, 2015); nurture their communication and social skills (Wolch *et al.*, 2014) and foster a sense of community and belonging (McCormack *et al.*, 2010). The last two benefits are relevant to studying children’s play and learning behaviours in these spaces (Staempfli, 2009).

Over the last five years, researchers have documented the impact of COVID-19 on children’s use of HDMA–UGSs. While these spaces provide opportunities for stress alleviation amidst lockdown measures (Guo *et al.*, 2022), confinement directives and concerns about viral transmission restricted children’s access to these spaces (Sugiyama *et al.*, 2010). Studies increasingly focused on highlighting the significance of informal UGSs during COVID-19, but this category still requires in-depth analysis (Sikorska *et al.*, 2020; Okech and Nyadera, 2022).

Furthermore, multiple studies recorded a decline in the frequency and duration of outdoor recreational activities among children during COVID-19. Research suggests that while children’s structured activities have been limited, their unstructured activities have not been sufficiently documented, such as free play (Tisborn and Seehagen, 2024; Jafari and Carnemolla, 2025). Meanwhile, there was a notable increase in the integration of digital technologies into their daily routines, especially during the lockdown period, as emphasized by Mendoza *et al.* (Wang-Lu *et al.*, 2024). However, the role that technology plays in the relationship between children and UGSs remains unclear (Bers, 2012).

COVID-19 highlighted urban inequalities (Escorcia Hernández *et al.*, 2023, Alraouf, 2021; Renukappa *et al.*, 2024) and a pressing need to reevaluate relevant principles (Alraouf, 2021) and redefine those spaces (Shawket and El Khateeb, 2020). The focus has shifted towards studying the complex connection between sustainable landscape architecture, human influence and the urban setting, as highlighted by Kawther and Hassan (2021) and Salama *et al.* (2024). To achieve this goal, three major research gaps are evident to be filled. Firstly, there are no sufficient studies investigating children’s play in HDMA (Staempfli, 2009), especially under strict confinement. Secondly, while many papers have explored the limited availability of formal UGSs in HDMA during COVID-19, there is a lack of qualitative research on the role of informal UGSs in enhancing children’s experiences during the pandemic (Sikorska *et al.*, 2020). Thirdly, existing studies have paid little attention to the role of technology in children’s daily lives and whether it helps them engage with HDMA–UGSs (Bers, 2012). These gaps suggest that policymakers and service providers need insight into children’s experiences with HDMA–UGSs, especially during the three-year quarantine period.

3. Research methodology

This investigation employed an exploratory approach to review the current evidence and build a foundation for subsequent rigorous studies, as established by [Cooper and Schindler \(2014\)](#). In-depth semi-structured interviews were conducted to examine practitioners' perspectives on children's experiences with HDMA-UGSs in the local government areas (LGAs) of Melbourne, Australia. The research team obtained first-hand knowledge and deeper insights into the phenomenon of urban children's interactions with nature in Melbourne. The following sub-sections introduce the research context, the theoretical context, the process of data collection and analysis, and the study limitations. The researchers acknowledge that their academic backgrounds and professional interests in urban planning and environmental health may have shaped the framing of the research questions, data interpretation and emphasis on the benefits of UGSs. To mitigate potential bias, reflexive practices were employed the research team employed rigorous interview protocols, purposive sampling and reflexive analytical practices to minimise bias and ensure data saturation.

3.1 Case study context

In Australia, the capital cities are highly populated and urbanised, particularly their metropolitan areas and the need for increased public open space poses a complex urban planning challenge ([Kelly and Donegan, 2015](#)). However, the lack of regional UGSs data hampers vital public health research, including the younger generation's resilience to the experience of nature deficits ([Kent and Thompson, 2019](#)). Melbourne is Australia's most populous city and faces challenges of urban sprawl and population growth ([Howe, 2009](#)). This research focused on the central metropolitan zone of Melbourne (refer to [Figure 1](#)). From early 2020 to the end of 2021, Melbourne was subject to six lockdowns to mitigate the spread of

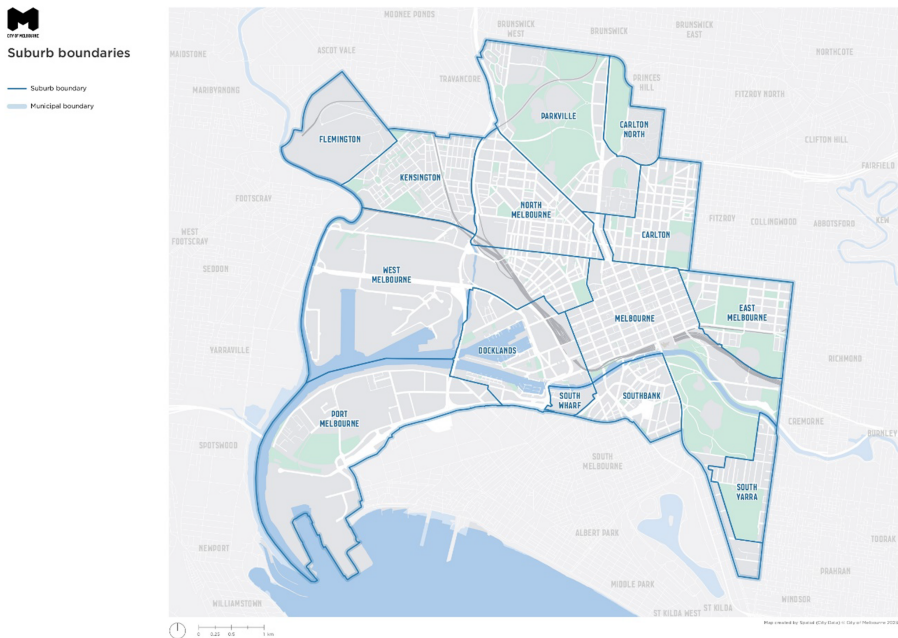


Figure 1. LGA of Melbourne, divided by the City of Melbourne municipal boundary (maps.melbourne.vic.gov.au). Note: The dark, thin line indicates the suburb boundary, while the light, thin line indicates the municipal boundary. The map is indicative and presented at an approximate scale of 1:100,000

COVID-19. Under the Melbourne restrictions, many public events were cancelled, postponed or reduced in size due to restrictions on public gatherings on health grounds (Schurer *et al.*, 2023). From 2020 to 2022, in Victoria, all educational institutions switched to virtual learning. Public outings were restricted to a five-kilometre radius from home in Melbourne, and outdoor physical activity was limited to one hour per day.

3.2 Theoretical foundation

The theoretical foundation for this research adopted Ecological Systems Theory (EST) developed by Bronfenbrenner *et al.* (1998). EST highlights how various layers of the environment, from immediate contexts to broader societal influences, shape children's well-being and their engagement with the natural world. Our research team drew on EST to address the question, "How did practitioners perceive changes in school-aged children's attitudes and behaviours regarding UGSs change over the COVID-19 experience". Within this framing, three sub-theories facilitated a deeper examination of the study, namely affordance theory (Kyle *et al.*, 2004), behavioural psychology (Prins *et al.*, 2022) and nature deficit disorder (Louv, 2008).

Affordance theory in environmental psychology examines human-place bonds (Kyle *et al.*, 2004; Hadavi *et al.*, 2015). This perspective helps researchers understand how children perceive and interact with UGSs, especially during COVID-19, to improve these UGSs. Further, using behavioural psychology, researchers can identify children's preferences and behaviours with UGSs during COVID-19, aiding in the development of targeted interventions like outdoor programs (Gray *et al.*, 2023). The specific traits of nature deficit disorder provide a lens to examine the roles of digital platforms in the relationship between children and UGSs (Wang *et al.*, 2023). This lens can assist researchers to understand children's experiences with UGSs amidst disruptions to daily routines and increased reliance on digital devices during lockdowns.

3.3 Data collection

The research used semi-structured interviews to explore practitioners' perspectives on children's experiences with HDMA-UGSs in inner Melbourne, Australia. Ethical approval was obtained from Griffith University (approval number 2022/840). The transcribed interview data was rigorously coded using thematic analysis, revealing recurring patterns and capturing the essence of the interviewees' experiences. This approach facilitated: (1) detailed expressions and discussions on various aspects, offering a deeper appreciation of their perspectives, experiences and emotional tones (Galletta and Cross, 2013); and (2) a holistic appraisal of children's experiences with HDMA-UGSs, uncovering underlying contradictions and connections and leading to a richer dataset (Kallio *et al.*, 2016).

Twenty-three in-depth interviews were conducted with practitioners with 5–10 years' experience facilitating children's outdoor play, nature-based education and child well-being, focused across LGAs of Melbourne (refer to Appendix Table A1 for the selection criteria). The team connected with potential interviewees ($n = 44$) via the reference team, providing interview information sheets and consent forms. Explicit approvals and signed consent were obtained from 23 ($n = 23$) interviewees. Table 1 and Table 2 summarise the expertise of the interviewees. To ensure the anonymity of interviewees, names and specific titles were replaced with generic practitioner titles: Director of outdoor natural play programs, Nature Educator, Chief Executive Officer of a childcare centre, and Senior Researcher in child health, well-being and welfare.

Each semi-structured interview was conducted one-on-one, addressing nine open-ended questions (refer to Appendix Table A2) and lasting 45–60 min. Communication was video-recorded via Microsoft Teams software, and transcripts were generated using the confidential speech-to-text service provided by the research team's academic institution. Following the 23 interviews and data analysis, no new insights or themes emerged, indicating data saturation.

Table 1. Interviewee code

Code	Position	Fields
EP1-5	Executive Position	Child health, well-being and welfare, outside-of-school-hours care, outdoor or natural play program
MP1-5	Management Position	Early learning and childhood service
SR1-3	Senior Researcher	Child health, well-being and welfare
NE1-10	Nature Educator	Outdoor or natural play program

Source(s): Authors' own work

Table 2. Interviewee background information

Code	Gender	Job title	Years of experiences	Quantity of children approached daily	The ages of the children they care for
MP1	Female	Executive manager	10	10–30	4–12
MP2	Female	Managing Director and Co-founder	8	Below 10	4–12
SR1	Female	Researcher	5	10–30	4–12
SR2	Female	Executive Manager	8	10–30	4–12
SR3	Female	Researcher	5	Below 10	4–12
MP3	Female	Director Play and Programs	9	10–50	4–12
MP4	Female	Researcher	5	Below 10	4–12
MP5	Female	Play lead/worker	3	10–50	4–12
EP1	Female	Founder and CEO	10	10–30	4–12
EP2	Female	Managing Director	6	10–30	4–12
EP3	Male	CEO	5	Below 10	4–12
EP4	Female	Play lead	10	10–50	4–12
EP5	Male	CEO	5	10–50	4–12
NE1	Female	Play lead/worker	5	10–50	4–12
NE2	Female	Play lead/worker	8	10–50	4–12
NE3	Female	Play lead/worker	10	10–50	4–12
NE4	Female	Play lead/worker	8	10–50	4–12
NE5	Female	Play lead/worker	4	10–50	4–12
NE6	Female	Play Consultant	9	10–50	4–12
NE7	Male	CEO	6	Below 10	4–12
NE8	Female	CEO	4	Below 10	4–12
NE9	Male	Founder and CEO	11	10–30	4–12
NE10	Female	CEO	6	Below 10	4–12

Source(s): Authors' own work

The trustworthiness of the study was assured through various parallel concepts such as credibility (Basham, 2009), dependability (reliability), confirmability and transparency (Given, 2008). The commonly used indicators of credibility and dependability are methodological coherence (thorough data collection, analysis and interpretation), researcher responsiveness (the findings and analysis are verified with study interviewees) and audit trail (the transparency of all procedures). The research team ensured credibility through a purposive sample by selecting managerial-level interviewees who were involved in sustainability-related decision-making. Confirmability was established by sending interview transcripts to the

interviewees for their feedback. These trustworthiness principles enabled the research team to establish the robustness of the current study (Jayarathna *et al.*, 2024).

3.4 Data analysis

The responses were transcribed into scripts, translated and then subjected to classification, analysis and examination, using the qualitative software program NVivo, following the thematic analysis process identified by Clarke and Braun (2016). In the initial stage of open coding, relevant text underwent an open inquiry process, including identifying keywords associated with the research question. In the second stage of axial coding, the data were reconfigured in innovative ways, resulting in the identification of eight themes under four categories. In the third step of thematic analysis, emerging macro-themes and patterns were refined to provide descriptive and analytical outcomes in response to the research question.

Throughout each stage, the researcher tested whether similar themes emerged from different sources, sought out discordant data challenging assumptions and verified the coding of data samples (Caldera *et al.*, 2017). The analysis diagram is referred to in Figure 2.

3.5 Mitigating actions to address potential limitations

Due to this study being conducted during the COVID-19 pandemic and associated lockdown restrictions, the ethical requirements set by the Melbourne government prohibited personal research applications involving direct contact with children. While this limitation may have introduced variations in the findings, the research team applied rigorous interview protocols to mitigate potential biases. Due to the busy industry environment, access to potential participants was limited. The interviewees mostly consist of individuals willing to contribute to local government, potentially biasing the results towards that demographic. To minimise these limitations, the research team diversified the interviewee pool using purposive sampling to include individuals from various socio-economic backgrounds in the LGAs. The research team confirmed the collection of multiple viewpoints (Klein and Myers, 1999) and tracked the

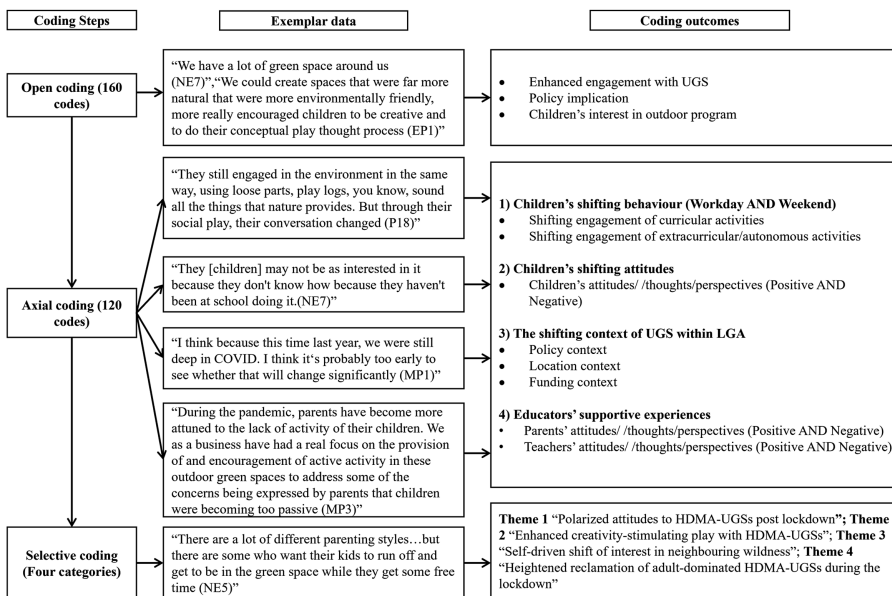


Figure 2. Coding structure diagram. Source: Authors' own work

clear chain of evidence (Walsham, 1995) to minimise bias from specific demographics. The research team also followed a rigorous data collection process to ensure the data reached saturation. Rigorous interview protocols, such as neutral questioning, were conducted to help counteract individual biases and enhance the reliability and validity of the study findings (Klein and Myers, 1999). The theoretical saturation of findings was also corroborated (Corbin and Strauss, 2008). While the sample size is focused and geographically limited to Melbourne's inner districts, this deliberate scope enables an in-depth exploration of localised dynamics. Findings offer valuable insights that can inform local policy discussions, while highlighting the need for further research to support wider applicability. For example, the findings could be generalisable to other geographical contexts that imposed similar lockdown restrictions on their residents.

4. Findings

This section presents the interviewee's perceptions regarding shifts in children's attitudes and behaviours and the perceived influences on children's attitudes and behaviours about HDMA-UGS during COVID-19. The following two subsections present these two types of findings in detail. [Appendix Table A3](#) summarises each interviewee's perspectives on the four themes in attitudes and behaviours and influences on children's attitudes and behaviours related to policy and service providers.

4.1 Perceived shifts in children's attitudes and behaviours

Four themes emerged from the analysis illustrating shifts in children's attitudes and behaviours. Those themes include polarised attitudes towards HDMA-UGSs post-lockdown, enhanced creativity-stimulating play within HDMA-UGSs, self-driven shift in children's preferences from artificial playgrounds to natural areas, heightened reclamation of adult-dominated HDMA-UGSs during the lockdowns.

4.1.1 Polarised attitudes to HDMA-UGSS post lockdown. According to the response from 23 interviewees, children's attitudes to HDMA-UGSs showed two trends post-lockdown, relating to either enthusiasm or resistance. There were 13 interviewees who expressed a desire and expectations for children in the research context to engage with HDMA-UGSs after the lockdown.

It [the COVID-19] improved it [children's engagement with the HDMA-UGSs] in some ways, as children have certainly had more time and were keen to spend it outdoors. (NE10)

Three reasons kept children enthusiastic about HDMA-UGSs. These spaces allowed them to connect with peers during the lockdown. Some children, living in affluent houses in HDMA, enjoyed privileged opportunities to engage with nature. Furthermore, local practitioners implemented alternative programs and customized games to maintain their connection with HDMA-UGSs. Two interviewees mentioned that children were seen as "resilient" and "adaptable" (NE5), while one contended that COVID-19 did not "significantly affect" them (NE4). Some children maintained their enthusiasm for HDMA-UGSs post-lockdown despite a temporary disconnection from nature, for example,

After three years of lockdown, they [children] still show very high levels of resilience. (SR3)

In contrast, five interviewees noted children's negative attitudes towards HDMA-UGSs post-lockdown. One interviewee observed that children under six were confused about independently engaging with these spaces (NE6). Some children lost interest in outdoor environments. Possible reasons included hygiene habits formed during the lockdown, parents' virus-related concerns and safety issues (refer to [Figure 3](#)).

... it [the COVID-19] was an important period for them [children] because they [children] highlighted how the COVID-19 had disrupted all their healthy habits, including physical activity. (SR3)

Children's shifting attitudes after COVID-19 Pandemic		
Synthesised Interpretation	Exemplary quotes of selected codes	Interviewee reference
Children's positive attitudes towards HDAM-UGSs	<i>Some children emerged from that period of lockdown with much more engagement with nature. (NE3)</i>	MP3, SR2, EP2, MP2, SR3, EP3, NE1, MP4, NE3, NE4, NE7, NE8, NE9, MP5, NE10
Synthesised Interpretation	Exemplary quotes of selected codes	Interviewee reference
Children's negative attitudes towards HDAM-UGSs	<i>After the pandemic, there was a bit of hesitancy [for children] to go out and engage with the environment. (EP5)</i>	MP1, MP3, EP2, MP2, SR3, EP3, MP4, NE3, NE4, EP4, NE6, NE7, NE8, EP5
The possible reasons for these shifts in children's positive attitudes towards HMDA-UGS		
Synthesised Interpretation	Exemplary quotes of selected codes	Interviewee reference
Impact of children's desire for peer connection	<i>...that was strongly communicated by children regarding how much they missed their friends and teachers [during the lockdown]. (MP1)</i>	MP1, SR3, NE3, EP4
Impact of children's families' socio-economic status (house typology)	<i>They [children] were all essentially locked up in their apartments, in their high-rise buildings. (MP1)</i>	MP1, NE2
Impact of interventions (local outdoor programs) by local educators	<i>This is a big project [Play Map] where we have mapped the types of play potential [for children] within local government areas in neighbourhoods. (EP4)</i>	MP3, EP1, EP2, EP3, NE1, NE2, NE3, EP4, NE7, EP5, NE9, NE10
The possible reasons for these shifts in children's negative attitudes towards HMDA-UGS		
Synthesised Interpretation	Exemplary quotes of selected codes	Interviewee reference
Impact of parents' attitudes of resistance (concerns of the virus)	<i>There were times when we [the interviewee and children] didn't even go outside because it wasn't as safe. (NE3)</i>	SR1, EP1, NE3, EP4, NE9
Impact of children's habits cultivated during lockdown	<i>[The interviewee] think children are less inclined to want to play outside... they [children] see it as a bit dirty and messy. (NE8)</i>	MP2, NE8, NE9

Figure 3. Theme 1 – synthesised interpretation and exemplary quotes from interviewees. Source: Authors' own work

COVID-19 appeared to have changed children's play behaviours. One interviewee described how parents' daily behaviours during the lockdown influenced their children's play. The children's play patterns mirrored the habits they formed during the lockdown.

Through observing children's social play, we [the interviewees] noticed that their conversation changed. Children were pretending to scan "products" in a "shop" while playing outdoors ... imitating their parents who used barcodes to scan products during the lockdown. (NE7)

Regarding the influence of polarised attitudes of children towards HDMA-UGSs on their future growth and development, one interviewee stated that it is "too early to tell" (MP1). However, the other 19 interviewees expressed that the three-year "traumatic times" (NE1) caused those children to miss their "critical windows" and lose their "baseline" for living (MP2). COVID-19 disrupted children's current understanding of their normal daily routines, causing them to lose trust in what life should entail.

They [children] missed out on those opportunities, those traditional milestones that children would typically experience in public spaces, playgrounds, and similar environments. (MP1)

Although children's polarised attitudes indicated noticeable trends after the lockdown, three interviewees emphasised that separation between children and HDMA-UGSs existed before the occurrence of COVID-19. One interviewee stated that encouraging children to go outside was "always a big challenge" (NE6). The possible reasons for "a big challenge" included "digital devices" (EP1) as a primary distraction for children (refer to Figure 3).

4.1.2 Enhanced creativity-stimulating play with HDMA-UGSs. According to 23 interviewees, children's interest was shifting toward HDMA-UGSs within a five-kilometre radius of their homes, such as backyards – which had become their primary means of accessing UGSs (Berdejo-Espinola *et al.*, 2021). The constraints of mobility stimulated children's creativity to use limited spaces more innovatively. Six interviewees argued that children became more innovative than before COVID-19 by using nearby natural materials to play. The lockdown period provided children with a "positive time" to connect with nearby natural spaces in "creative ways" and feel more "powerful" (NE8).

It [the COVID-19] involved many children discovering what’s in their local area, which they may not have done before . . . We started noticing a significant increase in the presence of wooden sticks, cubbies, and forts in natural spaces. (EP4)

Furthermore, nine interviewees mentioned that creativity-stimulating play in nearby HDMA–UGSs catered to children’s needs for adventurous play. Children practised problem-solving by making creative choices (NE4) within the spaces that are not “overused”, “over-supervised” or “over-safe”. Eleven interviewees confirmed that such play enhanced children’s cognitive skills (see Figure 4).

. . . because they [children] are always capable of making creative choices in problem-solving, and they [children] are more connected to nature. (NE4)

Three interviewees explained the possible reasons for children’s enhanced creativity-stimulating play within HDMA–UGSs. COVID-19-related policies and interventions served as catalysts to stimulate children to utilise their creativity and access HDMA–UGSs (NE1). However, a few interviewees also highlighted that governments and parents neglected children’s play, which was a major form of exercise for them during the lockdown.

I [the interviewee] find that we [the interviewees] must invest more time in providing children with these opportunities to play and learn. They [children] lack the same foundation [about engaging with nature], which I [the interviewee] believe is due to the lockdown. (NE2)

The second reason for children’s enhanced creativity-stimulating play in HDMA–UGSs was due to social challenges from inequality, such as housing type. Creativity-stimulating natural play is typically available to children in homes with backyards or apartments with private balconies. Children without access to these private HDMA–UGSs had fewer opportunities to practice creativity and agency during COVID-19 lockdowns.

I [the interviewee] think that had to do with family and being busy working, and perhaps a lack of someone physically available to take them [children] to outdoor spaces, especially if children in urban areas don’t have a backyard. They [children] lack immediate access to outdoor spaces near their homes. (NE3)

Therefore, even though many interviewees concurred that enhanced creativity-stimulating natural play was one of the perceived changes in children’s behaviours after the COVID-19 period, this was also limited by social conditions, particularly mentioned socio-economic attributes (refer to Figure 4).

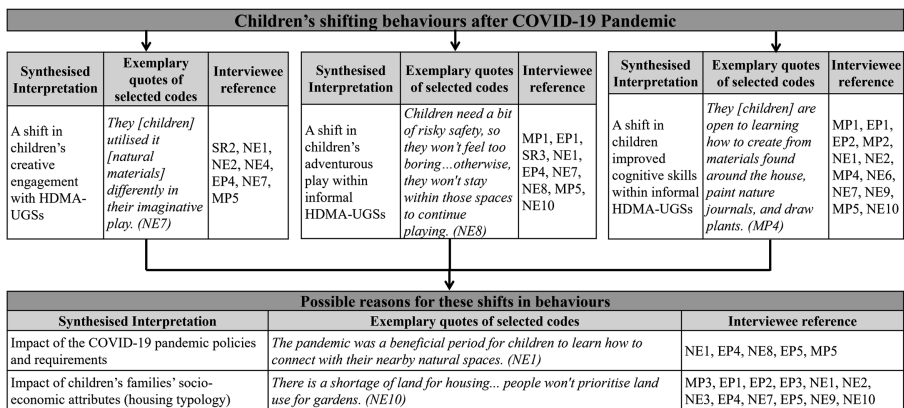


Figure 4. Theme 2 – selected coding and exemplary quotes from interviewees. Source: Authors’ own work

4.1.3 Self-driven shift of interest in neighbouring HDMA–UGSs. Based on responses from 23 interviewees, parks and playgrounds were the most frequently used UGSs before COVID-19. The closure of these HDMA–UGSs led children to prefer informal options. Neighbouring HDMA–UGSs, such as abandoned pocket parks, residual spaces, vacant lots and undeveloped creek sides, were used frequently during the lockdown. Three interviewees noted that restrictions on children’s outdoor activities resulted in more frequent visits to nearby HDMA–UGSs. This increased visitation enhanced children’s familiarity and curiosity about informal green spaces in their HDMA.

When the playground equipment was closed for a while, children started exploring any green spaces they could discover. (EP4)

Over half of the interviewees noted that children are increasingly interested in reconnecting with natural areas rather than artificial playgrounds. Five interviewees pointed out that the artificial features of formal HDMA–UGSs were already problematic before COVID-19. The excess of such features limited children’s creativity, agency and opportunities to explore nature and solve problems independently (i.e. EP3). As a result, one interviewee said it was “not surprising” that children’s interests shifted back to informal and natural spaces offering “conceptual play” (EP1).

After the COVID-19, children’s opinions [regarding HDMA-UGSs] emphasised a preference for natural spaces over playground equipment. (EP4)

Three interviewees provided examples to support the viewpoint of children’s shifting preferences from formal to informal outdoor education settings, including, for instance, a growing number of bush kindergartens. Childcare and primary educational institutions are increasingly integrating nature play and bush programs into their curriculum. Some of those institutions collaborated with the landscape industry to design outdoor classrooms (NE5) (refer to Figure 5).

The other observation I [the interviewee] have made through some of the research, surveys, and activities we’re conducting is the rising prevalence of bush kindergartens and nature playthings. (NE10)

The reasons for children’s shift in interest towards nearby HDMA–UGSs include their “biophilic” instinct to be near nature (EP2), COVID-19 policies and requirements (MP3, EP1, EP2 and EP5), and positive local interventions (MP1, MP3 and EP1-3). These interventions

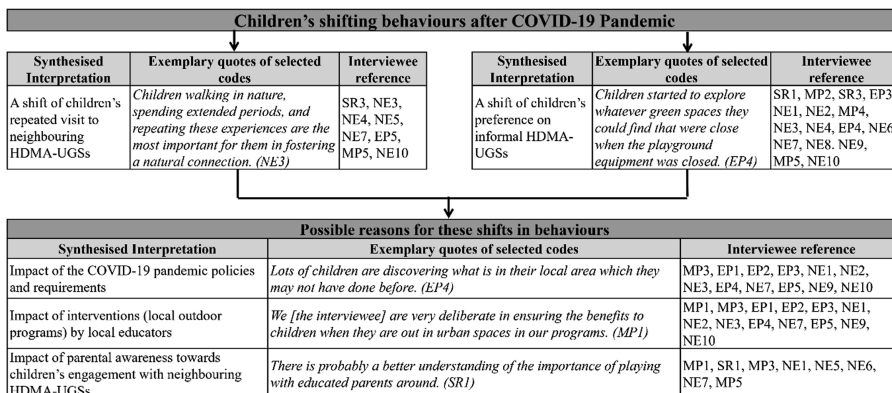


Figure 5. Theme 3 – selected coding and exemplary quotes from interviewees. Source: Authors’ own work

involved setting up interactive outdoor installations and implementing alternative programs during COVID-19.

The final reason for children's interest in nearby HDMA-UGSs is parental influence. Six interviewees noted that parents often take their children to explore these areas, which boosts their interest in places like MP1, SR1 and NE1. However, if parents consider distant HDMA-UGSs unsafe, children may lose motivation to explore those farther away.

I [the interviewee] wonder if children have lost some motivation to explore further out because they [children] may have discovered nearby places . . . I [the interviewee] believe it will depend a lot on the parents. (MP4).

4.1.4 Heightened reclamation of adult-dominated HDMA-UGSs during the lockdowns. According to 23 interviewees, COVID-19 quarantine policies reduced adults' control over HDMA-UGSs and increased children's access to these spaces. For example, one interviewee noted that children gained the right to use roads previously occupied by vehicles (MP3). Two interviewees observed that children showed greater agency by actively using various public spaces, including UGSs, during the pandemic (MP3 and SR3).

They [children] were frequently seen in their neighbourhoods, interacting with other children from nearby neighbourhoods while playing on the streets, possibly for the first time in 2 decades. (EP4).

Furthermore, five interviewees noted that COVID-19 allowed children to adjust their routines, structure their days and use accessible HDMA-UGSs (e.g. NE3 and NE8). For example, during the lockdown, children had to do home-schooling. One interviewee mentioned that some children were pleased with this, as they could organize their lunchtimes, play independently and avoid school bullying (NE5).

[Because of the COVID-19 lockdown], some of them [children] had allowed themselves to structure their days a little differently, enabling them to take breaks outdoors . . . and they adjusted their daily structure, rather than adhering to a fixed school schedule. (SR2).

As noted in [section 4.1.2](#), the policy enforcing a five-kilometre lockdown radius gave children opportunities to explore nearby HDMA-UGSs, boosting their creativity and sense of belonging. However, nine interviewees felt that parental control remained dominant within families. Eighteen interviewees observed that children's attitudes and behaviours towards HDMA-UGSs were still influenced by their parents, who retained the final say on exposing their children to "outdoor undue risk" (MP1).

Other families perhaps had more flexible working hours or could take that time, leading to increased exploration of their [children's] outdoor space, prompting them to go for walks every day. (NE3)

Moreover, there was another concern building upon the debate of parents' dominant power over children during the COVID-19. Eight interviewees pointed out that parents overlooked the significance of children's play amid the lockdown. Five interviewees emphasised that play was not being prioritised by parents, despite its fundamental importance for children during the COVID-19 pandemic. The neglect of the need for play harmed children's physical and even mental well-being (see [Figure 6](#)).

4.2 Perceived influences on children's attitudes and behaviours

This section explores the perceived influences on children's attitudes and behaviours, examining the impact of required periods of lockdown, curtailed access to formal UGSs, the deficiency of guidance from the local authority and autonomous interventions from local practitioners.

4.2.1 Lockdown requirements of a five-kilometre radius in LGAS. All 23 interviewees discussed the five-kilometre distance requirement during the COVID-19 lockdown. The

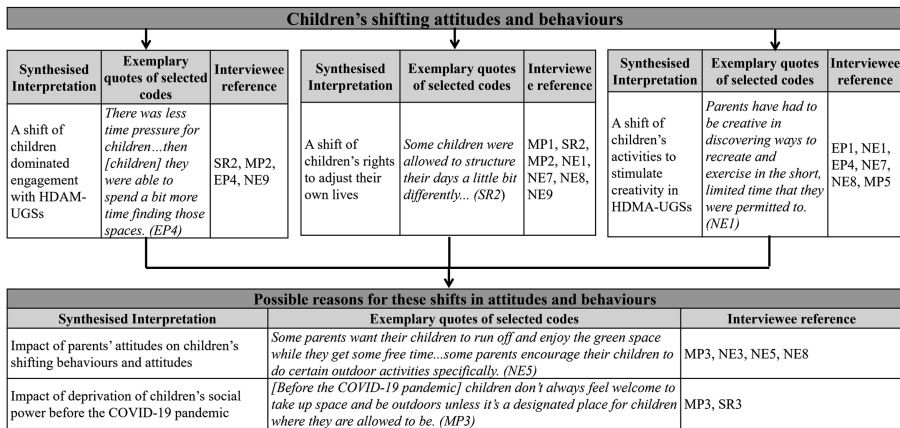


Figure 6. Theme 4 – selected coding and exemplary quotes from interviewees. Source: Authors' own work

research team identified three key aspects of this requirement in the LGAs. Firstly, six interviewees noted that staying within 5 kilometres of home positively impacted children's engagement with nature, allowing them to creatively explore nearby HDMA-UGSs and replan their outdoor activities. Secondly, the lockdowns encouraged families to help children reconnect with nature in new ways. However, 12 interviewees warned that these restrictions could cause severe mental health issues for caregivers, potentially affecting children's outdoor activities negatively. Thirdly, three interviewees mentioned that the five-kilometre radius exacerbated existing inequities, particularly for children in apartment settings without backyards, limiting their access to HDMA-UGSs. These differences show that the impact of the radius requirement depended on how children were guided in using HDMA-UGSs (refer to Figure 7).

4.2.2 Curtailed access to formal HDMA-UGSs. The closure of playgrounds during the COVID-19 lockdown influenced children's experiences with HDMA-UGSs. The research team identified three main impacts of this restricted access. First, 15 interviewees noted that formal HDMA-UGSs, especially playgrounds, were closed, limiting children's use of these spaces. Despite this, local practitioners found creative ways to connect children with nature. Second, the closure led practitioners and caregivers to focus on nearby informal HDMA-UGSs, revealing drawbacks such as safety issues, poor maintenance and overuse. This

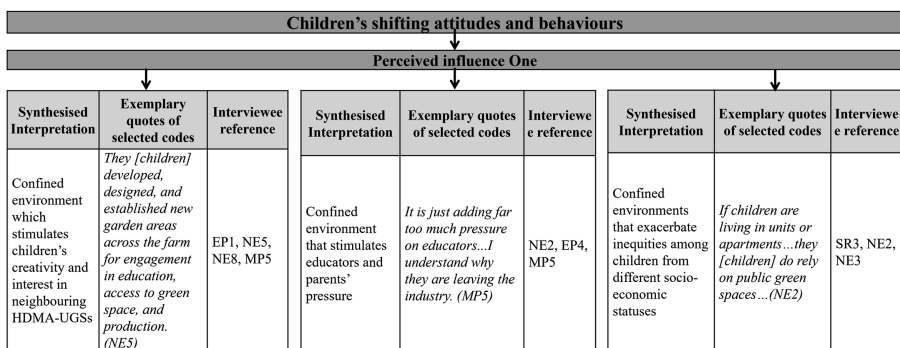


Figure 7. Synthesised interpretation of interviewees' perspectives. Source: Authors' own work

prompted policymakers to rethink children’s needs for natural and informal UGSs. Third, seven interviewees highlighted the importance of caregiver support in connecting children with informal HDMA–UGSs after the closure of formal ones, while others stressed the need for proactive measures to address parental resistance and rebuild trust in outdoor green spaces (Refer to Figure 8).

4.2.3 *Deficiency in guidance for engagement with HDMA–UGSs in LGAS.* Guidance deficiencies from government authorities influenced children’s experiences with HDMA–UGSs during COVID-19 lockdowns. The research team identified three key issues. Firstly, twelve interviewees noted positive local government measures, like funding “bush kindergartens” during COVID-19. However, the major policy led to dissatisfaction due to the closure of formal HDMA–UGSs and restrictions on children’s mobility, which some described as “inappropriate”, “criminal” and “irreversible”. Secondly, local governments failed to provide timely funding for UGSs and support for outdoor educators.

Three interviewees reported that funding shortfalls affected HDMA–UGS repairs and outdoor programs, reducing children’s access. Four interviewees noted that fewer outdoor educators increased pressure on others, further impacting program implementation and deepening the disconnection between children and HDMA–UGSs. Thirdly, seven interviewees highlighted that local government processes were ineffective during the lockdowns. Issues included a lack of multilingual information in guidelines, confusing non-English speaking families about outdoor activity permissions (refer to Figure 9).

4.2.4 *Autonomous interventions within LGAS by practitioners.* Autonomous interventions identified by practitioners within their LGAs revealed another perceived influence on UGS use. Three key aspects are discussed: technology collaboration, physical intervention and

Children’s shifting attitudes and behaviours								
Perceived influence Two								
Synthesised Interpretation	Exemplary quotes of selected codes	Interviewee reference	Synthesised Interpretation	Exemplary quotes of selected codes	Interviewee reference	Synthesised Interpretation	Exemplary quotes of selected codes	Interviewee reference
Closure of formal HDMA-UGSs suspending the provision of local practitioners	<i>During the pandemic and lockdown, we [the interviewee] were required to suspend our outdoor programs. (MP3)</i>	MP1, MP3, NE1, NE4, EP4, NE8	Closure of formal HDMA-UGSs that expose the existing drawbacks of current local regulations	<i>The local government taped up all the play equipment and locked the gates to many natural spaces...as a criminal act. (NE1)</i>	MP1, SR1, SR2, EP1, EP2, EP3, NE2, NE3, NE4, NE5, NE6, NE7, NE8, EP5, NE9, MP5, NE10	Closure of formal UGSs that stimulate the support of parents to encourage children’s outdoor engagement.	<i>Some playgrounds are very old and tattered, likely posing a significant danger to children playing on them...some parents are concerned about it. (SR2)</i>	MP1, SR1, MP3, NE1, NE5, NE6, NE7, MP5

Figure 8. Synthesised interpretation of interviewees’ perspectives. Source: Authors’ own work

Children’s shifting attitudes and behaviours								
Perceived influence Three								
Synthesised Interpretation	Exemplary quotes of selected codes	Interviewee reference	Synthesised Interpretation	Exemplary quotes of selected codes	Interviewee reference	Synthesised Interpretation	Exemplary quotes of selected codes	Interviewee reference
Deficiency in managed policy during the COVID-19 pandemic	<i>Children were at home for two years...then to ask them to go on a school camp or excursion is a big request... They [children] have become accustomed to that environment. (EP5)</i>	NE1, EP4, NE8, EP5, MP5	Deficiency in managing funding and staff pressures during the COVID-19 pandemic	<i>The grants have dried up, so we [the interviewee] couldn’t run any events. Our funding dropped to about a third, but our demand probably increased by tenfold. (EP1)</i>	MP3, EP1, NE9, MP5	Deficiency in the management of community resources and guidelines during the COVID-19 pandemic	<i>[There is a] lack of clear directives from the state government...things [of community resources about COVID-19 pandemic policy] were just available only in English. (MP3)</i>	MP3, EP1, EP4, NE8

Figure 9. Synthesised interpretation of interviewees’ perspectives. Source: Authors’ own work

family mental health support. Firstly, three interviewees noted that the Internet and digital devices distract children from interacting with HDMA–UGSs. Nine interviewees highlighted that online programs and tech-based interventions by local organizations helped children connect with UGSs. Online sessions and supplementary guides encouraged families to engage with nearby HDMA–UGSs. Secondly, four interviewees suggested using physical interventions like books, posters, and outdoor artworks to guide families to UGSs. The concept of “play streets” was mentioned as a way for children to explore creativity and bond with HDMA–UGSs. Thirdly, practitioners aimed to reduce family stress during COVID-19. Nine interviewees stressed that parental influence was crucial in shifting children’s attitudes towards HDMA–UGSs. However, lockdowns increased mental challenges for parents. Local practitioners provided support and guidance to help families recover from the crisis (refer to Figure 10).

5. Discussion and calls to action

In this section, the research team highlights the significance of the research findings in addressing the challenges faced by children, as mentioned in the introduction. This section also discusses three corresponding design strategies for HDMA–UGSs from both theoretical and practical perspectives. These strategies include improving neighbouring HDMA–UGSs, facilitating governance for adventurous play, and integrating design with digital literature.

The findings of this research reveal three significant end-user benefits when policymakers and service providers enable the calls to action discussed. These benefits include mitigating children’s extinction of experience, enhancing megacities’ biodiversity, and improving children’s resilience towards human-induced disasters. This research shows that integrating HDMA–UGSs, and adventurous play enhances children’s attachment to cope with what Pyle termed the “extinction of experience”. Creating interconnected corridors for wildlife in cities supports ecological balance and offers health benefits like stress reduction and improved air quality. Lastly, integrating UGSs and digital tools can improve community resilience to cope with future pandemics.

The findings discussed contribute to ecological system theory and its sub-theories in several ways, including affordance theory, behavioural psychology and nature deficit disorder. The findings (1) underscore the widespread applicability of affordance; (2) argue that children possess an inherent attraction towards activities involving natural-based risk, which is consistent with theories in behavioural psychology; and (3) challenge the traditionally negative perception of digital devices that is supported by nature deficit disorder. The condensed theoretical significance is depicted in Figure 11. The detailed contribution is illustrated in the following sub-sections.

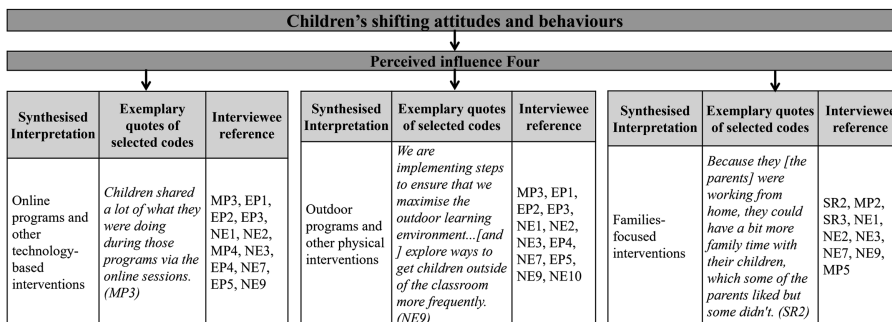


Figure 10. Synthesised interpretation of interviewees’ perspectives. Source: Authors’ own work

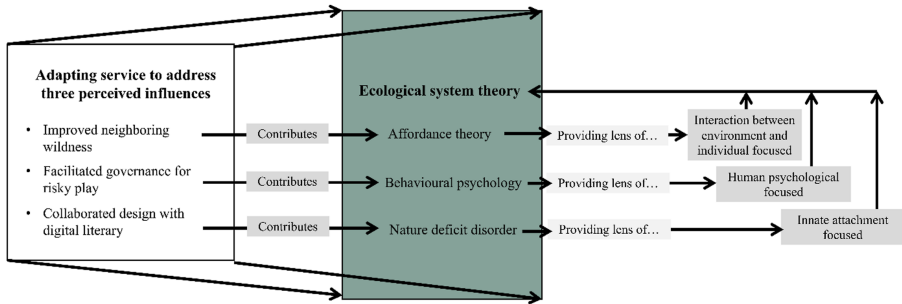


Figure 11. Finding and theory model. Source: Authors’ own work

5.1 Improve the quality of nearby HDMA–UGSs

If we can’t get out there to create it and we’re locked in a room, then that imagination and creativity that a child has precious and is lost at a young age (SR2).

From a theoretical perspective, affordance theory offers a lens to investigate how children as individuals perceive and interact with their environment (Waters, 2017). Feedback from 23 interviews of LGAs in Melbourne supplements this theory, as referred to in interviewee SR2, by emphasising deeply that “affordance” is contingent upon the specific characteristics of the environment and the needs of the individuals inhabiting a particular environment. Particularly exemplified, natural environments and spaces with loose structures significantly increase spatial affordance for children by providing them with more opportunities for exploration and imaginative play. By considering the influence of contextual features and variables on affordances for children, the findings not only broaden the sub-theory, affordance theory but also enhance the overarching theory, EST, emphasising the crucial role interconnected ecosystems play in nurturing children’s well-being.

Within the practical context, past studies examined the significance of neighbouring HDMA–UGSs during lockdown, including backyards (Das and Samanta, 2021), pocket parks (Liu and Wang, 2021) and all informal HDMA–UGSs (Gibson and Rush, 2020). By comparing relevant studies from other countries, such as Poland, South Korea and across several European cities (Sikorska et al., 2020; Kim et al., 2021; Biernacka et al., 2023). These international examples are valuable for comparison. They reflect similar urban densities, governance structures and cultural values. Together, they offer transferable insights for improving the functionality and equity of HDMA–UGSs in Melbourne and other comparable cities. They highlight opportunities to better support children’s well-being and foster more inclusive environments (Biernacka et al., 2023).

The findings of this research further indicated those positive influences. The suggestions for improving neighbouring HDMA–UGSs inform policymakers and service providers with evidence-based guidelines to further investigate the potential of those spaces. The practical directions include enhancing the richness of natural elements and biodiversity of current neighbouring HDMA–UGSs, transforming urban residual areas and abandoned areas into new neighbouring HDMA–UGSs, and integrating those spaces into the overall urban development master plan. Public health officials can also further design and conduct campaigns within those spaces to encourage local children from diverse socio-economic backgrounds and their families to engage in natural activities, thereby promoting their well-being and promoting social equity (Kabisch, 2019). In a broader scope, enhanced neighbouring HDMA–UGSs can help address land scarcity, improve ecological benefits, and better manage natural and human-made disasters.

5.2 Facilitate UGSs for adventure play

It's sort of done quite a lot of work and talking with families and people about risk and play and the importance of having risk and children being able to mitigate and analyse their own risks and their own bodies, you get that beautifully within nature spaces and natural play if kids are able to kind of challenge themselves (EP4).

On a theoretical level, the findings of this research align with theories in behavioural psychology. Feedback from 23 interviews of LGAs supplements this theory, as referred to in interviewee EP4, by emphasising the importance of managed risk over complete safety in creating an outdoor environment for children. As stated, theories in behavioural psychology suggest humans, including children, have an innate tendency to seek out and engage in activities that involve an element of risk (Tomanović and Petrović, 2010). The findings supplement the aspect of intrinsic motivation for the theory of behavioural psychology, which proposes that individuals are driven to engage in activities that provide a sense of competence, autonomy and relatedness. Building upon the intrinsic motivation, the findings not only broaden the sub-theory, which is the theory of behavioural psychology but also enhance the overarching theory, EST, by emphasising the crucial role of intrinsic agency in shaping children through their interactions with the external environment.

Within the practical context, although past studies have argued the importance of “safety” (Little and Eager, 2010), this research argued the importance of “risk”, which aligns with a few studies. There is a growing debate on the balance between making sure our children are safe versus letting them play in physically and emotionally stimulating and challenging environments (Sandseter, 2009). Children are likely to be attracted to “adventurous spaces” with durable challenges rather than ultra “safe” facilities (Brussoni *et al.*, 2012). Particularly, the current urban policy prioritises “Zero risk” for children. The suggestions of adventurous play of this research can advise policymakers and service providers to design and implement innovative interventions, and break the stereotype of “safety” standards. This finding highlights a trend of adoption of natural-based design as the approach to provide children with “risky but controlled” HDMA–UGSs and healthy risk-taking activities. Achieving this goal is required to incorporate land-use decisions, zoning regulations and green space development plans.

5.3 Integrate design with digital technology

It [COVID-19] was a very sad time for people and engagement ended up coming through technology. There were sessions and activities for children, like play sessions, conducted through technology . . . these played a vital role in children's lives, especially during the lockdown (EP3).

As stated by interviewee EP3, the findings of this research instead offer a promising strategy for addressing nature deficit disorder by leveraging digital devices to augment outdoor experiences. Within the theoretical context, the findings supplement this theory by supporting the past concept of digital nature connection, which explores the interplay between media, technology and the environment (Jones *et al.*, 2003). The findings support the need to strike a balance between digital engagement and unplugged outdoor experiences to ensure that children receive the full benefits of both realms. The findings just allow the researchers to delve into how digital devices act as a “medium” through which children engage with and experience real UGSs and explore how these technologies mediate social interactions and experiences in green spaces. The findings broaden the sub-theory “nature deficit disorder” and enhance the overarching theory of EST by emphasising the roles of digital devices within the microsystem, further highlighting its significance on children's connection with nature.

Within the practical context, although past perspectives about digital technology are often negative to children's development (Loebach *et al.*, 2021), including cognitive, social, emotional and physical development. However, this research provides different insights.

The findings align with studies focused on the opportunities for children's outdoor engagement in the "digital age" (Yin *et al.*, 2022). Some research shows that digital interventions can boost children's motivation to engage with HDMA-UGSs by enhancing their critical thinking, problem-solving skills and adaptability to their environment (Fox-Turnbull, 2019), including but not limited to Augmented Reality (AR), Virtual Reality (VR) and Artificial Intelligence (AI).

The findings of this research further contribute to the debate on whether advances in digital technology have contributed to the increased decline in child engagement with nature. Given evidence-based knowledge, policymakers and service providers can explore digital-based interventions, such as interactive playgrounds (Hodgkins *et al.*, 2008) in urban planning and landscape design to accelerate children's current engagement with HDMA-UGSs and reconnect them during future lockdowns as contingency planning (Yin *et al.*, 2022). Policymakers and service providers are encouraged to realize that digital devices are not barriers but catalysts for children's outdoor natural engagement.

6. Conclusion

In conclusion, this research reveals that Melbourne children's varied attitudes towards local HDMA-UGSs, increased creativity through natural play and shifting interests to nearby HDMA-UGSs are influenced by lockdowns, UGS closures, lack of local authority support and interventions by practitioners. To address these issues, the research suggests enhancing neighbouring HDMA-UGSs, improving governance for adventurous play and integrating digital literacy into design. The findings of this research supplement the theoretical lens of affordance theory, behavioural psychology and nature deficit disorder, supporting EST with a focus on individual experiences. Meanwhile, the findings of this research can also help tackle challenges such as the lack of UGS experiences for children, increasing urban biodiversity and increasing resilience to disasters.

The long-term influence of this research lies in providing evidence-based knowledge about how families, schools and society influence children's engagement with HDMA-UGSs during COVID-19 in Melbourne, enabling the implementation of corresponding policies and strategies to enhance children's well-being and development by reconnecting them with nature. For example, policymakers and service providers could explore incorporating interactive technologies into ecological mapping, expanding initiatives that connect nearby green spaces, and prioritising natural elements over artificial equipment in playground design. Beyond immediate design interventions, the findings suggest potential long-term shifts in how children relate to UGSs post-pandemic. These include an increased preference for unstructured, self-directed play in nature and a growing divergence in attitudes towards outdoor environments – ranging from enthusiastic engagement to lingering hesitancy. This highlights a critical opportunity for future urban planning to adopt adaptive policy frameworks that support flexible, contingency-based approaches to children's access and use of green spaces under changing social or environmental conditions. Such frameworks might include strategies for equitable distribution of nature-rich spaces, cross-sectoral emergency planning and child-informed green infrastructure development. Building on this study, future research could examine how children's polarised attitudes evolve over time and in response to different green space typologies, or how creative play in nature might influence cognitive, emotional and social development. These research directions would further clarify how to embed children's diverse needs into policy and service design in more inclusive and resilient ways.

Acknowledgments

We extend our sincere thanks to our colleagues at the Cities Research Institute and the School of Engineering and Built Environment at Griffith University for their valuable contributions and literature suggestions. This study was limited to interviews conducted exclusively with adult practitioners.

Table A1. Criteria table

Criteria	Rationale	Examples of evidence	
<i>Core criteria</i>			
<i>Interviewee meets each of these criteria</i>			
C1	Working in the School as a Teacher or Principal OR affiliated with the school through an appointed or volunteer role	Participants who work as primary education practitioners in the case study area are enabled to provide first-hand data regarding children	Participants have been shown their qualifications for teaching and organizing related programs/projects during the pandemics
C2	Working/worked (formally or informally) with children in the case study area, for more than 3 years (preceding C19)	Participants who have sufficient working experience with children	Participants have been shown their working evidence/contract for over 3 years with the relevant organizations
C3	Mastering relative knowledge in the fields of children's well-being	Participants who possess high-degree certificates and relevant teaching awards to prove their educational professions	Participants have been shown their publications, certificates and awards to prove their wide knowledge and in-depth experience with children
<i>Desirable criteria</i>			
<i>Interviewee meets one or more of these criteria</i>			
D1	Diversity	Participants who can represent a perspective and/or experience that contributes to a diversity of viewpoints regarding the topic area. This includes gender, location and cultural background	Women in leadership roles; involvement in cultural organizations to achieve an outcome
D2	Expertise in children's physical well-being, practically and theoretically, including daily behaviour patterns and commuting mobility	Participants who can be outdoor activities organizers who conduct after-school and before-school care activities AND extra-curricular local school activities etc.	Participants conducted relevant outdoor physical activities for children (i.e. local bush care, spring outings etc.)
D3	Expertise in children's mental well-being, practically and theoretically, including mental status during the pandemic	Participants who can be activity organizers who provide mental assistance to children etc.	Participants conducted children's psychological well-being focused programs/agenda/guidelines/services (i.e. school planting programs and homeschooling projects, any published agenda, strategic)
D4	Working in partnership with local families and having familiarity with local parenting culture	Chairs/representatives of the school parents' commission; Officers/researchers of local parent support services organizations	Participants provided related reports/services/programs to assist local families in protecting children
D5	Focusing on connections between children's holistic development AND outdoor space (playground; green infrastructure; outdoor play etc)	Officers/researchers of local children's rights organizations/institutions/departments	Participants conducted/advocated children's outdoor programs (i.e. Out-of-Home needs)
D6	Familiar with children's holistic development AND trauma recovery	Officers/researchers of local organizations/institutions/departments focusing on children's safety, mental health and recovery from trauma	Relative training programs/events to assist children in recovering from COVID-19

Source(s): Authors' own work

Table A2. Nine open-ended questions for semi-structured interviewsQuestions

1. As we begin, please could you tell me a little bit about yourself, regarding your current position and how long you have been working with children in Inner Melbourne?
2. Based on your personal experience and observations, have you noticed any differences in how children use the green spaces in the inner Melbourne region before and during the pandemic? Could you please describe these differences?
3. From your perspective, how accessible are green spaces in the inner Melbourne regions for children during the pandemic? Have you observed any barriers that make it challenging for them to access these green spaces?
4. Based on your observations, how did children and their families respond to the pandemic-related restrictions regarding their outdoor engagement?
5. Have you noticed any impacts, both mentally and physically, on children in the inner Melbourne region due to these changes or restrictions?
6. Does the shifting behaviour of children impact your work and responsibilities in the inner Melbourne region?
7. What challenges did you face while working with children during the pandemic?
8. Have you considered any suggestions for improving the existing green space services in the inner Melbourne region to protect children from future pandemics?
9. Based on your observations, findings or personal experience, do you anticipate that children's engagement with green spaces in the inner Melbourne region will return to their pre-COVID state?

Source(s): Authors' own work

Table A3. Interviewee perceptions about children’s attitudes, behaviours and influences

Interviewee identifier	Perceived changes in children’s attitudes and behaviours				Perceived influences on children’s attitudes and behaviours			
	Polarised attitudes to HDMA-UGSs post lockdown	Enhanced creativity-stimulating play with UGSs	Self-driven shift of interest in neighbouring HDMA-UGSs	Heightened reclamation of adult-dominated HDMA-UGSs	Lockdown requirements of a five-kilometre radius	Curtailed access to formal UGSs and facilities	Deficiency of guidance from the local authority	Autonomous interventions from local practitioners
OM1	✓	□	✓	✓	✓✓	✓	✓	✓
OM2	✓	□	□	✓	✓✓	✓	✓	✓
SR1	□	□	□	□	✓✓	✓✓	✓✓	✓✓
SR2	✓	□	□	□	✓✓	✓✓	✓✓	✓✓
SR3	✓	✓	✓	✓	✓✓	✓✓	✓✓	✓✓
DI1	□	□	□	✓	✓✓	✓✓	✓✓	✓✓
DI2	✓	□	□	□	✓✓	✓✓	✓✓	✓✓
DI3	✓	✓	✓	□	✓✓	✓✓	✓✓	✓✓
CE1	□	✓	□	□	✓✓	✓✓	✓✓	✓✓
CE2	✓	□	□	□	✓✓	✓✓	✓✓	✓✓
CE3	✓	□	□	✓	✓✓	✓✓	✓✓	✓✓
CE4	✓	✓	✓	□	✓✓	✓✓	✓✓	✓✓
CE5	✓	✓	□	□	✓✓	✓✓	✓✓	✓✓
NE1	□	✓	□	✓	✓✓	✓✓	✓✓	✓✓
NE2	✓	□	✓	✓	✓✓	✓✓	□	✓✓
NE3	✓	□	✓	✓	✓✓	✓✓	✓	✓✓
NE4	✓	✓	✓	□	✓✓	✓✓	□	✓✓
NE5	✓	□	✓	□	✓✓	✓✓	□	✓✓
NE6	✓	✓	□	□	✓✓	✓✓	□	✓✓
NE7	✓	✓	□	□	✓✓	✓	✓	✓✓
NE8	✓	✓	✓	✓	✓✓	✓	□	✓✓
NE9	✓	□	✓	□	✓✓	✓	✓	✓✓
NE10	□	□	✓	□	✓	✓	✓	✓

Note(s): ✓ Perceived ✓ Somewhat perceived × Not perceived □ Absent

Source(s): Authors’ own work

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