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## CHILDREN'S CONTACT WITH NATURE IN LOW-INCOME COMMUNITIES: PARENTS' AND TEACHERS' PERSPECTIVES

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### ABSTRACT

A growing body of literature reveals that children are spending less time in nature in recent years. Both perceived and physical accessibility to greenspaces can contribute to children's usage of these spaces, especially for low-income communities. Given the important roles of parents and teachers in children's exposure to outdoor environments, this study aims to explore how elementary school teachers' and parents' perceptions and attitudes of children's contact with nature can help us improve children's contact with nature. The study was conducted in a school in the Kansas City Public Schools district in Kansas City, Missouri and used a mixed methods approach. A spatial analysis of the school's attendance zone identified the types of greenspaces available. Then, parents (n=31) and teachers (n=20) were surveyed using multi-lingual photo-surveys that gathered their perceptions of children's contact with nature. Survey data was analyzed in SPSS 29, which included frequencies, correlations, factor and reliability analysis, and independent samples t-tests to understand the strength of factors and associations between variables. Findings revealed that children's contact with nature was limited, including the types of greenspaces children go to, the frequency of visits to greenspace, and the minimal exposure of nature during school. However, parents and teachers were aware and had positive attitudes towards the importance of contact with nature and liked all the proposed outdoor settings and activities. Factors limiting contact with nature included the need for parent supervision, curriculum, walkability, and safety concerns. These findings led to proposing a set of planning and design strategies including re-envisioning existing greenspaces, creating safe and green routes to school and greenspaces, transforming vacant lots, and updating the existing policies. Despite the small sample size, this study contributes to the growing body of literature by exploring factors associated with children's contact with nature using both spatial and social data analyses.

### Keywords

Children's wellbeing, contact with nature, parents' perceptions, teachers' perceptions, disinvested areas.

## 1 INTRODUCTION

Interacting with nature is known to provide a multitude of benefits for children including healthy physical and mental development (Clements, 2004; Hanscom & Louv, 2016; Keniger et al., 2013). However, more children are spending less time in nature. Researchers suggest a contributor to this is low accessibility of greenspaces (Clements, 2004; Soga & Gaston, 2016). This is especially prevalent among communities, including those with high levels of low-income and racially minoritized populations, where their neighborhoods have less overall vegetation cover and fewer accessible quality greenspaces (Bates et al., 2018; Strife & Downey, 2009). In addition, children's physical and mental health problems have been linked to diminished exposure to nature (Vidal & Castro Seixas, 2022).

Additional barriers for children's access to greenspace include parental concerns for safety in their neighborhoods, physical barriers such as distance, and their limited knowledge of the benefits of nature (Fernandes et al., 2023; Kytä, 2004; Vidal & Castro Seixas, 2022). Cities should offer safe, accessible places for children to be in contact with nature as more people are living in urban environments. Therefore, it is important to evaluate available greenspaces and gather community perceptions to understand how to address the challenges they face and identify opportunities to improve children's contact with nature. Parents and teachers are two adult groups who have a strong role in deciding how, where, and for how long children can be exposed to different outdoor settings. This study aims to explore these opportunities through understanding parents' and teachers' perceptions of children's contact with nature in low-income neighborhoods.

### 1.1 Greenspace equity and human wellbeing

There is an inherent human-nature connection that makes access to greenspaces essential to the health and wellbeing of people (Amoly et al., 2014; Keniger et al., 2013). Interacting with greenspaces creates a host of positive human health benefits, including improvements and maintenance of physical health, mental wellbeing, cognitive ability, and social relationships (Barton & Rogerson, 2017; Keniger et al., 2013). However, there is a growing disconnection between people and the natural environment in cities. An increasing body of evidence suggests mental and physical health problems may be associated with limited access to greenspace and contact with nature (Barton & Rogerson, 2017; Beery et al., 2023; Hadavi, 2017).

Studies have found that inequitable distribution of greenspace including distances to greenspaces and overall greenness of an area, is associated with lower socio-economic status. Low-income and racially minoritized communities often travel longer distances to greenspaces and are shown to have lower quality greenspaces in their neighborhoods (Dai, 2011; Rigolon & Flohr, 2014; Wen et al., 2013). In most of the studies, perceived close distance from green spaces ranges from five to fifteen minutes of walk (e.g., Hadavi, 2017; Leslie et al., 2010). Others have found that some low socio-economic and minoritized populations may have nearby parks and other greenspaces, yet the quality, safety, available amenities, and acreage were lacking and was influential on people's perceptions and limited usage of those spaces (Fernandes et al., 2023; Rigolon, 2016). In addition, where greenspace is minimal, there is greater risk of environmental hazards due to reduced essential ecosystem services (i.e., reducing pollution or temperatures) that can impact people's health and wellbeing. Many disadvantaged communities have been found to have lower life expectancies, increased risk for chronic diseases, less physical activities, and have a lower quality of life (Barton & Rogerson, 2017; Wen et al., 2013).

### 1.2 Children's contact with nature

Environmental inequities are especially concerning for their impacts on children's health and wellbeing. Children's physical environments can have serious, life-long psychological and physical health impacts in their development (Hanscom & Louv, 2016; Strife & Downey, 2009; Sunyer et al., 2015). As cities become more dense, children are living in environments with limited greenspaces and diminished contact with nature (Rigolon, 2016; Rigolon & Flohr, 2014; Strife & Downey, 2009). It is important to consider the value of equitable and frequent access to greenspaces for children.

Childhood is the critical time of exploration, learning and growing, and it is thought that being outdoors in nature is ideal for healthy childhood development (Souter-Brown, 2015). Nature provides many opportunities to engage and stimulate the senses, challenge and develop cognitive skills and motor

functions (Clements, 2004; Hanscom & Louv, 2016; Moore, 1974; Souter-Brown, 2015). While nature challenges children, it is also a calming, stress-reducing environment (Hanscom & Louv, 2016). In contrast, the built environment has been found to overstimulate and overwhelm children with its busyness and noise (Alvarsson et al., 2010; Hanscom & Louv, 2016). There is evidence of improvements to mental health, cognitive functioning, and physical health in children who are regularly exposed to greenspaces (Amoly et al., 2014).

Students have been found to be more engaged in learning, improved academically, and have better social skills when taught outdoors in nature (Mann et al., 2022). Some studies have also found greater levels of greenness surrounding schools, and even as little as a window view to greenspace, to improve student academic performance, reduce stress, and increase attention (Dadvand et al., 2017; Wu et al., 2014). Furthermore, the level of greenness around schools can influence air pollution levels, which is shown to impact brain development and cognitive functions (Dadvand et al., 2017; Sunyer et al., 2015).

### **1.3 Challenges to children's contact with nature**

Over time, children's ability to freely navigate their outdoor environments and access greenspaces have been restricted (Clements, 2004; Kytä, 2004; Vidal & Castro Seixas, 2022). Compared to past generations, children today are growing up indoors, spend time doing sedentary activities (i.e., screen-based activities), and have less free time from increased pressure of education-related activities (Clements, 2004; Souter-Brown, 2015; Vidal & Castro Seixas, 2022). Researchers suggest that children's accessibility and usage of greenspaces is impacted by a multitude of factors such as availability and proximity of greenspaces, parent restrictions, safety, quality and design of greenspaces, environmental hazards, limited education of nature, and awareness of the benefits of being in greenspaces (Clements, 2004; Dai, 2011; Kytä, 2004; Rigolon & Flohr, 2014; Vidal & Castro Seixas, 2022). In addition, children have been historically left out of urban policies, where children's rights and needs have not been considered in urban planning decisions (Vidal & Castro Seixas, 2022). Children need a diversity of play environments that support both structured and unstructured play opportunities in natural settings to meet their developmental needs (Rigolon & Flohr, 2014; Skar et al., 2016).

### **1.4 Contact with nature in schools**

Researchers suggest that greening schoolyards can be a solution to provide children access to greenspace because children spend much of their time on school property (Bikomeye et al., 2021; Children & Nature Network, n.d; Schulman & Peters, 2008). Green schoolyards have shown to increase children's physical activity, created more positive social interactions, improved community perceptions of safety, and created better community relations (Bates et al., 2018; Bikomeye et al., 2021; Bohnert et al., 2022). Green schoolyards may provide safe, accessible greenspace for children's contact with nature; however, there are barriers that make greening schoolyards difficult or not desirable in some communities.

Some studies have reported that teachers find it difficult to incorporate outdoor lessons in the green schoolyard because they do not have the knowledge or training to incorporate using the green schoolyard elements in the curriculum (Bohnert et al., 2022). Another barrier is that natural play elements are viewed as unsafe because they are thought to be unpredictable, cause obstruction to sight lines, and create higher potential for injury (Dyment & Bell, 2008). Additionally, usage outside of school may be reduced for children that rely on a school bus for transportation to the school or from parent permission (Bates et al., 2018; Bohnert et al., 2022). The most apparent restriction that prevents green schoolyards is acquiring funding (Schulman & Peters, 2008). School funds are often limited, especially in low-income areas, and landscape maintenance is often costly (Schulman & Peters, 2008). Although green schoolyards have been well-researched for their benefits and potential for providing accessible greenspace, fewer studies have investigated potential use of *nearby* greenspaces during school. Proximity is an important factor that is influential to schools' frequency of use of nearby greenspaces, while there are other factors such as teacher preferences and the curriculum, that need to be considered as well (Beery et al., 2023).

### **1.5 The roles of parents and teachers**

Because young children are increasingly becoming more dependent on parents, researchers suggest that parents' perceptions are a major factor to children's exposure to greenspaces (Veitch et al., 2006). Current research, although limited, consists of parents' perceptions of safety and impacts on children's access to greenspaces (Clements, 2004; Sefcik et al., 2019). The dependence of children on parents is

plausibly transferred to teachers during school hours. Therefore, to understand the larger issue of children's limited contact with nature, it is important to focus on the settings that children spend most of their time – schools and residential neighborhoods – and gather *both* parents' and teachers' perceptions of children's exposure to nature (Beery et al., 2023).

Studies that have surveyed parents often use five-point Likert scale questions about various barriers to access nearby nature (Skar et al., 2016). These include physical and social factors such as access (i.e., number of greenspaces near home), concerns for traffic, lack of walkways, role of institutions (i.e., school), role of parents, attitudes, time pressures, and safety (Skar et al., 2016; Veitch et al., 2006). For example, researchers found that a parent's perception of safety of physical park features and quality of the park, determines if their children will have contact with them (Sefcik et al., 2019; Veitch et al., 2006). Parents have also reported fearing crime and safety issues in the area contributed to their children spending less time outdoors (Clements, 2004; Sefcik et al., 2019; Skar et al., 2016; Veitch et al., 2006).

Parents may also need to supervise their children at greenspaces, which can be difficult to find time for (Clements, 2004; Skar et al., 2016; Veitch et al., 2006). Another factor to consider, are parents' knowledge of the benefits of nature for children and how their own preferences (i.e., dislike of things associated with nature such as insects) influence their children's contact with nature (Sefcik et al., 2019; Skar et al., 2016). In addition, when asked what could encourage more time in nature, parents suggested better availability of greenspaces and facilitation (i.e., signage, paths, nature playgrounds) of nature spaces for their children (Skar et al., 2016; Veitch et al., 2006). They also believed that institutions including kindergartens, before/after school care, and schools need to play a larger role in facilitating time in nature and organize more activities outdoors (Skar et al., 2016).

## 1.6 Research objectives

While previous studies have explored several aspects of children's contact with nature through teacher's or parents' perspectives separately, there are not any studies that comprehensively explore the perceptions of these two groups and compare their attitudes and preferences for children's contact with nature. To have a more inclusive approach to improve children's contact with nature, considering both influential groups is essential. Failing to include either of these groups may lead to a partial understanding of the issue. Further, as discussed, exploring this issue in low-income and disinvested areas is even more important due to the pressing need of children to access quality greenspaces in such areas. In this study, nature is referred to a variety of greenspaces that may include combinations of trees, lawns, shrubs, or garden plants that would shape outdoor environments with diverse environmental affordances such as neighborhood parks, athletic parks, community gardens or nature parks. Also, in this study, low-income is referred to areas that contain households with two median income levels of below \$30,000 and between \$30,000 to \$60,000.

Building upon the literature on children's access to greenspace and contact with nature, this study focuses on school attendance zones in the historically disinvested areas of Kansas City, MO to explore the answer to the following question: *How can parents' and teachers' perceptions and attitudes of greenspace accessibility inform recommendations to improve children's contact with nature?*

To address this question, this study utilizes both qualitative and quantitative approaches through spatial and social data analysis of greenspace accessibility in the areas where children spend most of their time – neighborhoods and schools. This study seeks to understand not only what greenspaces are available in these neighborhoods and nearby the schools but explores parents' and teachers' perceptions of children's greenspace accessibility to address the challenges they face. More specifically, it examines parents' and teachers' perceived accessibility of diverse types of nearby greenspaces, frequency of use of those spaces by children, and barriers to use of such spaces. Additionally, it explores and compares attitudes towards and awareness of the value of contact with nature for children among parents and teachers as well as their preferences for different types of environments children should be able to use.

Ultimately, it is expected that the findings of this study inform place-based design recommendations for improving children's contact with nature for communities most in need in Kansas City to be shared with schools by researchers.



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## 2 METHODS

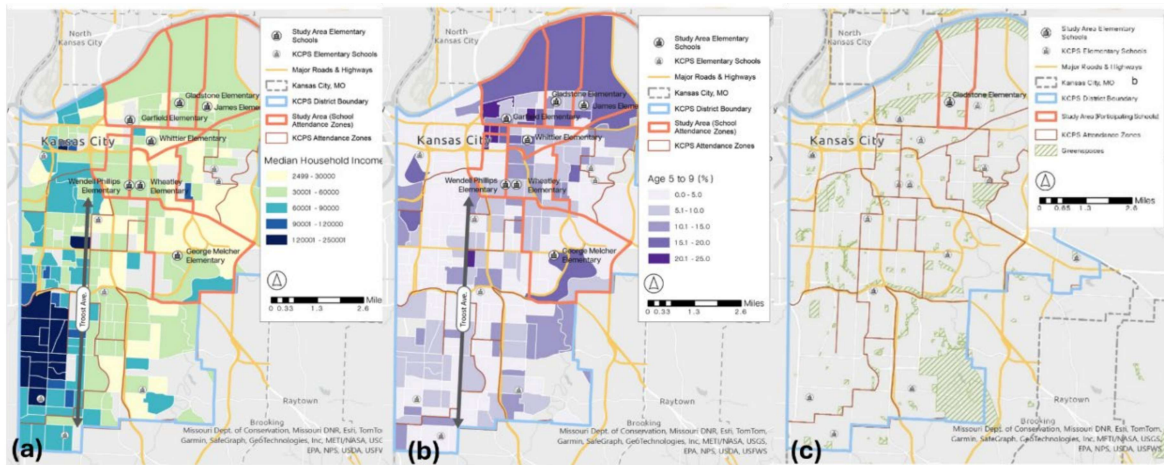
### 2.1 Study area and selection of school zone

With its historical redlining, which involved school attendance boundaries, Kansas City, Missouri remains one of the most racially segregated cities in the United States (González-Pérez, 2021). Many decades after the racist zoning practices, the Troost Avenue is still a social and conceptual barrier for equitable urban development. There is a correlation between areas on the east side of Troost with high percentage of minoritized ethnic and racial groups and current dynamics and indicators of urban inequality such as mean income, quality of housing, as well as criminalization and evictions. Therefore, racially minoritized communities on the east side of the city, still face structural and spatial inequalities that have negatively impacted their quality of life (González-Pérez, 2021). Because of this, Northeast Kansas City serves as a suitable case for exploring children's access and contact with nature in low-income communities.

To select potential elementary schools, in this area, spatial analysis of socio-demographics at the block group level was used to initially identify four school attendance zones within the KC Public Schools district boundaries. The two socio-demographic factors used to select potential schools were median household income (\$2,499 to \$30,000 and \$30,001 to \$60,000) and highest percent of population between 5 and 10 years old. Seven total potential schools were identified: Garfield Elementary School, Whittier Elementary School, Gladstone Elementary School, James Elementary School, Wheatley Elementary, Wendell Phillips Elementary, and George Melcher Elementary. Among these schools that we reached out to, Gladstone Elementary School was the only school that accepted to participate in this study (See Figure 1).

The broader context of the school includes a mix of residential, commercial, and institutional zones, contributing to a diverse community. Gladstone Elementary is located near several major roads and highways that provide easy access to the school, such as U.S. Route 71 and local streets like Gladstone Boulevard. The area around the school includes a variety of local businesses, ranging from small shops and restaurants to larger retail stores and service providers. The commercial presence is typically representative of a mixed-use urban area. The percentage of population between 5-9 years old in a major part of this school's attendance zone ranges between 15 to 20 percent.

Gladstone Elementary School contains two playgrounds that have a concrete area with basketball hoops, standard playgrounds, and a small mown grass area. There are two fenced-in areas that appear to be mown grass drainage areas. There are a few trees that are located on the perimeters of the school grounds. The school is situated by two greenspaces, including a 300-acre nature park (Kessler Park) within a ¼ mile, or 10-minute walk, and a 26-acre neighborhood park (Budd Park) around a ½ mile, or 15-20 minutes' walk. Both parks are in a state of decline, with less frequent maintenance, and in need of repairs and renovation.



**Figure 1. a) Median household income in Kansas City Public Schools district boundaries; b) Percent of population between 5 and 10 in KCPS district boundaries; c) Gladstone School's attendance zone. Maps by Emily Moore.**

## 2.2 Survey instrument

Two separate photo-surveys on a five-point rating scale were designed for parents and teachers. Most questions were similar in both surveys, however, the teachers' survey included questions about curriculum and outdoor teaching. Surveys were provided online for both parents and teachers through Qualtrics. For parents, surveys were offered in four languages including English, Spanish, Swahili, and Burmese to be inclusive of the entire target population.

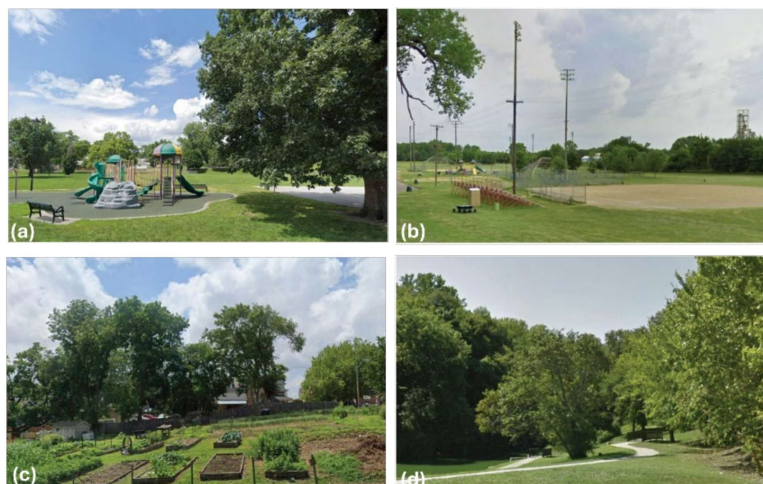
Two sets of photos were included in the surveys. One set depicted a variety of existing types of green spaces in the attendance zone to examine participants' perceptions of what is available, frequency of use, and barriers to use such space. These greenspaces included neighborhood park, athletic park, garden, and nature park, which were identified through on-site observations and spatial analysis (See Figure 2). Key features of each of these types of green spaces are listed below:

**Neighborhood park:** playground, athletic courts, picnic shelters, paved walking paths, open fields, water fountains, community pool/splash pad, scattered tree cover, maintained landscape, and benches.

**Athletic park:** Turf fields, sports infrastructure, low tree cover, maintained landscape, athletic courts, and track.

**Nature park:** Densely wooded area, prairie/meadows, body of water, nature trails, and minimal landscape maintenance.

**Gardens:** Vegetable gardens, pollinator gardens, garden beds, gardening equipment and storage.



**Figure 2. Existing green space types: a) Neighborhood park; b) Athletic park; c) Garden; d) Nature park. Photos by Emily Moore.**

The other photo set included proposed children's outdoor settings with a variety of environmental attributes and affordances to capture participants' preferences for what they would like to have available for children to use. The selection of images was based on the variety of outdoor activities that would meet the needs of elementary school children including outdoor classrooms, structured and unstructured spaces for physical activities and sports, adventures, and group creative activities. Other items in the survey captured participants' awareness and attitudes towards children's contact with nature (See Figure 3).

Attitudes towards children's contact with nature included the importance of contact with nature, time that should be spent in nature, and importance of outdoor learning in schools. Awareness was defined as knowledge about mental, behavioral, and physical health benefits of contact with nature. For perceived barriers that may negatively influence children's time and quality of experience in greenspace, walkability, proximity, and safety were included. Surveys for schools gathered more information on teachers' preferences for outdoor or nature-based learning and challenges in the school system.





**Figure 3. Proposed outdoor settings and activities to capture parents' and teachers' preferences:**  
 a) Outdoor classroom; b) Nature trail; c) Playground; d) Athletic field; e) Forest; f) Nature playground

### 2.3 Target population, recruitment, and sample specifications

The target population for this study included the parents and teachers of children/students in kindergarten through sixth grade at Gladstone Elementary School. The total number of students whose parents were targeted was 398 while the total number of teachers was 22. Parents were recruited through an online flyer that was shared by the school administration through the schools' internal, multilingual communication service called Talking Points. The flyer included an introduction to the study, instructions for the survey, and a link to the online survey. Teachers received an email sent out by the school administration with the link to fill out their survey online. To increase survey responses, reminder messages were sent out by the school administration and the timeframe for collecting data was extended.

A sample size of 51 participated in this study including 31 parents (response rate nearly 8%) and 20 teachers (response rate nearly 91%). Most participants that completed the parent version of the survey were mothers/stepmothers (71%), identified as female (74.2%), married (71%), between 30-39 years old (45.2%), Hispanic (54.8%) or white (16.1%), owned at least one car (87.1%), a highest level education being high school (54.8%) or some college (16.1%), and had a total household income less than \$25,000 (32.3%) or between \$25,000 and \$35,000 (19.4%). About 19% of parents had one child with special needs or neurodiversity, and 6.5% with one child with a physical disability. In addition, many parents chose to drive their children to school (58.1%), or children walked with adults (19.4%). Travel time to school was primarily less than 5 minutes (32.3%) or between 5 and 10 minutes (41.9%). Most participants that completed the teacher version of the survey ( $n=20$ ) were female (85%), 30 years old or more (75%), white (70%), highest level of education being a Master's (55%) or Bachelor's degree (35%) and had a total household income of \$50,001 or more (70%).

### 2.4 Statistical analysis

The collected data from the surveys was imported to SPSS (version 29) software for analysis. Data analyses include frequencies, Pearson correlations (to see the potential associations between variables), factor analysis (to see if some items cluster together based on high correlations), reliability tests (to see if the clusters shaped through factor analysis were statistically reliable and were not clustered by accident), and independent sample t-tests (to see if there are statistically significant differences between parents' and teachers' responses) to understand the strength of and associations between different factors that may be related to children's contact with nature. For the purposes of this study, mean values were categorized as low (mean = 1.0 – 2.0), moderately low (mean = 2.1 – 3.0), moderately high (mean = 3.1 – 4.0), and high (mean = 4.1 – 5.0). It should be acknowledged that due to the small sample size, the strength and generalizability of the statistical analysis results was limited, however, it is still worthwhile to share as this study provides a basis for how gathering both parent and teacher perceptions of children's

access to nature can shed light on potential planning and design solutions to improve children's contact with nature.

**Variables.** There are three overarching variables being measured: attitudes, awareness, and barriers. For the purposes of this study, attitudes were the participants' feelings towards children's contact with nature (i.e., importance of contact with nature, nature-based learning, types of outdoor settings, and activities). Awareness was defined as the participants' knowledge towards the benefits of nature including the physical, mental/emotional, behavioral, and cognitive benefits. Barriers were defined as walkability, safety, and school-specific factors that may limit children's contact with nature.

### 3 RESULTS

#### 3.1 Greenspace types, frequency of and barriers to use

**Perceived proximity to greenspace types.** Parents reported that they had neighborhood parks (mean = 3.48) and athletic parks (mean = 3.32) nearby with moderately high mean values, while they disagreed that they had nature parks (mean = 2.81) or gardens (mean = 1.87) nearby with moderately low mean values. Teachers, however, perceived neighborhood parks (mean = 3.00) and nature parks (mean = 2.65) to be nearby the school with a moderate mean value, whereas gardens (mean = 2.35) and athletic parks (mean = 1.35) were reported not to be nearby the school with moderately low and low mean values.

These findings were compared with the greenspace availability assessment that identified one nature park and one neighborhood park within  $\frac{1}{4}$  and  $\frac{1}{2}$  radius of the school. It is also important to note that although parents said they lived close to an athletic park, there were no athletic parks identified by the greenspace availability analysis in the immediate school attendance zone. It was possible the image representing the athletic park was associated with the neighborhood park in the area since they contain some similar features, or it was an athletic park outside the school attendance zone.

#### **Frequency of taking children/students to greenspaces and the barriers that may influence it.**

Parents take their children most often to neighborhood parks (mean = 3.48), sometimes to nature parks (mean = 2.94) and athletic parks (mean = 2.55) and rarely to never to gardens (mean = 1.94). Parents' frequency of taking their children to greenspaces and potential barriers to do so were explored for correlations to see if specific barriers may play a role in how frequently parents take their children to greenspaces. Pearson bivariate correlations were conducted and only a few statistically significant correlations were found (See Table 1). For neighborhood parks, how frequently parents take their children there was significantly negatively correlated with 'unsafe street crossings' ( $r = -.392, p = .032$ ) and 'safety concerns in the area' ( $r = -.366, p = .047$ ). Similarly, how frequently parents take their children to athletic parks was negatively correlated with 'unsafe street crossings' ( $r = -.381, p = .038$ ). No statistically significant correlations were found for the frequency of taking children to gardens or nature parks and any of the barriers. However, across the greenspace types, there were moderately high mean values for 'safety concerns in the area' as a barrier. In addition, 'distance from home,' was moderately high as a barrier for visiting gardens. All other mean values for barriers were moderately low.

Parents also reported that their children never or rarely go to any of the greenspace types by themselves or with friends, as all mean values were below 2.0. The mean values for parents' comfort with their children going to greenspaces by themselves or with friends was also below 2.0. Pearson correlation showed that there was a significant positive correlation between these two variables, where parents' comfort was meaningfully associated with children going to greenspaces by themselves or with friends. Parents were also not comfortable with their children playing unsupervised before or after school in public greenspaces near the school (mean = 2.03).

The mean value for how frequently teachers took students to any of the greenspace types was below 2.00, which indicates that most teachers never to rarely take their children to these types of greenspaces. However, the mean values for how comfortable they felt taking their students to neighborhood parks, athletic parks, and gardens (means = 3.1 – 4.0) were moderately high and nature parks was moderately low (mean = 2.85).

Like parents, how frequently teachers take their students to neighborhood parks was significantly negatively correlated with 'safety concerns in the area' ( $r = -.455, p = .044$ ). As shown in Table 1,

teachers' comfort taking their students to neighborhood parks was also negatively correlated with 'safety concerns in the area' ( $r = -.472, p = .036$ ) and 'injury concerns' ( $r = -.564, p = .010$ ). There were not statistically significant correlations between how frequently teachers take their students to athletic parks and barriers to do so. However, the teacher's comfort in taking students to athletic parks was negatively correlated with 'unsafe street crossings' ( $r = -.469, p = .037$ ) and 'injury concerns' ( $r = -.710, p < .001$ ). Barriers that may prevent how frequently teachers take their students to gardens include 'lack of time' ( $r = -.535, p = .015$ ), 'distance from school' ( $r = -.541, p = .014$ ), 'unsafe or disconnected sidewalks to get there' ( $r = -.525, p = .018$ ), 'unsafe street crossings' ( $r = -.572, p = .010$ ), and 'safety concerns in the area' ( $r = -.466, p = .038$ ). There were also significant negative correlations with how comfortable teachers were taking students to gardens and barriers such as 'unsafe or disconnected sidewalks to get there' ( $r = -.595, p = .006$ ), 'unsafe street crossings' ( $r = -.750, p < .001$ ), 'safety concerns in the area' ( $r = -.600, p = .005$ ), and 'injury concerns' ( $r = -.564, p = .012$ ). For nature parks, frequency of taking students by teachers was only negatively correlated with 'distance from school' ( $r = -.501, p = .029$ ). Comfort in taking students to nature parks was negatively correlated with 'unsafe or disconnected sidewalks to get there' ( $r = -.459, p = .042$ ) and unsafe street crossings ( $r = -.509, p = .022$ ).

Across the greenspace types, many barriers for parents and teachers taking their children/students to greenspaces were significantly positively correlated with each other. These correlations show that these barriers may be related and contribute to the overall system of walkability and safety issues. For example, as distance becomes more of a barrier, barriers such as unsafe sidewalks become more of an issue. It is important to address these issues as a collective to reduce negative perceptions of accessibility to greenspaces.

**Difference between parents and teachers.** A series of independent samples t-tests were run to check differences in mean values for frequency of taking children/students to greenspaces by parents versus teacher, and the barriers to do so. The effect size for each test was measured through Cohen's d calculation (See Tables 2 and 3).

**Frequency of use.** The independent samples t-tests showed statistical significance with how frequently parents versus teachers take their children/students to neighborhood parks ( $t = 5.247, p < .001$ ), athletic parks ( $t = 5.796, p < .001$ ), and nature parks ( $t = 5.432, p < .001$ ). The effect sizes were high for these test results (Cohen's  $d > 0.7$ ). Parents reported taking their children to these greenspaces more often, especially to neighborhood parks which had a moderately high mean value; however, the mean values for nature parks and athletic parks were still within the moderately low range. Teachers reported to take their students to these greenspaces rarely to never, indicated by the low mean values. There was no statistical significance for how frequently parents and teachers take their children/students to gardens. Both mean values were below 2.00, meaning most parents and teachers do not take their children/students to gardens (Table 2).

**Neighborhood park barriers.** As shown in Table 3, for neighborhood parks, differences between parents and teachers regarding barriers of 'lack of time' ( $t = -3.122, p = .003$ ) and 'distance from school/home' ( $t = -2.980, p = .006$ ) were statistically significant with high effect sizes (Cohen's  $d > .7$ ). 'Lack of time' and 'distance from school/home' were moderately high barriers for teachers taking their students to neighborhood parks and moderately low barriers for parents. The differences in 'unsafe or disconnected sidewalks', 'unsafe street crossings', 'safety concerns in the area', and 'injury concerns' were not statistically significant. Both parents and teachers reported that 'unsafe street crossings,' and 'safety concerns in the area' were moderately high barriers. 'Unsafe or disconnected sidewalks,' and 'injury concerns,' were moderately low barriers.

**Table 1. Correlations between frequency of visits to different types of greenspaces and perceived barriers by parents and teachers**

| <b>Parents</b>                                                            |                          |                             |                                               |                        |                             |                 |  |
|---------------------------------------------------------------------------|--------------------------|-----------------------------|-----------------------------------------------|------------------------|-----------------------------|-----------------|--|
| How frequently do you take your children to public greenspaces like this? | Barriers<br>Lack of time | Distance from <u>home</u>   | Unsafe or disconnected sidewalks to get there | Unsafe street crossing | Safety concerns in the area | Injury concerns |  |
| <i>Neighborhood Parks</i>                                                 |                          |                             |                                               |                        |                             |                 |  |
| Pearson                                                                   | -.057                    | -.154                       | -.336                                         | -.392*                 | -.366*                      | -.174           |  |
| Correlation                                                               | .776                     | .417                        | .069                                          | .032                   | .047                        | .362            |  |
| Sig. (two-tailed)                                                         |                          |                             |                                               |                        |                             |                 |  |
| <i>Athletic Parks</i>                                                     |                          |                             |                                               |                        |                             |                 |  |
| Pearson                                                                   | .393*                    | -.137                       | -.196                                         | -.381*                 | -.317                       | -.138           |  |
| Correlation                                                               | .029                     | .471                        | .298                                          | .038                   | .082                        | .467            |  |
| Sig. (two-tailed)                                                         |                          |                             |                                               |                        |                             |                 |  |
| <i>Gardens</i>                                                            |                          |                             |                                               |                        |                             |                 |  |
| Pearson                                                                   | .289                     | .084                        | .099                                          | .160                   | .000                        | .213            |  |
| Correlation                                                               | .115                     | .664                        | .617                                          | .417                   | 1.000                       | .277            |  |
| Sig. (two-tailed)                                                         |                          |                             |                                               |                        |                             |                 |  |
| <i>Nature Parks</i>                                                       |                          |                             |                                               |                        |                             |                 |  |
| Pearson                                                                   | .053                     | -.048                       | -.041                                         | -.156                  | -.206                       | .117            |  |
| Correlation                                                               | .780                     | .802                        | .828                                          | .419                   | .274                        | .552            |  |
| Sig. (two-tailed)                                                         |                          |                             |                                               |                        |                             |                 |  |
| <b>Teachers</b>                                                           |                          |                             |                                               |                        |                             |                 |  |
| How frequently do you take your students to public greenspaces like this? | Barriers<br>Lack of time | Distance from <u>school</u> | Unsafe or disconnected sidewalks to get there | Unsafe street crossing | Safety concerns in the area | Injury concerns |  |
| <i>Neighborhood Parks</i>                                                 |                          |                             |                                               |                        |                             |                 |  |
| Pearson                                                                   | -.119                    | -.436                       | -.347                                         | -.323                  | -.455*                      | -.299           |  |
| Correlation                                                               | .617                     | .055                        | .134                                          | .164                   | .044                        | .200            |  |
| Sig. (two-tailed)                                                         |                          |                             |                                               |                        |                             |                 |  |
| <i>Athletic Parks</i>                                                     |                          |                             |                                               |                        |                             |                 |  |
| Pearson                                                                   | -.218                    | -.250                       | .062                                          | .089                   | .052                        | .055            |  |
| Correlation                                                               | .355                     | .288                        | .795                                          | .710                   | .828                        | .818            |  |
| Sig. (two-tailed)                                                         |                          |                             |                                               |                        |                             |                 |  |
| <i>Gardens</i>                                                            |                          |                             |                                               |                        |                             |                 |  |
| Pearson                                                                   | -.535*                   | -.541*                      | -.525*                                        | -.572*                 | -.466*                      | -.195           |  |
| Correlation                                                               | .015                     | .014                        | .018                                          | .010                   | .038                        | .423            |  |
| Sig. (two-tailed)                                                         |                          |                             |                                               |                        |                             |                 |  |
| <i>Nature Parks</i>                                                       |                          |                             |                                               |                        |                             |                 |  |
| Pearson                                                                   | -.319                    | -.501*                      | -.238                                         | -.244                  | -.099                       | .177            |  |
| Correlation                                                               | .170                     | .029                        | .312                                          | .301                   | .687                        | .467            |  |
| Sig. (two-tailed)                                                         |                          |                             |                                               |                        |                             |                 |  |

\*Statistically significant at 0.05 level.

*Athletic park barriers.* For athletic parks, the difference between parents and teachers regarding barriers such as 'lack of time' ( $t = -3.624, p < .001$ ), 'distance from school/home' ( $t = -5.450, p < .001$ ), and 'unsafe or disconnected sidewalks to get there' ( $t = -2.467, p = .017$ ) were statistically significant with high effect sizes (Cohen's  $d > 0.7$ ). These barriers were reported as moderately high to high mean values by teachers and moderately low by parents. There were not statistically significant differences between

parents and teachers in terms of 'unsafe street crossings', 'safety concerns in the area', and 'injury concerns'. 'Unsafe street crossings' and 'safety concerns in the area' were both moderately high barriers while 'injury concerns,' was moderately low.

**Table 2. Differences between parents and teachers regarding frequency of visits to different types of greenspaces**

| How frequently do you take your children/students to public greenspaces like this? (95% confidence interval) |          |  |              |
|--------------------------------------------------------------------------------------------------------------|----------|--|--------------|
| <i>Neighborhood Parks</i>                                                                                    |          |  |              |
| t – value                                                                                                    |          |  | 5.247**      |
| two-sided <i>p</i>                                                                                           |          |  | <.001        |
| df                                                                                                           |          |  | 49           |
| Mean                                                                                                         | Parents  |  | 3.45 (1.234) |
|                                                                                                              | Teachers |  | 1.65 (1.137) |
| <i>Athletic Parks</i>                                                                                        |          |  |              |
| t – value                                                                                                    |          |  | 4.746**      |
| two-sided <i>p</i>                                                                                           |          |  | <.001        |
| df                                                                                                           |          |  | 49           |
| Mean                                                                                                         | Parents  |  | 2.55 (1.338) |
|                                                                                                              | Teachers |  | 1.10 (.308)  |
| <i>Gardens</i>                                                                                               |          |  |              |
| t – value                                                                                                    |          |  | .830         |
| two-sided <i>p</i>                                                                                           |          |  | .410         |
| df                                                                                                           |          |  | 49           |
| Mean                                                                                                         | Parents  |  | 1.94 (1.124) |
|                                                                                                              | Teachers |  | 1.65 (1.309) |
| <i>Nature Parks</i>                                                                                          |          |  |              |
| t – value                                                                                                    |          |  | 4.893**      |
| two-sided <i>p</i>                                                                                           |          |  | <.001        |
| df                                                                                                           |          |  | 49           |
| Mean (SD <sup>a</sup> )                                                                                      | Parents  |  | 2.94 (1.263) |
|                                                                                                              | Teachers |  | 1.40 (.754)  |
| <sup>a</sup> Standard deviation; **Statistically significant at 0.005 level.                                 |          |  |              |

*Garden barriers.* Besides 'lack of time,' being a higher barrier for teachers, there were no statistically significant differences in barriers for parents and teachers taking their children/students to gardens; meaning, they answered similarly. 'Distance from home/school,' was a moderately high barrier while 'unsafe or disconnected sidewalks,' 'unsafe street crossings,' 'safety concerns in the area,' and 'injury concerns' were moderately low.

*Nature park barriers.* For nature parks, the differences between parents and teachers in terms of 'lack of time' ( $t = -2.961$ ,  $p = .005$ ) and 'unsafe or disconnected sidewalks to get there' ( $t = -2.529$ ,  $p = .015$ ) were statistically significant (Cohen's  $d > 0.7$ ). Both barriers were reported as moderately high for teachers while being moderately low for parents. The rest of barriers were not statistically significantly different among parents and teachers. 'Distance from home/school,' 'unsafe street crossings,' and 'safety concerns in the area' were moderately high barriers and 'injury concerns' was a moderately low barrier for both groups.



**Table 3. Differences between parents and teachers in terms of perceived barriers to use each type of greenspaces**

| The following reasons negatively influence how often I take my children to a public greenspace like this:             |          | Barriers<br>Lack of time | Distance from<br><u>home/school</u> | Unsafe or disconnected<br>sidewalks to get there | Unsafe street crossing | Safety concerns in the area | Injury concerns |
|-----------------------------------------------------------------------------------------------------------------------|----------|--------------------------|-------------------------------------|--------------------------------------------------|------------------------|-----------------------------|-----------------|
| <i>Neighborhood Parks</i>                                                                                             |          |                          |                                     |                                                  |                        |                             |                 |
| t – value                                                                                                             |          | -3.122**                 | -3.205*                             | -1.093                                           | -.202                  | -.488                       | -.213           |
| two-sided p                                                                                                           |          | .003                     | .006                                | .280                                             | .841                   | .628                        | .832            |
| df                                                                                                                    |          | 48                       | 48                                  | 48                                               | 48                     | 48                          | 48              |
| Mean (SD) <sup>a</sup>                                                                                                | Parents  | 2.7<br>(1.149)           | 2.4 (1.037)                         | 2.77 (1.431)                                     | 3.07<br>(1.437)        | 3.67<br>(1.348)             | 2.57<br>(1.382) |
|                                                                                                                       | Teachers | 3.8<br>(1.322)           | 3.55 (1.504)                        | 3.2 (1.281)                                      | 3.15<br>(1.424)        | 3.85<br>(1.226)             | 2.65<br>(1.309) |
| <i>Athletic Parks</i>                                                                                                 |          |                          |                                     |                                                  |                        |                             |                 |
| t – value                                                                                                             |          | -3.624**                 | -5.450**                            | -2.467*                                          | -1.700                 | -1.085                      | -.480           |
| two-sided p                                                                                                           |          | <.001                    | <.001                               | .017                                             | .096                   | .283                        | .633            |
| df                                                                                                                    |          | 49                       | 48                                  | 48                                               | 48                     | 49                          | 48              |
| Mean (SD)                                                                                                             | Parents  | 2.61<br>(1.116)          | 2.87 (1.252)                        | 2.93 (1.285)                                     | 2.93<br>(1.53)         | 3.35<br>(1.496)             | 2.53<br>(1.57)  |
|                                                                                                                       | Teachers | 3.9 (1.41)               | 4.6 (.821)                          | 3.8 (1.105)                                      | 3.65<br>(1.348)        | 3.8<br>(1.322)              | 2.75<br>(1.552) |
| <i>Gardens</i>                                                                                                        |          |                          |                                     |                                                  |                        |                             |                 |
| t – value                                                                                                             |          | -1.963                   | -.254                               | -.638                                            | .968                   | .683                        | .639            |
| two-sided p                                                                                                           |          | .055                     | .801                                | .527                                             | .485                   | .498                        | .526            |
| df                                                                                                                    |          | 49                       | 47                                  | 46                                               | 45                     | 47                          | 45              |
| Mean (SD)                                                                                                             | Parents  | 2.61<br>(1.256)          | 3.38 (1.498)                        | 2.71 (1.41)                                      | 2.68<br>(1.492)        | 3.1<br>(1.423)              | 2.29<br>(1.487) |
|                                                                                                                       | Teachers | 3.45<br>(1.791)          | 3.5 (1.821)                         | 3 (1.686)                                        | 3<br>(1.599)           | 2.8<br>(1.673)              | 2 (1.528)       |
| <i>Nature Parks</i>                                                                                                   |          |                          |                                     |                                                  |                        |                             |                 |
| t – value                                                                                                             |          | -2.961**                 | -1.024                              | -2.529*                                          | -1.846                 | .047                        | .235            |
| two-sided p                                                                                                           |          | .005                     | .311                                | .015                                             | .071                   | .452                        | .291            |
| df                                                                                                                    |          | 48                       | 47                                  | 48                                               | 47                     | 47                          | 45              |
| Mean (SD)                                                                                                             | Parents  | 2.7<br>(1.208)           | 2.8 (1.349)                         | 2.43 (1.382)                                     | 2.55<br>(1.487)        | 3.13<br>(1.655)             | 2.46<br>(1.598) |
|                                                                                                                       | Teachers | 3.8<br>(1.399)           | 3.21 (1.398)                        | 3.4 (1.231)                                      | 3.3<br>(1.261)         | 3.47<br>(1.307)             | 2.95<br>(1.393) |
| <sup>a</sup> Standard deviation; *Statistically significant at 0.05 level; **Statistically significant at 0.005 level |          |                          |                                     |                                                  |                        |                             |                 |

### 3.2 Awareness and attitudes

**Awareness of the benefits of nature for children.** Based on the literature, it was hypothesized that parent and teacher awareness and attitudes towards children's contact with nature including, knowledge and feelings towards the benefits for children, may be associated with how frequently children go to certain greenspaces or do outdoor activities. However, our linear regression models showed that having

knowledge and positive attitudes towards the benefits of children's frequent contact with nature did not seem to be associated with how often parents and teachers took their children to greenspaces.

Both parents ( $n = 31$ ) and teachers ( $n = 20$ ) had high mean values for knowledge of the various benefits of nature for children (i.e., physical health, mental and emotional health, behavioral health, and cognitive skills). To see if there were significant differences between how parents and teachers responded, independent samples t-tests were conducted. The four survey items addressing knowledge were checked for correlations and they were strongly correlated (all above 0.5). Therefore, we tested the reliability of clustering them together as a latent variable. Since the Cronbach's alpha appeared to be strong ( $\alpha = 0.929$ ), we calculated the mean of the four items and created a latent variable called 'knowledge of the benefits of nature.' Combined, parents and teachers had a moderately high mean value for 'knowledge of the benefits of nature' for children (mean = 3.77).

**Attitudes about benefits of frequent contact with nature.** Both parents' and teachers' attitudes towards the various benefits of nature for children had high mean values for physical health, mental and emotional health, behavioral health, and cognitive skills. Independent samples t-tests showed no statistically significant difference between the two groups of participants. The four survey items addressing attitudes towards benefits frequent contact with nature were checked for correlations and they were strongly correlated (all above 0.5). The reliability test of the four items resulted in a high Cronbach's alpha ( $\alpha = 0.95$ ). Therefore, we calculated the mean of the four items and created a latent variable called 'attitudes towards the benefits of nature.' Combined, parents and teachers felt frequent contact with nature was important for its benefits for children with a high mean value (mean = 4.17). With these latent variables, correlations were checked and knowledge of the benefits of nature and attitudes of the benefits of nature were significantly positively correlated ( $r = 0.493$ ,  $p < .001$ ).

Additionally, about 80% of teachers also agreed or strongly agreed that frequent contact with nature in school settings was important. This had a significant positive correlation between their knowledge of the benefits of nature for children ( $r = .628$ ,  $p = .003$ ) and their attitudes towards the benefits of nature for children ( $r = .525$ ,  $p = .017$ ).

*Adequacy of children's current contact with nature.* The mean values for parents feeling children do not spend enough time in nature outside of school time (mean = 3.23) and during school time (mean = 3.19) were moderately high. About 74.2% of parents responded neutral to strongly agree (38.7% 'neutral,' 9.7% 'agree,' and 25.8% 'strongly agree') that their children *do not* spend enough time in nature outside of school. Similarly, 74.2% of parents responded neutral to strongly agree (38.7% 'neutral,' 16.1% 'agree,' and 19.4% 'strongly agree') that their children *do not* spend enough time in nature during school time.

About 60% of teachers disagreed to strongly disagreed that their school organizes enough outdoor or nature-based learning in the curriculum (mean = 1.8). The frequency of incorporating outdoor (mean = 1.85) or nature-based learning (mean = 2.05) by teachers was also reported as low. Attitudes towards their school organizing enough outdoor or nature-based learning in the curriculum and how frequently they incorporated outdoor learning in their lessons were correlated and there was a significant and positive correlation ( $r = .564$ ,  $p = .008$ ). About 85% of teachers also responded they felt neutral to strongly agreeing they were comfortable incorporating outdoor or nature-based learning in their lessons. In addition, how knowledgeable teachers were of the benefits of nature for children was significantly correlated with how comfortable they were incorporating outdoor or nature-based learning in their lessons ( $r = .602$ ,  $p = .005$ ).

Attitudes towards the importance of frequent contact with nature in school, attitudes and awareness of the benefits of frequent contact with nature for children, and teachers' comfort incorporating outdoor or nature-based learning in their lessons were each not significantly correlated with how often teachers incorporated outdoor or nature-based learning in their lessons. Although teachers may support and think outdoor or nature-based learning was important, they were not incorporating them in their lessons. Because of this, it was important to explore school-specific barriers that might be associated with how often teachers incorporated outdoor or nature-based learning in their lessons.

### 3.3 School-specific barriers

According to the mean values, the school-specific barriers that limited their school from providing outdoor or nature-based learning to their students include other curricular time commitments (mean = 3.9), funding (mean = 3.7), district initiatives (mean = 3.55), school initiatives (mean = 3.45), and lack of training and professional development (mean = 3.10).

There were many significant correlations among school-specific barriers. 'School initiatives' were significantly positively correlated with 'district initiatives' ( $r = .637, p = .003$ ), 'other curricular time commitments' ( $r = .640, p = .002$ ), and 'lack of training and professional development' ( $r = .619, p = .004$ ). 'Other curricular time commitments' were also correlated with 'district initiatives' ( $r = .640, p = .002$ ). In addition, 'other curricular time commitments' and 'lack of training and professional development' were correlated ( $r = .536, p = .015$ ). Teachers reported that parent permission to take students to greenspaces was less of an issue (mean = 2.15). It was also found that how frequently teachers take their students to athletic parks, gardens, and nature parks, was significantly negatively correlated with other 'curricular time commitments.' However, again, no significant correlations were found between how frequently teachers incorporated outdoor or nature-based learning in their lessons and school-specific barriers.

### 3.4 Location, setting and activity preferences

*Preferences for in-school vs outside of school outdoor learning.* When asked if parents or teachers preferred outdoor or nature-based learning to be on-campus or off-campus in nearby public greenspaces, both had moderately high to high mean values. To see if there were differences in the mean values between parents and teachers, independent samples t-tests were conducted. The results showed no statistical significance, which suggests that parents and teachers similarly supported outdoor or nature-based learning whether it be on- or off- campus.

*Preferences for types of outdoor environments and activities.* Both parents and teachers liked all proposed outdoor settings (i.e., nature trail, playground, athletic fields, outdoor classroom) shown in the photo survey (means > 4). In addition, the independent samples t-tests showed there were no statistically significant differences between groups.

Parents were also asked what outdoor activities their children do the most and what activities parents prefer their children to do *outside* of school time. Mean values showed that their children played on playgrounds (mean = 3.77), did imaginative/pretend play outside (mean = 3.42), and nature learning/exploration (mean = 3.16) the most, while sports and learning in an outdoor classroom had moderately low mean values. However, most parents liked all proposed outdoor activities (means > 3.8). How frequently children did sports ( $r = .567, p < .001$ ), and imaginative/pretend play outside ( $r = .465, p = .008$ ) were significantly positively correlated with parent preferences for those activities.

Teachers were asked what outdoor activities their students did the most and what activities they liked their students to do *during* school time. Their students most frequently did sports (mean = 4.40), played on playground (mean = 4.55), and did imaginative/pretend play (mean = 3.70), while nature-based learning/exploring nature (mean = 2.65) was moderately low and 'learning in an outdoor classroom' was low (mean = 2.00). There were no correlations between teachers' preferences and what activities students did, however, teachers liked or strongly liked all proposed outdoor activities (means > 4.40).

## 4 DISCUSSION

### 4.1 What do the findings suggest?

The findings showed that children were getting most of their exposure to greenspaces outside of school and through supervision of their parents and not during school. However, how often children go to greenspaces was still limited. Findings showed that parents took their children most often to neighborhood parks, only sometimes to nature parks, and rarely or never to athletic parks and gardens. We also learned that most children rarely had independence to go to any public greenspaces by themselves or with friends and that this was associated with their parents' comfort in them doing so. As found in the literature, free play is important for children's development, yet parents feel the need to supervise their children for concerns of safety and injury (Clements, 2004; Kytä, 2004; Veitch et al., 2006; Vidal & Castro Seixas, 2022). Although injury concerns and lack of time were less of a concern to parents in this study, safety

concerns in the area were an overall concern and was further supported by the open-ended responses that mentioned crime, poor maintenance, and bad neighborhood. In addition, it was predicted that their children's grade may be associated with how frequently children go by themselves or with friends to greenspaces, and how comfortable parents were with letting their children go by themselves or with friends to greenspaces. However, teasing out these potential associations was not possible because parents were allowed to select multiple answers in the survey for what grades their children were in. In future studies, it is highly recommended to control for children's age when addressing specific questions.

Additionally, at school, teachers rarely or never took their students to any of the greenspace types. Despite a nature park existing within a quarter mile away from the school, almost half of the teachers strongly disagreed or did not know there was a nature park close to the school. It is thus important to consider the level of awareness about available resources, and how it would play a role in teachers' decision for taking students out. This also underlines the importance of combining on-site observations and spatial analysis with social data analysis to account for discrepancies between subjective and objective measures.

Another point worth discussing is about parents and teachers feeling that their children did not spend enough time in nature during or outside school. This is in accordance with the fact that both teachers and parents demonstrated high levels of knowledge about the importance of frequent contact with nature for children's physical and mental wellbeing. This is in line with their interest in all proposed greenspace settings and outdoor activities that were presented, whether it was playing on a conventional playground or doing nature-based activities in more natural settings. According to parents, their children less frequently did sports, learned in an outdoor classroom, or did nature-learning and exploration. In school, nature learning and exploration and learning in an outdoor classroom were also the least common activities. This was supported by most teachers who reported that they rarely or never incorporated outdoor or nature-based learning in their lessons. Parents and teachers also supported outdoor or nature-based learning either on-campus or off-campus in nearby public greenspaces. This suggests the necessity of exploring opportunities for adding such activities to the school's programs.

In terms of barriers to take children/students to greenspaces, safety concerns in the area and unsafe street crossings were consistently moderately high barriers reported by both parents and teachers. This was supported by additional safety concerns parents identified (i.e., crime, drugs/alcohol, maintenance, bad neighborhood) in an open-ended question. This highlights the need for a two-scale approach to improve safety. One is about improving perception of safety in residential neighborhoods and school attendance zones, and the other is about site-scale design improvements in street crossings across the school attendance zones.

For teachers, lack of time was a moderately high barrier for all greenspaces, distance from school was moderately high and high for neighborhood parks and athletic parks, and unsafe or disconnected sidewalks was moderately high for athletic parks and nature parks. An additional barrier teachers experienced was not having enough adult supervision to take students to nearby greenspaces. This suggests the need for exploring opportunities for partnerships with local organizations that educate and do volunteer days with schools that may be able to assist outdoor events. It was also thought that parents and teachers may have perceived more natural greenspaces as unsafe for their children to be in, however, injury concerns were consistently a moderately low barrier for all greenspace types.

While walkability and safety factors are critical for ensuring accessibility to greenspaces, teachers experienced school-specific barriers that may not allow visits to greenspaces or having outdoor or nature-based learning in lessons. Based on students' low-academic levels, having a specific curriculum, the testing requirements, and other school-specific barriers, it does not seem the school includes time for outdoor or nature-based learning. Funding and training or professional development may also be focused on the specific curriculum needs, and not nature-based learning. Most teachers believed that the school incorporated insufficient outdoor or nature-based learning opportunities for children.

## 4.2 Planning and design implications

The findings confirm that there is a need to increase the opportunities for children to be in contact with nature during and outside of school time in these areas and both parents and teachers are supportive of

this. To do so, the barriers that may prevent children from accessing greenspaces must be addressed. Also, the systematic barriers within the schools should be alleviated through planning and design for a child-friendly environment where nature-based learning and play are at the core. Five key goals are recommended based on the findings of this study: (1) providing more diverse nearby outdoor experiences for children in their neighborhoods, (2) providing nature-based learning spaces in outdoor settings for school use, (3) improving walkability in neighborhoods, (4) improving perceptions of safety, and (5) supporting children's contact with nature in education.

Based on the small area that was investigated in this study, design and planning strategies that can help achieve the above goals include (1) transforming nearby vacant lots to increase access to small greenspaces, (2) re-envisioning existing greenspaces to provide more environmental affordances for children, (3) creating safe and green routes to schools and greenspaces built upon 'safe routes to schools' programs, and (4) making short-term and long-term policies to support city-efforts for children's contact with nature. For a full description of site-specific implementation of these strategies that were shared with the school, please refer to Moore (2024). These recommendations were based on landscape architecture and planning perspectives for addressing the findings from the literature review, social data analysis, and greenspace availability assessment. However, it should be acknowledged that improving children's equitable access to and contact with nature is an interdisciplinary issue that requires collaboration between educators, community members, planners, landscape architects, local governments, parks and recreation, and non-profit organizations. This research was only conducted in Gladstone Elementary, so there is a need to expand this research across the district and city to understand what greenspaces are available to each school and the surrounding neighborhoods, the natural features they provide, what may prevent children from accessing those greenspaces, and what opportunities there are for increasing children's contact with nature.

## 5 CONCLUSION

This study explored parents' and teachers' perceptions of children's access and contact with nature in low-income disinvested areas using Gladstone Elementary School's school attendance zone within the Kansas City Public Schools district in Kansas City, Missouri as a case. A review of the literature revealed that there is a need to understand the barriers that prevent children from spending more time in nature during and outside school time. Many studies that have examined access to greenspaces have not considered both parent and teacher perspectives to assess the extent of where (types of greenspaces), when (during or after school), how (types of outdoor activities) children are exposed to nature, and the barriers that may limit them. This study used mixed methods including spatial analysis of available types of greenspaces in the school attendance zones and social data analysis through multi-lingual photo surveys. Findings from statistical analysis informed opportunities for practical place-based planning and design recommendations for improving children's access and contact with nature. Although conducted in Kansas City, Missouri, the proposed methods and the opportunities for translational planning and design process may be applicable in other cities. Children's disconnection from nature and its health and wellbeing implications are issues experienced globally and need to be addressed.

**Limitations.** While offering considerable contributions, there are several factors that should be acknowledged as the limitations of this study. One overall shortcoming of this study is the absence of children's direct input when exploring their needs. However, including this age group would have posed a series of complications to the project in research design, IRB approval process, and the timeframe of the project, necessitating extra funding and time. Other limitations of this study include the difficulties with recruiting participants and the timeframe for collecting survey responses. Out of seven schools that were reached out to, four schools had initially agreed to participate in the study; however, two of them later decided to not participate, and one did not distribute the survey despite several follow-ups. For the school that did participate, collecting data only occurred over a limited timeframe. In addition, sending reminders was dependent on school administration, so the frequency of reminders to be sent could not be controlled by the researchers. All communications were also sent via email or through the school's primary online communication platform, so the survey may not have reached as many people as we intended. As a result, the sample size was small, so our findings were not generalizable. Additionally, the survey was kept short to reduce the time it took to fill out, so it did not include other potential factors that can be associated

with children's access to nature. Although results may not be generalizable, findings still provide valuable information for informing place-based recommendations to improve children's contact with nature in this area.

**Contribution and Future Research.** Despite the limitations, this study contributes to the existing literature on children's access and contact with nature by having gathered data from both parents and teachers, which has not been done to our knowledge. Additionally, it sheds light on potential future research on what factors may be associated with children's contact with nature using both spatial and social analyses. However, additional research is needed to confirm the results of this study and to explore and support its suggested design strategies. Further, with each design strategy, there is a need to engage families, children, and schools to identify specific areas of concern, their opinions of specific greenspaces, nature play/learning opportunities, and co-designing nature spaces. It is suggested that future research incorporates another layer of data collection and analysis through semi-structured interviews with parents and teachers to offer a more comprehensive understanding of attitudes and perceived barriers regarding children's contact with nature. It is also worthwhile to explore how differently parents and teachers would respond to the survey used in this study across wealthier neighborhoods and school districts. Therefore, greenspace availability assessments and collecting social data from parents and teachers should be done district-wide and across the city to further understand children's access and contact with nature at large scale.

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