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When St. Louis School Nature Leaders and Environmental Partners Work Together Nature-based Learning Inspires Joy and Curiosity in K-2 Students

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When St. Louis School Nature Leaders and Environmental Partners Work Together Nature-based Learning Inspires Joy and Curiosity in K-2 Students

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Abstract

This study focused on what values teachers saw in nature-based learning, what outcomes they saw for their students, and what factors have enabled them to do nature-based learning. This explanatory sequential mixed-methods study looked at nature-based learning in St. Louis elementary schools with kindergarten through second-grade students.

We used purposive sampling to choose six schools to examine further through case studies. We then conducted interviews with 8 teachers on qualities of nature-based learning captured in 12 words.

We identified five themes from our interviews and observations: Every School Needs a Nature Champion, Community Bridges in Nature-Based Learning, There is Magic in the Green Spaces, How Do You Get Kids Outside?, and What Happens When Kids Get Outside? We propose a pyramid of nature-based learning derived from these teacher interviews that illustrates key aspects of student outcomes.

In addition, we used a map that showed the amount of green space surrounding each school and we examined the role that available green space plays in schools offering nature-based learning.

We also examined the relationship between green space surrounding a school and the economic make-up of the students in the school, as to identify inequities in opportunities for nature-based learning in the St. Louis area.

We found a significant but very small negative relationship between free and reduced lunch percentages of these schools and their available green space. The idea of a school nature leader was a particularly important and fairly new finding in the research on nature-based learning. That school nature leader also needs to be able to leverage community partnerships to assist their efforts. Young elementary school students benefit in many ways from nature-based learning, and those benefits need to be touted to those in decision-making positions for schools and celebrated by all of us.

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Introduction

If a child is to keep alive his inborn sense of wonder ... he needs the companionship of at least one adult who can share it, rediscovering with him the joy, excitement, and mystery of the world we live in.

-- Rachel Carson, *The Sense of Wonder*

As early childhood teachers (kindergarten and first grade), we have seen play and exploration pushed out of classrooms in favor of standardized testing and scripted curriculum. We have also witnessed children spending less time outdoors as access to electronic devices has grown exponentially. We find ourselves looking for ways to get children outside to help them nurture that sense of wonder Carson referenced. We also believe that all children, regardless of where they live or what school they attend, deserve opportunities to be in nature and experience the benefits and joys that accompany it.

Problem Statement

“In the space of a century, the American experience of nature has gone from direct utilitarianism to romantic attachment to electronic detachment,” wrote Louv (2006, p.16). The Outdoor Foundation tracks the outdoor participation of Americans in its annual report, and it defines moderate participation as spending at least ten days per year in some form of outdoor recreation. Its 2019 report shared that youth participation (ages 6-12) in moderate outdoor activity has fallen 3.1% since 2007, and it has declined each year over the last four years (Outdoor

Foundation, 2019). Even when children spend time outdoors, they are often not engaging directly with nature. Activities in nature, such as hiking, fishing, and camping, are less popular than activities such as organized sports and biking (Larson et al., 2011). Louv (2006) coined the term, “nature deficit disorder” and explained that nature deficits lead to obesity, attention disorders, and depression.

The World Health Organization views childhood obesity as an epidemic and cites inactivity as a major cause of the rise in children who are overweight (World Health Organization, 2021). Childhood obesity is linked to adult obesity and a variety of health problems. Simmonds et al. (2015) found that 55 percent of children who are obese were still obese as teens, and eighty percent of obese teens are still obese as adults. In addition, the Center for Disease Control estimates that over six million children have been diagnosed with attention deficit/hyperactivity disorder and that sixty percent of children with ADHD have another mental or behavior disorder (Center for Disease Control, 2020). Time in nature can help children combat obesity (Gray et al., 2015) and ADHD (Kuo & Fabor Taylor, 2004), and it has other benefits as well. Frumkin et al. (2017) cite improvements in cognitive and motor development and in overall health.

Outdoor play for children is also associated with improved self-regulation, flexibility, and independence (Fesseha & Pyle, 2016; Nicholson et al., 2016). More studies will be cited in the literature review to demonstrate the benefits that time in nature can have on child development.

In the United States, young children ages five to eight spend six to seven hours per day at school for typically 170 to 180 days per year (National Center

for Education Statistics, 2018). The Outdoor Classroom Day Movement conducted a survey in 2017 and examined time at school spent outdoors for learning and play in the United States, Canada, Australia, and the United Kingdom. Teachers in the United States provided the least amount of free playtime for children of all ages, and forty percent of elementary schools allowed less than 30 minutes of recess per day (Prisk & Cusworth, 2018). Elementary school is the prime time to develop curiosity and a sense of purpose for environmental awareness. Activities, such as observing trees, collecting soil samples, and comparing land in the shade and sun, enable children to help develop these traits when conducted regularly on school grounds (Martin 2003). However, nearly 30 percent of teachers in the United States conduct lessons outside less than once per month, and only ten percent of US teachers conduct lessons outside daily. These findings contradicted the fact that nearly all teachers acknowledged the benefits of improved retention of information and fewer behavior problems during outdoor lessons (Prisk & Cusworth, 2018). Schools emphasis on standardized testing contributes to the discrepancy between the actions and attitudes of American teachers regarding outdoor learning. Concerns about state testing have led to a narrowing of the curriculum, and many schools, particularly in low-income areas, have adopted scripted reading and math curricula that prepare students for standardized testing (Brown & Weber, 2016). As Milner (2013) points out, teachers cannot respond to the unique needs of their students, and students lose out on time for social studies, science, and physical activity at school. The teaching methods in these

test-preparation curricula often focus on memorization rather than critical thinking, and the methods do not match the ways that young children learn. Instead the current environment of schools rewards qualities such as calmness and silence (Barbarin, 2010). In contrast, environmental education for young children focuses on exploration and hands-on learning to develop children's relationships with nature and attitudes about the environment (Simmons et al., 2016; Arlemalm-Hagser, 2013; Barrable, 2019; Martin, 2003; McCree et al., 2018; Braun & Dierkes, 2017; Collado et al., 2013).

Children of color face additional barriers to getting outside. Safe parks and other natural spaces are often not available to people of color, particularly in low-income areas (Rowland-Shea et al., 2020). Housing segregation has contributed to inequities in natural spaces by leaving people of color in neighborhoods with less park space than white neighborhoods. Even when parks are present in neighborhoods, neglect and poor conditions can make them dangerous, leading people to view them as places where crime happens (Boone et al., 2009). Rowland-Shea et al. explained that segregation has led to people of color also being more likely to live in neighborhoods with environmental pollution and toxins. United States history, including slavery and Jim Crow, has influenced how African Americans interact with natural spaces today. Many African Americans still associate trees and wooded areas with lynchings and danger, and even after Jim Crow laws were outlawed, "sundown towns" still existed (Finney, 2014). Today, acts of discrimination, lack of access, lack of information about parks, and lack of park staff of color have affected the time that

people of color spend in parks and other natural spaces (Roberts & Chitewere, 2011).

Finally, a recent article in the New York Times demonstrated, with compelling visual maps, how people of color and people in lower socioeconomic groups in cities have remarkably fewer trees around them. Instead, they are surrounded by concrete, which impacts temperatures and pollution in those areas. The authors cited redlining policies in the middle of the twentieth century, where lending practices favored white, non-immigrant neighborhoods. These discriminatory policies led to discrimination in health and infrastructure investment, including tree coverage, as well (Leahy & Serkez, 2021). Access to green space, including tree cover, is a social justice issue, and it is central to our study.

The Science of Nature-Based Learning Collaborative Research Network, which is a collaboration of the University of Minnesota, the University of Illinois, the Children and Nature Network, and the North American Association for Environmental Education (NAAEE), identified questions about nature-based learning that still need to be researched. These topics include: the traits and actions of teachers who successfully bring nature-based learning into their classrooms; the costs and benefits of nature-based learning and how they compare with other learning initiatives; and the impact of nature-based learning on children in economically disadvantaged communities (Jordan & Chawla, 2019).

Similarly, Becker et al. (2017) indicated that research is sparse on how nature-based learning impacts mental health and self-regulation in children, particularly as more children are diagnosed with mental health conditions. Finally, Hale & Bockneck (2016) argue that a cultural lens needs to be applied when looking at the play of African-American children and that few studies have even examined African-American children's play.

Our study will benefit teachers, administrators, and environmental education professionals by providing a picture about what is happening with nature-based learning in St. Louis area schools. We show how green space is being used (if at all) by schools and begin to shed light on what factors make nature-based learning more likely to occur.

Purpose Statement

Our study was interested in nature-based learning offered by schools in the St. Louis, Missouri region. The Science of Nature-Based Learning Collaborative Research Network described nature-based learning through a definition that captures the environment and activities we plan to research. That definition states:

Nature-based learning, or learning through exposure to nature and nature-based activities, occurs in natural settings and where elements of nature have been brought into built environments, such as plants, animals, and water. It encompasses the acquisition of knowledge, skills, values, attitudes, and behaviors in realms including, but not limited to, academic

achievement, personal development, and environmental stewardship..., it includes informal learning during children's free play or discovery in nature in their yards, near their homes, in green schoolyards, on the naturalized grounds of child care centers, or in any other natural area. It includes non-formal learning in nature during out-of-school programs, camps or family visits to parks or nature centers. And it includes formal learning when children have contact with nature during structured activities in schools, preschools, and child care centers, or during outdoor field trips (Jordan & Chawla, 2019, p.2).

We explored how and why teachers in the St. Louis region, who have varying proximity and access to green space on or near their school grounds, facilitate (or do not facilitate) intentional nature-based play and nature-based learning activities for their kindergarten through second grade students. We examined how teachers framed their choices with respect to curriculum, philosophies, and school policies.

The qualitative portion of our study used observations and teacher interviews to explore what educators perceive to be the qualitative benefits of nature. We found some qualities to explore in the North American Association for Environmental Education's (NAAEE) *Early Childhood Environmental Education Programs*. The NAAEE document provides guidelines to early childhood programs for excellence in environmental education. In its introduction, Ruth Wilson defines environmental education as: the development of a sense of wonder; appreciation for the beauty and mystery

of the natural world; opportunities to experience the joy of closeness to nature; and respect for other creatures. It also includes the development of problem-solving skills and the development of interest and appreciation in the world around us (Simmons et al., 2016, p. 2).

This definition resonated with us because it listed qualities that are not typically assessed in school but are still important when we want children to grow up respecting nature. From this document, we chose the following twelve words: nature-based learning, mystery, wonder, joy, emotions, appreciation, exploration, curiosity, respect, knowledge, creativity, and intimacy. These words were shared with teachers to elicit reflection and discussion.

We conducted case studies on six schools, by choosing two schools with a lot of green space around them, two schools with moderate green space, and two schools with virtually no green space.

Research Questions

1. What is the relationship between a school's proximity to green spaces and the percentage of students eligible for the free and reduced lunch program?
2. What value do K-2 teachers in the St. Louis region think nature-based learning has for their students and for themselves?
3. What outcomes do teachers see in themselves, their individual students and in their classroom communities that they attribute to nature-based learning? Do they see outcomes that build awareness of nature, empathy

for nature, responsibility for nature, and enjoyment of nature?

4. What factors influence teachers to implement nature-based learning and how important is proximity to green space as a factor?

Glossary of terms

Green Space: generally recognised as encompassing all forms of natural environments which include green vegetation such as open countryside, parks, woodland, allotments (a plot of land rented by individuals for growing fruit, vegetables or flowers) and cemeteries (Cronin-de-Chavez et al., 2019, p.118)

Nature based learning: learning through exposure to nature and nature-based activities, occurs in natural settings and where elements of nature have been brought into built environments, such as plants, animals, and water. It encompasses the acquisition of knowledge, skills, values, attitudes, and behaviors in realms including, but not limited to, academic achievement, personal development, and environmental stewardship..., it includes informal learning during children's free play or discovery in nature in their yards, near their homes, in green schoolyards, on the naturalized grounds of child care centers, or in any other natural area. It includes non-formal learning in nature during out-of-school programs, camps or family visits to parks or nature centers. And it includes formal learning when children have contact with nature during structured activities in schools, preschools, and child care centers, or during outdoor field trips (Jordan & Chawla, 2019, p.2)

Environmental education: the development of a sense of wonder; appreciation for the beauty and mystery of the natural world; opportunities to experience the joy of closeness to nature; and respect for other creatures. It also includes the development of problem-solving skills and the development of interest and appreciation in the world around us (Simmons et al., 2016, p. 2)

Literature Review

Louv (2006) coined the term, nature deficit disorder, in his book, *Last Child in the Woods*, and he defined it as a disconnect from nature that leads to problems with focus and increases in mental and physical ailments. In this paper, we start with Louv's work as a basis for our desire to see more children in the St. Louis area have access to outdoor spaces at school. We cited research in this chapter that supports the theory of biophilia, which posits that people need time in nature for proper development and that there is a biological basis for this need (Kellert & Wilson, 1993).

We also recognize that political, economic, and cultural issues contribute to inequities in accessing nature and that we cannot ignore factors that cause these inequities. In the scope of this paper, we cannot address all of these factors, so we focus here on the issue of access to green spaces. We believe that physical proximity of green spaces to schools has a positive potential impact on the creation of nature-based learning opportunities.

Defining Green Spaces

For the term, green spaces, Taylor & Hochuli (2017) argue that there is no universally accepted definition and that each study must provide its own definition. These researchers did find commonalities among definitions of green spaces that included: areas of vegetation, parks, areas with trees, cemeteries,

undeveloped areas, and recreation sites. Cronin-de-Chavez et al. (2019) reported:

Greenspace can take a variety of forms, but is generally recognised as encompassing all forms of natural environments which include green vegetation such as open countryside, parks, woodland, allotments (a plot of land rented by individuals for growing fruit, vegetables or flowers) and cemeteries (p. 118).

Our study looks at the quantity of green space available in proximity to schools, but we also must consider the quality of green spaces, as not all green spaces are equal. Brindley et al. (2019) tested their hypothesis that dirty, littered greenspace is linked to poor health of residents near that greenspace, and their results supported the hypothesis. The researchers posited that dirty greenspace hinders residents from spending time outdoors or detracts from their experience, so they do not receive the benefits of being in nature. Another study by Mears et al. (2020) also found a significant, inverse relationship between cleanliness of green spaces and rates of depression of nearby residents.

The Environmental Assessment of Public Recreation Spaces tool (EAPRS) measures park services and facilities and their conditions. The tool assesses amenities such as trails, play areas, water features, benches, shelters, restrooms, and signage. Each amenity is rated on its cleanliness, condition, proximity, and size (Saelens et al., 2005). Engelberg et al. (2016) examined cities across the country and their parks with the EAPRS tool. In their study, many parks in lower-income and/or predominantly African-American

neighborhoods measured lower using the EAPRS tool than parks in wealthier, white areas. However, they discovered that some areas of the country had better quality measures in lower-income area parks and that these parks benefited from local policies, funding decisions, and community participation.

Hunter & Luck (2015) developed a typology of qualities of urban green space to better represent the ways that physical and social factors interact and influence how green spaces are perceived and used. These qualities included physical features, such as amounts and types of vegetation and animals present; cultural characteristics, such as values and attitudes of residents; accessibility; abiotic characteristics, such as presence of water, protection from the sun, and noise; spatial qualities, describing how green spaces are connected to other land use in the urban area; and governance, which refers to who is in charge of green spaces and how rules are enforced. Lee et al. (2015) made similar observations when looking at urban green spaces. They concluded that researchers, public health professionals and urban planners must consider the needs and perceptions of residents when examining urban green spaces, as social and physical factors interact to create perceptions about the quality of green spaces.

Benefits of Time Outdoors

Simply being outside is important for children. As Lindsay et al. (2017) report, time spent outside corresponds highly with physical activity levels of young children. Sobko et al. (2018) measured the effect of nature connections on preschool children's health. They used the Connectedness to Nature Index for

Parents of Preschool Children (CNI-PPC), which is likely the first instrument to measure preschool children's feelings and actions regarding nature. The researchers found that responsibility towards nature was positively related to prosocial behaviors and had a significant effect on lower rates of problems with others and hyperactivity. Figure 1 shows the statements that were developed for the CNI-PPC to adapt it from the original Connected to Nature scale, developed by Mayer & Frantz (2004). The CNI-PPC was developed specifically for young children living in urban settings and focuses on the emotional and the intellectual aspects of nature.

Figure 1.

Statements in Connected to Nature Scale-Parents of Preschool Children

<i>Enjoyment of Nature:</i>
My child likes to hear different sounds in nature.
My child likes to see wildflowers in nature.
Being in nature makes my child feel peaceful.
My child likes to garden and plant.
My child enjoys collecting rocks and shells.
My child enjoys touching animals and plants.
<i>Empathy for Nature:</i>
My child feels sad when wild animals are hurt.
My child is distressed when he/she sees animals being hurt.
My child is heartbroken when animals pass away.
<i>Responsibility toward Nature:</i>
My child believes that picking up trash on the ground can help nature.

My child treats plants, animals, and insects with care.
My child enjoys recycling paper and bottles.
<i>Awareness of Nature:</i>
My child notices wildlife wherever he/she is.
My child chooses to read about plants and animals.
My child feels the difference between outdoors and indoors.
My child hears birds and other sounds in nature.

Note: From Sobko T, Jia Z, Brown G (2018) Measuring connectedness to nature in preschool children in an urban setting and its relation to psychological functioning. PLoS ONE 13(11): e0207057. <https://doi.org/10.1371/journal.pone.0207057>. Copyright 2018 Sobko et al.

The qualities captured in the CNI-PPC survey are important precursors for people who grow up to care about and protect the environment. As Sobel et al. (2016) explained, children need to form a relationship with their environment in order to want to protect it and care for it. That connection to place is formed through positive, joyous experiences in nature. The authors described the relationship between young children and the environment as mutually beneficial. They said, “Children need the stimulation, adventure, and wonder of nature to foster their healthy, holistic development, and nature needs children to fall in love with it so they will become the future stewards of the natural world”(Sobel et al., 2016, p. 153).

Becker et al. (2017) reviewed research studies that examined the effects of outdoor learning experiences on students. They identified six studies that found positive effects on students' social skills. Several of these studies involved gardening projects, and the students who participated in the projects reported increased self-esteem, improved communication skills, and improved teamwork skills.

In fact, researchers have identified many developmental skills that improve through outdoor play. Ceciliani & Bortolotti (2013) cite the development of resourcefulness, task completion, strength, gross motor skills and physical growth as all resulting from outdoor play time. Christensen & Mikkelsen (2008) demonstrated the benefits of risk-taking behaviors during outdoor play and argued that children learn much from regular opportunities to engage in risk-taking activities. Their findings provided evidence that children learn to gauge potential risks, adjust their activities based on perceived risks, make decisions about their own capabilities, and problem solve with others to determine rules of participation in activities. Cognitive and social development also occurs through outdoor play. Children can try out concepts, such as math concepts like volume and mass, during outdoor play, and they learn valuable social skills, like taking turns and cooperating with others (Burriss & Burriss, 2011). Experiential, nature-based learning supports improvement in students' problem-solving skills; collaboration and communication skills; and enjoyment in learning outdoors.

Time outdoors also reduces stress and can help children be more calm. It can also improve attention, including in children with ADHD (Kuo et al., 2019). Researchers have found several mental health benefits to time outdoors. It can decrease depression (Beyer et al., 2014; McEachen et al, 2016), lessen anxiety (Song et al., 2015), and increase feelings of happiness and well-being (MacKerron & Mourato, 2013; White et al., 2013).

Outdoor Learning in Schools

Johnson (2007) posited that children benefit when schools use their nature to enhance learning. White et al. (2018) explained:

There are multiple benefits of outdoor learning within school grounds, including the close vicinity and easy access to school (saving money on travel costs and valuable teaching time), ease of frequent visits (facilitating long-term studies), and the realisation that children are more attentive to educational tasks, learn more, and feel more comfortable when taught in a familiar rather than novel environment (p.14).

Elliot & Krusekopf (2017) described an introduction of a nature-based kindergarten in a public school in British Columbia. They learned that the program resulted in a strong classroom community and that the children developed responsibility for staying safe, which led to increased self-regulation. The teachers learned to be flexible as unexpected situations arose, and they learned to participate in children's conversations without taking over. MacDonald & Breunig (2018) describe similar findings in a school in Southern Ontario with an

inquiry-based kindergarten program. Interviews with teachers and students revealed that students liked being in charge of their outdoor learning experience and that teachers liked the fact that they used students' interests to guide learning. The children developed independence in the outdoor space, and teachers reported that they could teach their curriculum standards in a way that seemed more genuine. A study by Nedovic & Morrissey (2013) found that when kindergarten students were given natural materials, such as flowers, plants, rocks, and shells, they engaged in pretend play that was longer and more creative than their previous play with classroom toys.

In a study with slightly older children (ages 9-10), Kuo et al. (2018) compared the same lesson delivered outside in a grassy site near a stream and in a regular classroom. The researchers found that student involvement and participation were higher for the lessons in nature, based on multiple measures. The results were consistent across teachers and across a ten-week period. In addition, they found that the number of times teachers were interrupted by student behavior was reduced by almost half in the lessons in nature. A study by Largo-Wright et al. (2018) found similar results with regards to student behavior. When two kindergarten teachers taught their language arts lessons for six weeks, one in a traditional classroom and one in an outdoor classroom, the researchers found that the outdoor classroom had fewer disruptions by students and fewer discipline problems, and this effect increased as the study progressed. Sobel (2014) analyzed the State Education and Environment Roundtable (SEER) report that looked at schools in sixteen states that incorporated the environment

into their curriculums through outdoor classrooms and outdoor projects. He described results that included fewer discipline referrals, improved attendance, improved test scores across subjects, improved public speaking skills, increased college acceptance rates, and improved ability to transfer knowledge to other settings. Sobel also cited studies that showed that students' attitudes towards the environment improved.

Other research to support outdoor classrooms came from Khan et al. (2019) who found that outdoor classrooms led to higher science test scores and higher student satisfaction in Bangladesh; Szczytko et al. (2018) who demonstrated that using outdoor learning spaces had positive effects on academic performance, attention and behavior for children with emotional, cognitive and behavioral disabilities; Williams et al. (2018) who demonstrated that the Science in the Learning Gardens program, funded by the National Science Foundation, improved science grades and student engagement with low-income, diverse middle school students; and Eick (2012) who demonstrated the impact that an excellent third grade teacher had on students' reading and science scores when she used an outdoor classroom for all of her instruction in those subjects.

As Sobel (2020), who is known for his innovative work with place-based education, stated about nature-based learning, "Children are developing more grit, perseverance, confidence, sense of place, happiness, and their test scores are improving. What is not to like?" (p. 1069).

Supports and Barriers to Outdoor Education in Schools

Although research has documented the benefits of nature-based learning, administrators and teachers must be willing and able to implement it. A study by Dring et al. (2020) examined how teachers felt about using school gardens and other outdoor spaces with their classes in British Columbia, Canada. Teachers cited the values they held about nature-based learning, such as their love of nature and their concerns about kids not spending enough time outside, as being key to them using outdoor spaces for learning. In addition, teachers shared that experiences they had with nature-based learning, grant funding, and administrative support were all factors that helped them implement outdoor learning opportunities. They also said that a lack of support from administration was a big obstacle for teachers to overcome. Other barriers included the time it takes to set up school gardens and outdoor spaces and a lack of training for teachers with little gardening and outdoor learning experience.

Greer et al. (2019) found similar results when researching a school garden program in a low-income, multicultural school district. They interviewed principals and teachers and found that the lack of funding for materials and pressure to teach standardized test preparation interfered with developing school gardens. However, principals and teachers shared the benefits they saw for students, such as new skills, outdoor play time, and community building. Teachers said initial lesson plans already prepared for teachers would make school gardens more likely to be implemented as teachers would have some structure to get started.

Professional development appears to be an important component to support teachers in implementing nature-based learning. Ernst & Erickson (2018) cited prior research that supported the need for professional development, and they conducted their own research on the impact of a mentor program following environmental education professional development. They found that teachers overwhelmingly liked the mentoring and said it was key to implementing environmental education in their classrooms.

Miller et al. (2022) identified barriers and enablers for nature-based learning through interviews with administrators and teachers. They cited barriers such as comfort in the outdoors, funding, pressure to cover curriculum, and weather conditions. Enablers included having a nature leader in a school who advocates for nature-based learning and having a supportive administration.

Finally, community partnerships with environmental organizations can assist schools with the training and materials they need to implement nature-based learning. Bailie (2010) presented a continuum of connections with environmental organizations, such as a local nature center, that can assist teachers in implementing nature-based learning. Teachers and their students can take a field trip to a nature center, either once or once per season. Teachers can attend training at local nature centers to increase their knowledge and comfort with outdoor learning spaces, and parents can attend training at a nature center as well to help them understand the importance of getting their children outside. A study by Fazio & Karrow (2013) examined environmental education programs in schools in Canada. Teachers named community partnerships as an important

resource to support their environmental education efforts. The authors recommended that school districts prioritize these relationships with community-based nature organizations.

Unequal Access to Outdoor Spaces

As mentioned in chapter one, racism impacts access to green spaces. Boone et al. (2009) explained that people of color are less likely to have parks in their neighborhoods, and those parks are less likely to be well-maintained and safe.

Floyd (2001) examined ideas about why discrimination exists in green spaces and proposed several hypotheses. One hypothesis contends that African Americans lack the financial resources to participate in recreation activities as a result of years of economic discrimination. Another hypothesis focuses on violent history in outdoor spaces that may discourage people of color from enjoying these spaces. For example, slavery and lynchings may be associated with outdoor spaces and lead African-Americans to not consider outdoor recreation culturally appropriate. Floyd also discussed the impact of discrimination that people of color experience in outdoor spaces, such as national parks. People of color have reported that they avoid outdoor parks and other natural spaces because of concerns about conflicts with white park visitors, about verbal and physical abuse from white park visitors and employees, and about not feeling welcome in these spaces. Finally, Floyd examined institutional discrimination that discourages people of color. Institutional discrimination can

include policies, hiring practices, program decisions, and advertising practices that exclude people of color. Byrne & Wolch (2009) provided further evidence of institutional discrimination by explaining how early urban parks, such as Central Park in New York City, often displaced poorer residents as they were built. In addition, early urban parks set up dress codes, behavior rules, and segregated spaces to limit access by marginalized groups. This history has led in part to the inequities that still exist today in urban green spaces.

Roberts & Rodriguez (2008) examined gender, ethnicity, class, and culture effects on park participation. Their findings dispute the idea that people of color do not value the environment. However, they did find that perceived discrimination and cultural factors affect people of color's use of natural spaces. Participants in their study talked about their lack of experience with outdoor activities that lead them to be concerned about being safe. They also cited concerns about getting dirty, about women and girls' hair being an issue, and about not believing that people like them participate in outdoor activities (Roberts & Rodriguez, 2008). Chronin-de-Chavez et al (2019) reported similar findings. While low income families and families of color valued time in nature, they faced issues such as not knowing where to go for high quality outdoor experiences, not being able to get to those places, and not knowing if their children would be safe in those places. Concerns about crime, poor behavior by others, and fear of getting hurt also prevented these families from using outdoor natural spaces. The issue of representation is discussed by Carolyn Finney (2014) in her book, *Black Faces, White Spaces: Reimagining the relationship of African-Americans to the*

great outdoors. Finney explained how organizations, ranging from magazines to the National Park Service, fail to show African-Americans enjoying nature and participating in outdoor activities in their advertisements and publications. In addition to increasing representation, Finney explained that Black people want more acknowledgement of African-Americans who are working in natural spaces. Finney advocated for giving more voice to Black environmentalists, authors, and artists doing this work.

Inequalities in access to green space matter because they can impact children into adulthood. An ambitious study by Browning & Rigolon (2019) examined whether access to green spaces could help children get out of poverty as adults. The authors hypothesized that opportunities to enjoy green spaces would lead to academic achievement, self-regulation, and imagination that would ultimately help children be more successful. They found that there was an association between green spaces and improvements in earnings as an adult. The authors acknowledged that other factors could be involved, but the results are promising.

McCree et al. (2018) conducted a longitudinal study looking at the effects of a Forest School experience for children who lived in poverty and had social-emotional issues. The researchers found that the children improved their self-regulation and flexibility. The researchers emphasized that the positive results were due to multiple interventions, but they did state that the Forest School changed the culture of the school and led to a bigger interest in sustainability.

Ray et al. (2016) looked at the relationships between race, income (as measured by the percentage of students eligible for free and reduced lunch), test scores, and the presence of a school garden in Washington, D.C. They found that the presence of a school garden correlated with higher test scores, and the relationship existed even when controlling for race and income. They also found that schools with more white and Hispanic students were more likely to have a school garden. The authors cited their study as evidence for school gardens and other informal learning spaces to reduce the achievement gap and promote environmental activism with communities of color.

Sprague et al (2020) provided further evidence of the benefits of nature-based learning for low-income communities of color. These researchers examined a 15-week nature program for Black and Hispanic low-income children in St. Louis. They found significant improvements in all areas tested, including physical, emotional, and social functioning and in STEM traits, including leadership, interest in science, and teamwork.

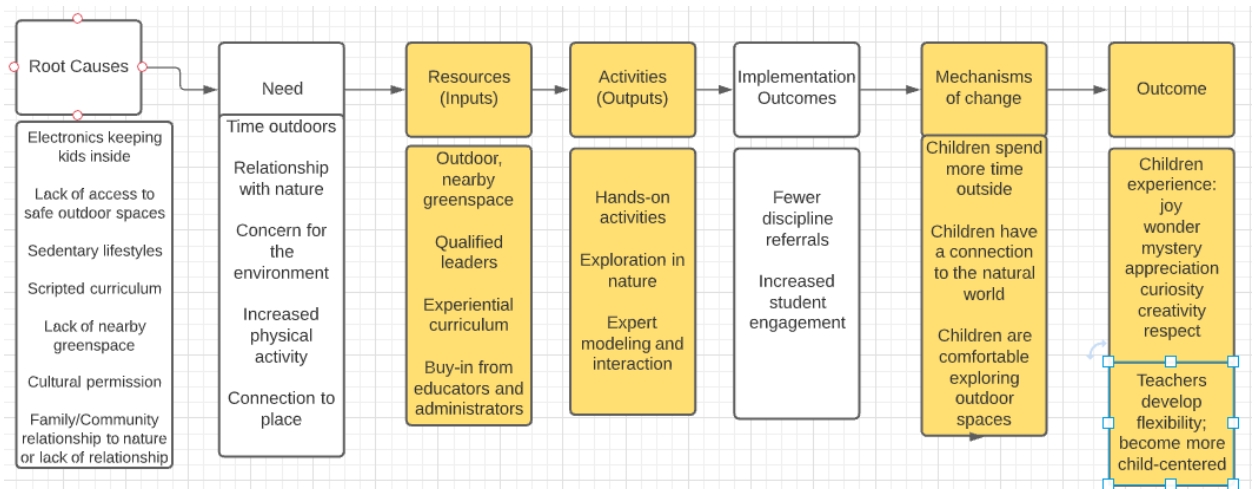
The literature on inequities in access to outdoor spaces centers on historical and ongoing discrimination, a European-centered approach to parks and recreation, and lack of representation in park employees and programs. However, children of color benefit from outdoor spaces just as white children do, and nature-based learning may help reduce the achievement gap. In our study, we hope to contribute to the literature by looking at how and why inequalities exist in access to green spaces and how those inequalities can be overcome.

Conceptual Model

Our conceptual model is based on a theory of change model from Ghate (2018). Our study will focus on the highlighted parts of the model. We do provide some information on root causes of the problem of children not spending enough time outdoors, and we include needs met from spending time outdoors. However, for this study, we focus on what are the needed resources and types of learning activities needed for nature-based learning and what are the outcomes for children and teachers.

Figure 2

Our Conceptual Model of Change as a Result of Nature-Based Learning



Methodology

Introduction to Research Methods

As researchers, we chose an explanatory sequential mixed methods design for our study. Creswell (2012) defined an explanatory sequential mixed methods design as a research design that involves collecting quantitative data first and then expanding on the data with qualitative information. In the case of this study, the quantitative data was first used to rate each school with kindergarten through second grade in our study area by the percentage of green space that exists within a quarter mile of the school. Quantitative data was then used to address the first research question, which is examining whether a relationship exists between the percentage of students eligible for free and reduced lunches and percentage of space within one quarter mile of the school that is green space. We used this quantitative data because we hypothesized that schools with higher percentages of free and lunches will have lower percentages of green space near them. Our hypothesis was based on research that shows that disadvantaged groups are less likely to live near green space (Boone et al., 2009; Leahy & Serkez, 2021). This information showed us if prior research is true for the St. Louis area specifically.

The qualitative data came from case studies on select schools with different percentages of green space surrounding them. The case studies used teacher interviews and student observations to learn about the nature-based learning happening at the selected schools. According to Creswell (2012), case

studies are an “in-depth exploration of a bounded system (e.g., activity, event, process, or individuals) based on extensive data collection” (p.465). Yin (2018) explained that case studies are best suited to research questions that are interested in how and why an event or process is occurring. In our study, we were interested in how and why schools were or were not using green spaces near them. Case studies typically use multiple kinds of data and use triangulation to bring the data together (Yin, 2018). Our multiple forms of data created pictures of nature-based learning in schools with varying amounts of green space available to them.

Research Positionality

Positionality is the idea that a researcher’s own relationships, assumptions, and experiences can influence how she interacts with subjects and data (St. Louis & Calabrese Barton, 2002). Mauthner & Doucet (2003) suggested that positionality can start with what they call “social location,” where a researcher considers her background and demographics that situate her in her social world. However, they also stress the importance of considering one’s educational history and the institutions that are part of that history, one’s theoretical lens, and the theory of knowledge that one brings to data analysis. The author’s also suggested that researchers should regularly be reflexive throughout the research process.

Melissa:

As the mother of a teenage boy who sends me videos of the birds eating from our feeders and the oldest of a large family and generation that grew up

snipe hunting, picking our own tomatoes and making smores on a campfire, I strongly believe in the benefits of being outside. I am aware of the role that nature can have on children but as an educator I lack the understanding on why my students are limited to less than thirty minutes a day outdoors and are unable to utilize the parks close by. I want to understand more about how to give children the chance to appreciate their surroundings, build a relationship with nature, and protect what they need to sustain for their future.

Julie:

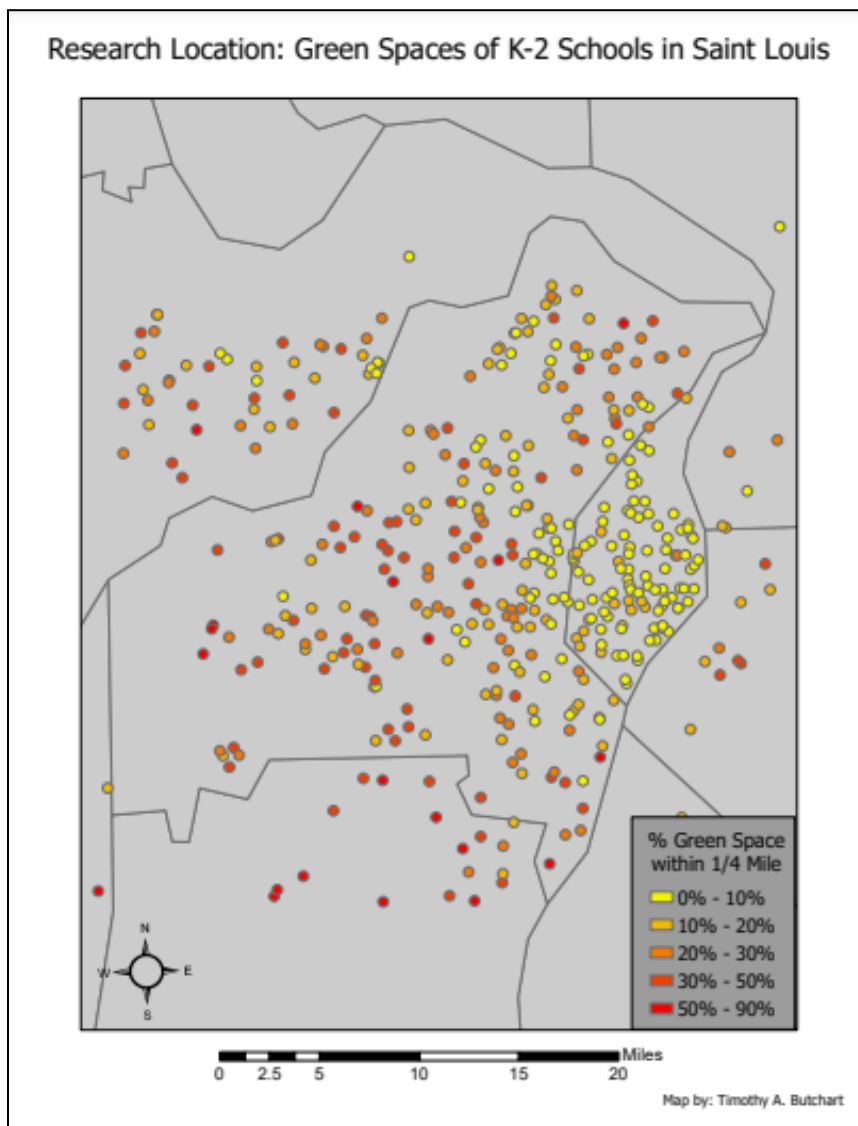
I have been teaching early childhood education for 16 years in schools that are predominantly African-American. I have seen the effects of standardized testing, as the curriculum standards have been pushed down to younger grades. Children do not have the opportunity to play and explore in kindergarten anymore. My own children, who are now in their early 20's, attended half-day kindergarten in the same district where I work. They had many more opportunities to play in their kindergarten classes than my current students have. I believe that more opportunities to be outside would lessen disruptions in the classroom and would likely increase engagement. I have also had a social constructivist approach to learning, which means I believe that children build their knowledge through hands-on experiences and by interacting with others. Teachers take a facilitator role in a constructivist classroom and help children pursue their interests.

Research Locations

We selected six schools, based on criteria explained in the “Research Sample” section, to use as case studies. These schools are located throughout the St. Louis area as defined by the coordinates used to generate our map and database.

Figure 3

Research location: Green Spaces of K-2 schools in St.Louis



Research Sample

For our overall sample, we worked with Timothy Butchart of the National Geospatial-Intelligence Agency to create the database and the St. Louis Schools and their Green Spaces Map, which included schools in the St. Louis region that have kindergarten through second grade students. The coordinates used to create the map were:

Upper-Left Corner: 90.72 W, 38.91 N

Upper-Right Corner: 90.09 W, 38.89 N

Lower-Right Corner: 90.14 W, 38.37 N

Lower-Left Corner: 90.76 W, 38.4 N

These coordinates include from Missouri: St. Louis City, St. Louis County, and portions of St. Charles County, Franklin County, Jefferson County, and Lincoln County. In Illinois, portions of Madison County, St. Clair County, Calhoun County, and Monroe County were included. Based on these specifications, 421 schools were included in the database and map.

To determine how close green space must be to a school, we relied on Browning & Rigolon (2019). In their study, they compared people's present-day earnings to their proximity to parks and areas covered in vegetation when they were children. The researchers used a quarter mile as the maximum distance to such green spaces and argued that this was the most reasonable distance children could travel. Boone et al. (2009) also identified a quarter mile as the distance people would be willing to go to get to a park.

Then, we used purposive sampling to choose six schools to examine

further through case studies. Purposive sampling is a qualitative method for choosing cases that will provide informative data for the topic being studied and will provide subjects able to participate (Palinkas et al., 2015). We used the following criteria for picking the case study schools:

1. Proximity to green spaces: We selected two programs with a high percentage of green space nearby (at least 60 percent of space within a quarter mile is green space), two schools that fell in the middle of the list of schools (15 - 30 percent of surrounding area is green space), and two schools with virtually no green space nearby.
2. Nature based learning is used throughout the school year.
3. Website contains mention of nature-based learning or visit to site allows us to see that a nature-based learning environment exists
4. Willing and able participants to speak with concerning school initiatives

Data Collection

Map development:

Timothy Butchart of the National Geospatial-Intelligence Agency developed the map and database prior to the start of this study, and these resources are included in Appendix A. He looked at 5 categories of green space- Herbaceous, Developed, Open Space, Deciduous Forest, Evergreen Forest, and Mixed Forest. He pulled the location of Missouri's public and private schools from the Missouri Spatial Data Information Service (MSDIS). He filtered the data for any schools that contained K-2. He pulled the location of Illinois' public and private

schools from the National Center for Education Statistics (NCES) and once again filtered them for K-2 schools.

He pulled the land cover data from the National Land Cover Database (NLCD). He used the most current NLCD data, which was produced in 2016. He used ArcGIS Pro 2.6 and the BUTCHART script, which he developed using Python 3.

Research Question 1:

For the first research question, we used data from the Niche website about the percentage of students eligible for free and reduced lunch. We also used the green space data from our map. That data was compiled in a Microsoft Excel spreadsheet and was analyzed on Excel.

Interviews:

We conducted interviews with teachers in grade levels kindergarten through second grade who utilize nature-based learning in our case study schools. During the interviews, we showed the picture cards and words, shown in Appendix B. The interviews followed the format outlined in Appendix C. We used elaborating probes as needed. Creswell (2012) defined elaborating probes as, “sub questions under each question that the researcher asks to elicit more information...clarify points or to have the interviewee expand on ideas” (p.221).

Interviews are common in qualitative research, and they allow the researchers to get more information than what can be observed and allow the researchers to tailor the questions to their needs. However, researchers cannot control how accurate the information is that the interviewees share (Creswell,

2012). For that reason, it is helpful to collect data from more than one source, which is why we interviewed more than one teacher in each school and observed students to see what is actually happening in the natural spaces.

We used word cards and pictures to guide our interviews. The idea for the pictures, in particular, came from a study by Lin et al. (2013). In this study, the researchers gave visitors to the Alamo disposable cameras to take photos during a visit. Those photos were then printed, and a set of nine photos were used in interviews where interviewees were asked to select three that had meaning to them. In our study, we are providing the pictures from images found on the internet, and we will ask interviewees to match the pictures to words.

Photographs can have many meanings and will elicit different responses from different people (Lin et al., 2013), so we can gain a great deal of information from this process.

Observations:

We observed students at three case study schools as they interact in their nature-based learning environment. We took notes about what the students were doing. The researcher was a non-participating observer, and we were limited to sites that gave us access to observe children. As Creswell (2012) explained, observation enables researchers to see what is actually happening in a setting.

Data Analysis

The data from our first research question was analyzed through a correlational analysis in Microsoft Excel. As Creswell (2012) explained, correlational analysis allows researchers to look for relationships among variables. For our study, we wondered if there is a relationship between the percentage of students who qualify for free and reduced lunch, and the percentage of green space around a school.

For the interviews, we recorded the interviews, with interviewees' permission, so that we could conduct in vivo coding of interview transcripts. In vivo coding uses the exact language shared by the interviewees as category names in order to best capture the subjects' experiences (Saldana, 2016). We also created transcripts of our observation notes, so that we could code those as well. We then engaged in thematic analysis to analyze our data. Terry & Hayfield (2021) define thematic analysis as, "a flexible analytical method that enables the researcher to construct themes - meaning-based patterns - to report their interpretations of a qualitative data set" (p.3). We looked through our coded data and grouped similar ideas together to develop some initial themes. Then, we assessed our initial themes by testing them against our data. Last, we named our final themes and defined them as related to our research questions. We also provided excerpts from our interviews as evidence to support our themes.

Findings

Introduction

Our study looked at nature-based learning in kindergarten through second grade classrooms in the St. Louis area. We discussed the problems of childhood obesity and of increased time children spend on electronic devices. The COVID pandemic exacerbated the problem with electronic devices, as all children spent some amount of time in virtual school over the last two and a half years. We also explained how focus on standardized tests in schools has reduced the amount of time children have for free play, particularly outdoors.

We interviewed teachers in the St. Louis area who were doing nature-based learning. We wanted to find out why they valued nature-based learning, what outcomes they see for themselves and their students, and what factors have enabled them to do nature-based learning. In addition, we examined the role that available green space plays in schools offering nature-based learning.

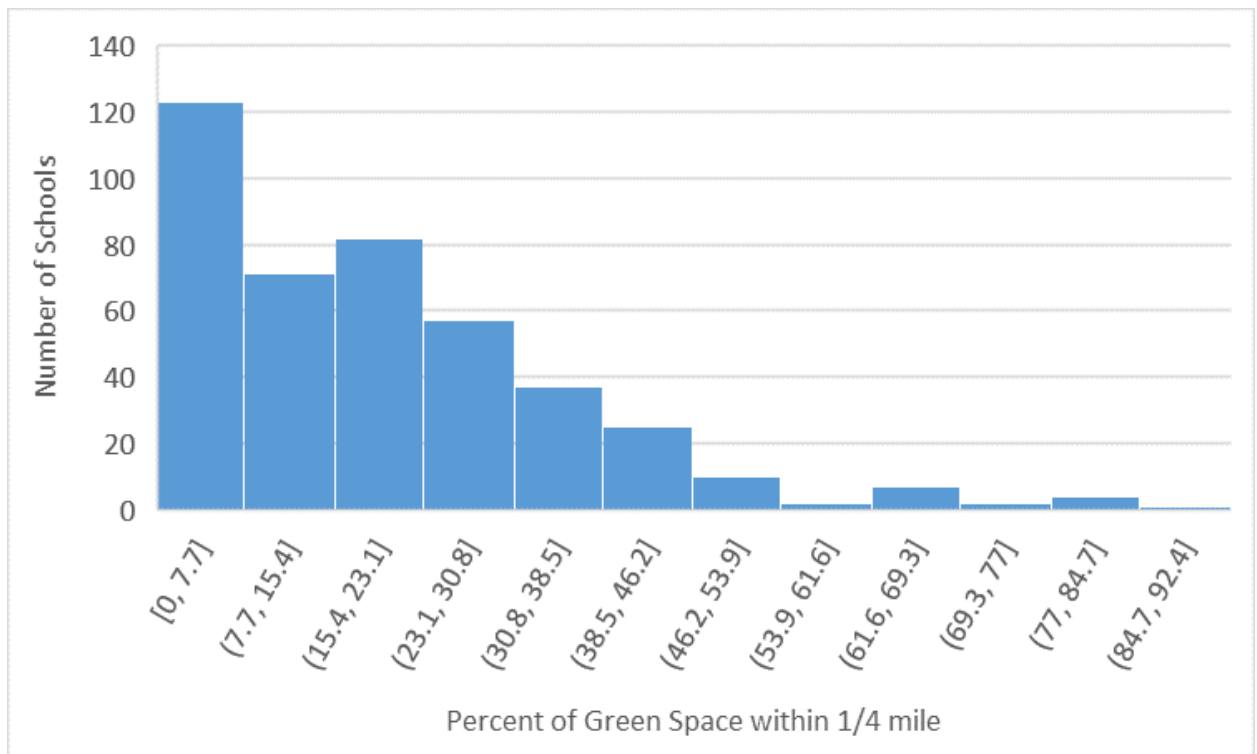
Our Map: Patterns and Notable Findings

We used our map and database, from Timothy Butchart of the National Geospatial Intelligence Agency, which defined the amount of green space within a quarter mile of each school, to find schools for the case studies. Each dot on the map (and each school in the database) represents a school with kindergarten through second grade in the map area. Schools on the map are color-coded to

indicate the amount of green space surrounding them. Table 1 breaks down schools by percentage of green space surrounding them.

Table 1

Distribution of Schools by Percent of Green Space

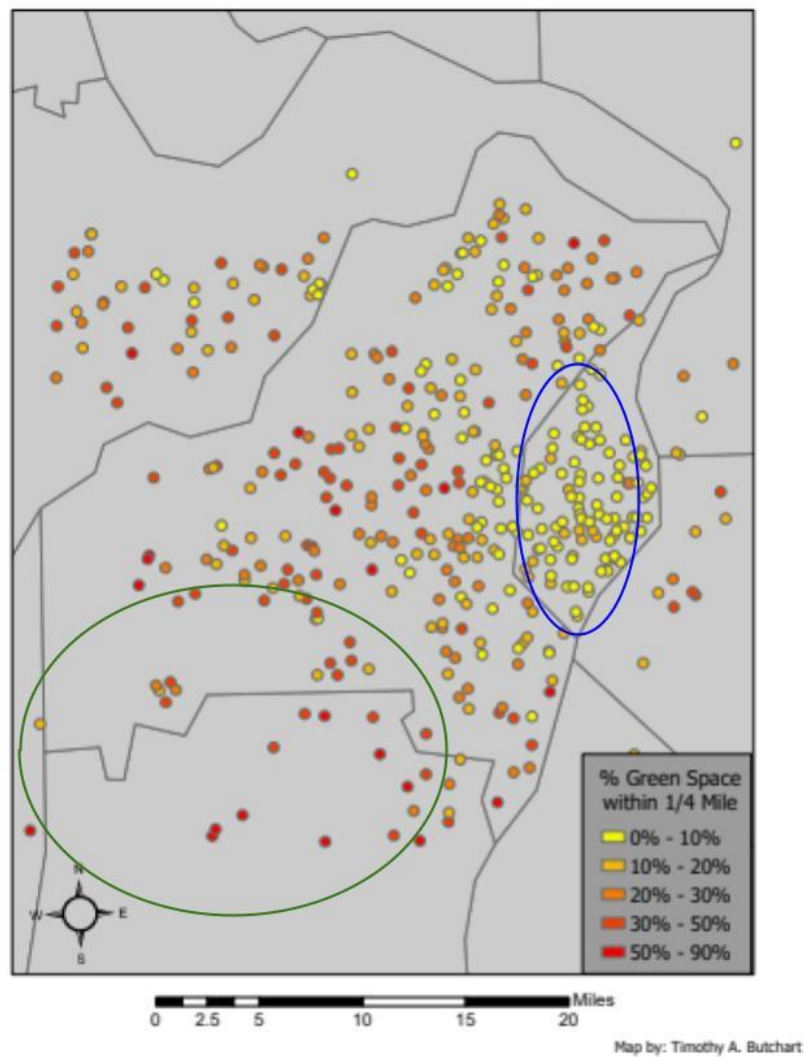


As this graph shows, very few schools had more than 46 percent of space around them as green space, and the largest number of schools had less than 7.7 percent green space around them. These findings make sense in a primarily urban/suburban area. As Figure 4 shows, the schools circled in blue are within the city of St. Louis, and nearly all of these schools are represented by yellow dots, putting them in the smallest category of green space, with less than 10 percent. The schools circled in green are in the more rural areas in outer St. Louis County and Jefferson County. Most of the deep red dots, representing schools with green space of greater than 88 percent, are out in these areas.

Figure 4

Comparing Green Space in St. Louis City to Southwest St. Louis County and Jefferson County

Research Location: Green Spaces of K-2 Schools in Saint Louis



Note: The blue circle encompasses schools in St. Louis City. The green circle encompasses schools in far southwest St. Louis County and Jefferson County.

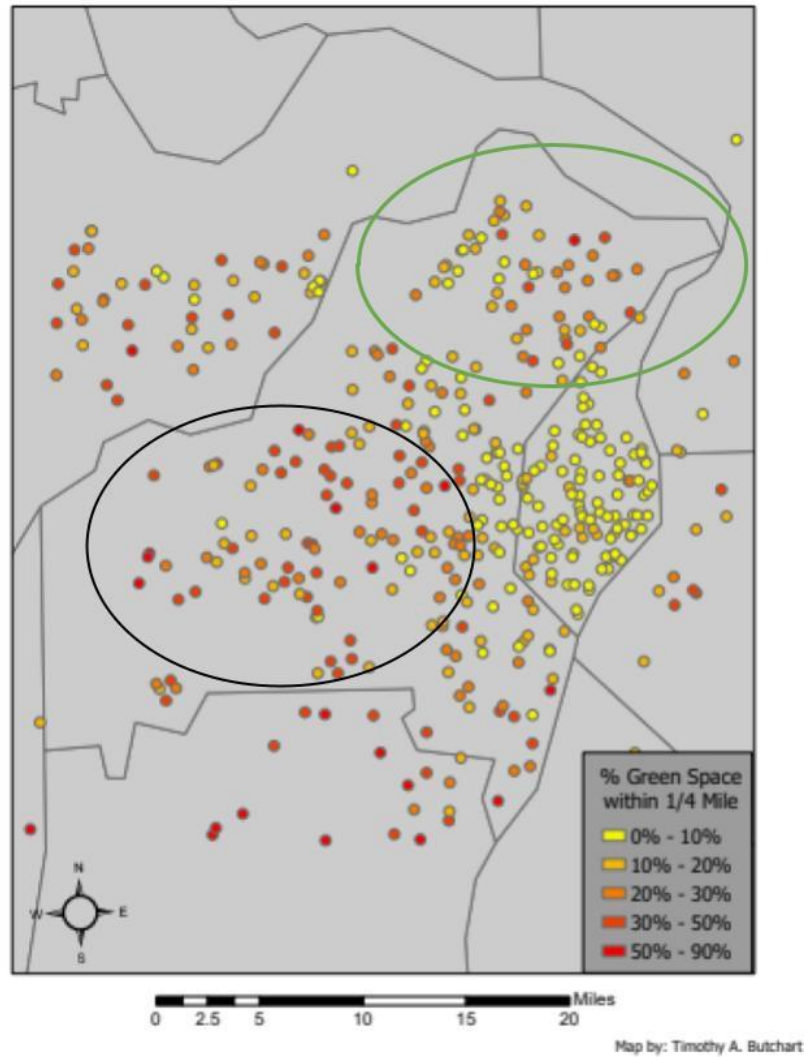
Source: Timothy Butchart, National Geospatial Intelligence Agency

As Figure 5 shows, we see some differences in green space within St. Louis County. West St. Louis county is an affluent area of the St. Louis area. The schools in this area are circled in black. North St. Louis county is a much less affluent area, and the schools in this area are circled in green. If we compare the schools in these two areas, we see more yellow and orange dots in the North St. Louis county area and more red and dark red dots in the West St. Louis county area.

Figure 5

Comparing Green Space in North St. Louis County to West St. Louis County.

Research Location: Green Spaces of K-2 Schools in Saint Louis



Note: North St. Louis County schools included in the green circle. West. St. Louis County schools included in the black circle. Map source: Timothy Butchart, National Geospatial Intelligence Agency.

These findings support prior research that children in less affluent areas have access to less green space (Rowland-Shea et al., 2020; Boone et al., 2009; Finney, 2014; Leahy & Serkez, 2021).

Case Study Schools

Our goal was to work with two schools with at least 60 percent of space surrounding it as green space, two schools with 15-30 percent green space surrounding it, and two schools with little to no green space surrounding it. We looked at school websites and social media sites and visited school grounds to find schools with evidence of nature-based learning. We reached out to 21 schools. Figure 6 shows the number of schools contacted and what responses we received.

Figure 6

Schools Contacted for Study

Number of schools contacted	21
Number of schools who participated	6
Number of schools who did not respond	8
Number of schools who said they had no nature-based learning	4
Number of schools who declined participation (District office did not allow research)	3

We interacted with six schools in the area for interviews and observations. Figure 7 outlines the details of these six schools.

Figure 7*Descriptions of Schools in Study*

School #	% Green space	Type of school	Grade levels	Interviews	Observations
1	> 60%	Public	K - 5	No	Yes
2	> 60%	Public	K - 5	Yes (2)	No
3	15 - 30%	Public	K - 5	Yes (2)	No
4	15 - 30%	Private	K - 8	Yes (2)	Yes
5	< 10%	Private	PreK - 5	Yes (3)	Yes
6	< 10%	Public	PreK - 2	Yes (1)	No

We created transcripts of our interviews and observations and stored them in a secure database. Then, we coded the transcripts using phrases from our research questions and purpose statement. After much reflection and analysis, we developed five major themes:

1. There Is Magic in the Green Spaces
2. How Do You Get Kids Outside?
3. Every School Needs a Nature Champion
4. Community Partnerships Can Bridge the Gap
5. What Happens When Kids Get Outside?

Theme 1: There Is Magic in the Green Spaces -

“Allow them to be immersed in and understand the relationship that we all have with our living surroundings.” (Ben, School #5)

This first theme centers on green space as a gift to teachers and students engaged in nature-based learning. The teachers in our study are concerned with protecting the environment and teaching children to do the same. Teachers are less concerned with the quantity of green space and more concerned with the changes they can make that will make a difference. Their students learn through hands-on experiences, careful observation, and rich discussions about the magic of nature.

Green space guided our selection of schools to investigate, and the schools we talked to had teachers who appreciated what they had. “Matt,” a teacher at school #4 explained the responsibility he feels for the gift of green space at his school.

If you have some land, the things you can do with it are endless ... So like, you know, planting trees and planting bushes, planting plants, planting cover crops, doing compost is beneficial to the land. And so like we're not exploiting the land by work, like we're helping the land. (“Matt,” School #4)

A teacher at another school, “Linda,” at School #3 explained that they were fortunate to have the room for garden beds, a prairie-type area with native plants, and a wetlands area. She said, “I do all of this because I have the opportunity to because we have this space.”

At one school with very little green space, a teacher we interviewed stated that small spaces can still work. Teacher “Ben” at School #5 said, “you can't just say we don't have any [green space] based on location, because there's always something you can do.” He went on to explain how a tree frog made its way into

the urban school area to the pond he built. His class had added plants to the pond area that bloomed and attracted bees and birds and other insects. He explained his discussion with his class about how much work that tree frog went through to make it to their little natural space. He added, “one small change can make a huge impact ... so when schools don’t have any green space, or when they don’t have any real kind of nature area, they’re not, they’re not giving themselves a chance to continue that growth.”

During our observations, we saw students and teachers interacting with and enjoying the green spaces around them. At school #5, we saw students finding and watching insects, playing with tree bark, collecting sticks, and throwing different sizes of rocks into puddles. At school #4, students were planting vegetables, picking flowers off of young fruit trees that were not strong enough to bear fruit yet, and playing with the chickens in the chicken coop. All of these experiences happened because the students were given time to be in these green spaces.

Connection to place develops as people engage with the natural spaces around them. As students spend time outdoors around their schools and neighborhoods, they develop feelings of belongingness to a place and they develop their own identity as an integral part of the environment. They appreciate their place in the world, and they learn how to care for it and protect it.

Matt, at school #4, shared his strong connection to place and he shares that connection with his students every day. He said, “this is my church. This is

my neighborhood. And this was my school. And I mean, also, I just love this land. Like I love this neighborhood. And I love this land right here.”

When we observed at School #1, students were building bird houses for the blue jays that build nests around their school grounds. The teacher shared information about blue jays with the students, such as how they are territorial and how they like to have a clear flight path to their nests. After the students assembled the bird houses, they went out to the school grounds and chose places on the perimeter of the woods for the bird houses to be hung. The teacher also explained that the students would be cleaning out the bottoms of the bird houses each year to prepare for the next season. The students learned a lot about blue jays, and their work connected them to the birds that share their school grounds.

“Ben” expanded on that idea:

I believe in having as many living things in the class as possible - plants and animals. And that just allows them to be immersed in and understand the relationship that we all have with our living surroundings. (“Ben,” School #5)

“Cheryl” at school #4 uses scavenger hunts with her students to get them to observe their environment. She said, “they’re taking a picture of that day, in that moment ... paying attention to what is going on right now, right in their environment.”.

Other teachers mentioned the idea of developing awareness for one’s environment. “Amy” at school #3 said, “it opens the world up to them, you know,

and they'll say, 'I have that tree'; 'I went home and talked about that tree at my house.'" She added that for homework, " I just give them some like hands on fun things their family can do. And a lot of times, I'll just have them walk around their neighborhood, and look for different things to get them outside."

"Steve" at school #6 also shared how he builds awareness through walks around the neighborhood.

Just kind of learning about their world. You know, oh, we're outside in the spring. What are some things we noticed? Hey, now the next time we're taking a walk, it's in the winter, what's changed? You know, why do you think that happens? What does the weather do for us? You know, and we could talk a little bit how in different areas like Florida, they don't have snow, they don't have the seasons that we have around here? Sure. So what do you think is different? And we, you know, talking about the different types of trees? Why do orange trees lose their leaves? Why do some not? ... Well, what about those trees in Florida? Do you think they lose their leaves? ("Steve," School #6)

We also spoke to staff at schools not included in our case studies who were not using the green space they had. A teacher at one high-green space school, adjacent to a large county park, indicated that they only used the park space occasionally for physical education classes, but they had no nature-based learning. A principal at another school, whose website advertised a nature trail, said no such space existed and that they had no nature-based learning. We

drove by the school property ourselves and saw the entrance to the nature trail, which was clearly marked.

Theme 2: How Do You Get Kids Outside?

**“I really pushed for it, to be outside and to take those lessons outside.”
(Amy, School #3)**

Our definition of nature-based learning stated that the learning occurs in natural settings, so teachers have to get kids outside before they can engage in any nature-based learning. We needed to learn from teachers what helped and hindered them from getting kids outside.

First, the teacher needs to be comfortable outdoors. A teacher at one of the high-percentage green space schools indicated that large spaces can be overwhelming to use with students.

Sometimes I find open space to be like, really hard to break down ... sometimes mud and things like that, like that can be kind of distracting. I think the hardest thing for me is like, once we get out there, how are we going to use this space appropriately? (“Sarah”, School #2)

Other teachers explained that they had to coax co-workers outside.

Both teaching partners I've had with his garden unit, neither of them are very into gardening. And they really, I don't think if I pushed going into the garden, they would have put some seeds in a cup in the classroom and they'd call it done. Yeah, but since I really pushed for it, you know, to be outside and to take those lessons outside. (Amy, School #3)

There are also racial differences in comfort with the outdoors, as we discussed in chapters 1 and 2. Steve at school #6 shared discussions he has had with his co-teacher, an African-American woman:

My teaching partner, who's actually a retired St. Louis police officer, is like, "I don't need to touch any bugs". You know, so even within our own classroom, there's that comfort level ... She's African American, and we have those conversations about how like, culturally, her, like her friends or family don't really didn't get out as much. You know, she's like, "I go to my backyard. That's about it." ... she takes big walks, you know, that's a big part of her life, too. So that's why it's so good for us as a whole. But she's like, "I'll take a walk down the street, but um, you're not gonna find me in the woods." ("Steve," School #6)

Student comfort also influences how easy it is to get kids outside.

Teachers mentioned allergies, comfort in the heat and cold, and concerns about getting dirty that made students uncomfortable. All three teachers at school #5 talk about warning parents up front that kids will get dirty and "Caroline" and "Beth" both mentioned that they have students bring extra shoes to keep at school for outdoor play. "Ben" talked about the challenge more:

There are just so many kids that won't try something because they're afraid to get dirty, or, you know, again, culturally, the parents, the parents might say, you know, you better not come home with dirty pants ... So I make it very clear to the family at the beginning of the year, yes, we wear uniforms. Yes, I understand that these uniforms cost money, but they are

going to come home dirty ... But that's because they really dove into what we're learning about. ("Ben" School #5)

"Steve" also noticed that some of his students and families were not always comfortable with outdoor activities. When the pandemic started, his class camped out in their own backyards as part of virtual learning. Some families told him that was not something they did. He told them that he understood and that everyone has their comfort zones. With his students, he slowly builds their stamina for being outside if they are not comfortable at first. He added, "that big outcome is that just 'hey, I can go outside and enjoy myself. I don't have to be worried or scared or oh, there's some mosquitoes or some bugs are gonna get me', you know."

Student behavior can be a factor, too. Amy from School #3 said, "there's those years where I barely went outside because it was hard to keep everybody safe and listening to me and nice."

Administrative support also helped teachers get kids outside. Every teacher expressed appreciation that their school leaders supported nature-based learning. Several teachers mentioned that their principals encouraged teachers to get kids outside. At the same time, teachers acknowledged that curriculum and pressure to meet standards affected how they use their time. Scheduling issues can also prevent getting outside when other teachers are coming to pull out students for special services. While it is often a juggling act for teachers, they all expressed commitment to making time for nature-based learning.

Theme 3: Every School Needs a Nature Champion

“I believe I have a lot of knowledge, and I try to impart it as much as I can, as we’re going.” (“ Matt,” School #4)

Our third theme, which we found to be immensely important, centers on our findings that a school needs a leader within the school who is passionate about nature-based learning. That person may have experiences or skills that facilitate nature-based learning or at least have the desire to learn about it. They are tireless advocates for giving students time outdoors. They believe in child-centered learning that focuses on children’s overall development, not just academic skills.

Every school we interacted with had at least one person who was considered a champion for nature-based learning. At school #4, “Matt” and “Cheryl” are clearly the nature champions. When “Matt” came to the school, they had five garden beds. Now the school has 25 garden beds, fourteen fruit trees, a beehive, and a chicken coop, and the school composts its scraps from its lunch program. He also sells produce from the gardens at a weekly market at the school. He sees the benefits for students reflected in the school culture:

We have a very good school culture on composting and recycling. It's like, very important for us to have as little landfill. Like we do a lot of trash education. And so having students, our garden club, take the school's recycling down to the dumpster and dumps it and then goes down to the garden. And so having students like carrying around compost or carrying

around like, “Oh, I want to be the one to dump,”, so that is definitely a part of our school. (“Matt,” school #4)

“Cheryl” has run the stream team at the school for 12 years. They learn about and take care of the stream that runs behind the school. She is the integrated arts teacher. She works with all grade levels teaching them about taking care of the environment. She said about her work, “It is going outside and wanting to do it and other people deciding that it looks fun. It’s becoming known for those kinds of things. It perpetuates.”

At school #3, “Linda” and “Amy” are passionate about nature-based learning, but they credit another teacher with leading the efforts at their school. As Linda described,

He just cultivated [a wetlands area] built a little bridge to go over it and then put plants in there that are native to Missouri. And then also in the back of our yard behind the playground. There's a big area that's like a prairie area that has plants and just different native plants that attract bees and other pollinators, butterflies, moths ... This year, he wrote a grant with the PTO to get us a new tiller, and to till, and he and his wife come up, and they till the beds. He is our leader. He's led us through this. And without him, I don't think I would have done this. Because if he didn't go out there and till those garden beds up, I wouldn't be doing that. (“Linda,” School #3)

“Amy” explained how he has also served as a mentor, “he has been a huge mentor, you know, for when I first started ... And so I think with his leadership, it's given me the confidence to know what's important.” And as “Amy”

described earlier, that confidence has allowed her to encourage her teammates to get kids outside for gardening and give more kids an opportunity to learn outdoors.

“Steve” shared that a school nurse was the “great grandmother” of his district’s Seed to Table program. She started a garden while working as a part-time nurse. The garden became popular, and she eventually moved to a full-time role getting the Seed to Table program going. He further explained why it’s beneficial to have nature champions at a district level. That Seed to Table program provides all kids the opportunity to garden. As he explained:

It became something the district really saw importance in getting those children to kind of learn and see those things being out in the garden ... like a guarantee thing, you know ... you could leave it to teachers like me, who are really excited about nature and being outside and doing these things, but I don't have every [class]. So thankfully, everybody does get a little chance when you get into the seed to table program, and have that kind of guaranteed chance to learn about the garden. Where does your food come from? What are some healthy things, you know? They make salads with the stuff they grow out in the garden so they can taste that.

(“Steve,” School #6)

“Steve” also shared that he is part of a committee in his building that focuses on environmental education and sustainability. The group is bringing chickens back to the school next year, and they talk about other initiatives and how to get other staff members on board.

“Caroline” talked about the need for a group of advocates within a school. She said, “It has to be a collaborative community effort to take care of it [nature-based outdoor spaces], and it has to be a shared value.” She expressed some frustration that administrators were not doing more to improve outdoor spaces for learning. The other nature champions in her school, “Beth” and “Ben” talked about a lot of activities within their own classrooms. “Ben” even commented:

I know that my space is small enough to where it's not very invasive to the folks around me ... I'm fortunate enough to have this right outside my classroom. It doesn't encroach on anybody else's turf, it doesn't take over anything else. (“Ben,” School #5)

Finally, we found evidence of what happens when there is no nature champion at a school. We mentioned earlier that we had contacted a school that had a nature trail in back of it, but the principal denied that anything like that existed. We found the trail when we visited the school one weekend. Then, we talked with someone who attended the school from about 2003-2008. He confirmed that there is a trail that had been developed and maintained by some Eagle Scouts. He also said that when he was there, he remembered a teacher who was a big advocate for nature-based learning, but he knew that she had since passed away (A. Lucarz, personal communication, May 7, 2022). The school provides a cautionary tale of what happens when no adult is there to advocate for getting kids outdoors, and great green space is abandoned.

Theme 4: Community Partnerships Can Bridge the Gaps

“At that time, we were learning about birds. So they took us on a walk ... and we saw and heard blue jays and robins and cardinals and some owl pellets. They brought binoculars for the kids and taught them how to use them.” (“Caroline,” School #5, talking about Forest Park educators at the Nature Playscape)

The fourth theme centers on the idea that teachers who are successful with nature-based learning leverage partnerships in the community. They work with organizations to gain knowledge and resources that support nature-based learning. They go to training and take courses to improve their own knowledge. They also take advantage of grants, field trips, learning materials, and the expertise of others to improve their students’ experiences outdoors.

St. Louis offers many organizations that can help teachers and schools improve their ability to offer nature-based learning to students. Every interviewee mentioned one or more of these organizations: the Missouri Department of Conservation, Forest Park’s Nature Playscape and the Voyagers program, Litzsinger Ecology Center, the Missouri Botanical Gardens, and Gateway Greening (now known as Seed St. Louis).

“Matt” and “Cheryl” at school #4 mentioned all of these organizations, in addition to a local nursery and volunteers from the community who had specific expertise that could help them. As “Cheryl” said, “I often want an expert ... someone who has done it, or is an expert in the field.”

“Matt” has received plants from the Missouri Botanical Gardens, and he talked about his extensive relationship with Gateway Greening. They have helped him with the fruit trees by providing training and even coming out to the school to look at how the trees are doing. He has also received grants from the organization to fund projects.

“Cheryl” participated in the Voyagers program in Forest Park, and she did a summer program at Litzsinger Ecology Center. She has also used some curriculum from the Missouri Department of Conservation.

“Caroline” at school #5 has benefited from her school’s partnership with Forest Park and the Nature Playscape. At the time of our interview, she was preparing for a field trip to the Fish Hatchery in Forest Park through a program with the Missouri Department of Conservation.

“Linda” and “Steve” both mentioned their districts’ partnerships with Litzsinger Ecology Center. Teachers can take their students on field trips to the ecology center, and they offer training for teachers as well. “Linda” described how much better her students understood erosion after they were able to see evidence of it at Litzsinger. She also said that her school received resources from the Missouri Botanical Garden. “We partnered with the Missouri Botanical Gardens ... and they provided us with 12 raised garden beds, and a shed.” (“Linda,” School #3)

“Ben” takes advantage of grants to get materials for his students, though he feels fortunate to have the resources:

You know, we're so heavily based around scholarships and grants and donors that writing another grant is no big deal for us. Like if I need something, I generally just need to ask for it. Or say, I am willing to work for it. I would like to write this grant for this proposal for this project, and I have a whole team of people that can help me. (“Ben,” School #5)

Without funding resources, teachers often end up spending their own money for materials. “Amy” mentioned that her district science kit provides limited resources for planting in small cups indoors, so she usually has to buy her own materials for her class to plant in the gardens. Partnerships in the community may be one way of preventing out-of-pocket expenses for teachers.

Theme 5: What happens when kids get outside?

“They've gotten to where they can't pass up an insect or a seed or a leaf without like, ‘what is this? And can we bring inside and observe it?’”

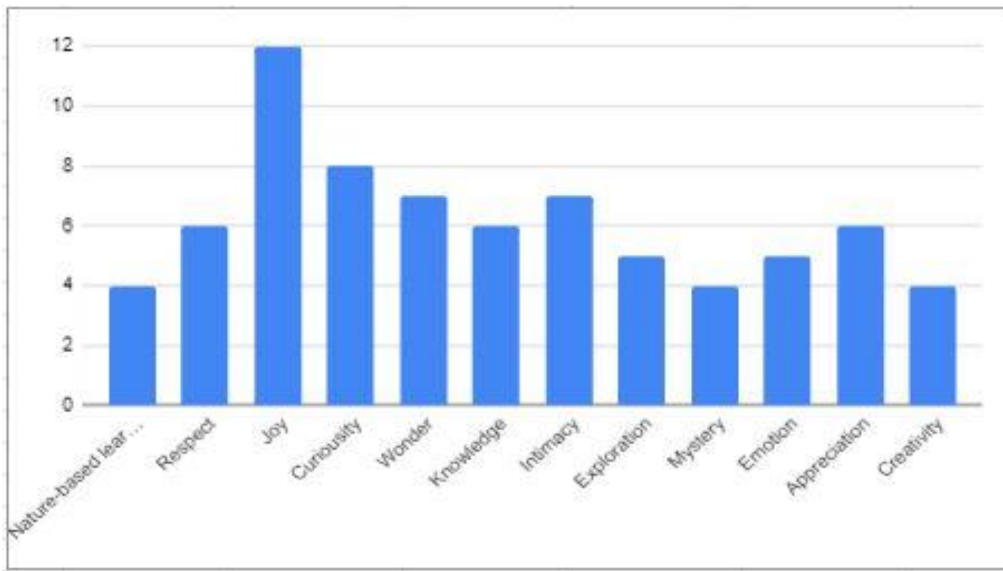
(“Caroline,” School #5)

We shared the extensive research on the benefits students get from time outdoors in chapter 2. We are focused on how children develop a love and respect for nature. For our interviews, we used pictures and twelve words on a Google Jamboard to guide part of the discussion. We believe these twelve words capture elements of the types of experiences we want children to have in nature. The twelve words are nature-based learning, mystery, wonder, joy, emotions, appreciation, exploration, curiosity, respect, knowledge, creativity, and intimacy. Eight of the ten teachers we interviewed interacted with the Google Jamboard

during our interviews. Figure 8 shows how often each word was discussed by teachers during this activity.

Figure 8

Frequency of Words Chosen on Interview Jamboards



The teachers chose joy and curiosity most often on the jamboard to match the pictures. We found that the jamboard was an effective tool for enhancing our interviews. As teachers talked about the words and pictures and connected them to each other, we asked them if they could relate them back to any of their own experiences in nature. Teachers made personal connections to the words and pictures that demonstrated how their students benefited from nature based learning. The quote at the beginning of the theme five section came from “Caroline” (School #5) as she reflected on the pictures of the boy with dirt on his hand and the boy with the magnifying glass. She said:

Yeah. The kid with his hands with dirt on it, and then the kid with a magnifying glass. Those are experiences that we've had several times this

year. Okay. They've gotten to where they can't pass up like an insect or a seed or a leaf without, "what is this? And can we bring it inside and observe it?"

"Amy" (School #2) also connected with the boy using the magnifying glass. She paired it with the word, curiosity, and said, "Before we start the garden, I always have them till the soil, and we look inside the soil at the different animals or the bugs or the worms. I mean, they're in there."

"Matt" (School #4) connected with the word, intimacy, on the jamboard. He talked about how much his students love the chickens and the bees at their school and how the younger students run around and laugh. He said, "they have an intimacy with nature that I did not have as a child."

Intimacy resonated with "Ben" (School #5) as he reflected on the words on the jamboard. He said:

There's a relationship that is formed with you and nature ... this intimacy that can build within you and your peers, you and your friends, you and your family ... that allows you to be present and be in the moment ... And yeah, there are some days, you know, kids run up to me and say that so and so's smashed a bug, and we talk about it. Instead of me getting really angry at them for doing that, it's a great chance to learn, it's a great chance to understand we have the power, that was a power move that didn't need to happen. Because just because we are bigger, stronger, more important. Because if we start doing that to anything, if we assert our dominance over anything, then that lets us know that we can assert our

dominance over anyone. And we really, really discussed that. So I think that that's a great one.

These words and ideas came up as teachers discussed how their students benefited from nature-based learning and from just being outside. "Caroline" noticed a difference in her student's play when they went to Forest Park's Nature Playscape versus how they play on their school playground.

When they were at the playscape, it took a little while. It took, you know, like, say 15 to 20 minutes where at first they were kind of running around and kind of crazy. And then like they settled down and they went into their different areas of things. They were into digging or building or climbing. And that creativity just started to flow and they started making up stories. ("Caroline," School #5)

Teachers also expressed their beliefs that student engagement and learning improved outdoors. "Linda" called it "next-level engagement." She further described what she meant:

[At Litzsinger Road Ecology Center] they can see the erosion where the tree, the root ball, you know, and all the dirt is eroded away. They see all these things. And when you see it in a picture, it's completely different... [At seed hunt at Missouri Botanical Gardens] just being out there and getting those seeds and finding those seeds. Like they're real seeds that you can hold. And like you can break apart and like you can we can plant them and see what happens. ("Linda," School #3)

“Cheryl” sees students making more connections between what they are learning in the classroom and what they are learning outside. She also sees them being more critical thinkers. She added, ““I see an appreciation for nature because they tell me in their excitement, the things that they see. I see that they're learning to notice things and question things.”

“Cheryl” also sees engagement leading to more active learners:

I see being an active learner has two purposes. One, it's motivational. And two, it shows you that you can learn anywhere, you know, and that learning is fun. And if you find it fun, you're going to want to learn more. You know, so it's like this cyclical thing. (“Cheryl,” School #4)

Teachers also see risk-taking as a benefit of nature-based learning.

“Caroline” explained:

I've seen how risk taking that happens in nature, like climbing trees, climbing rock, stuff, like that. It translates to the classroom. So I see kids, like I've seen kids who are pretty risk averse, and don't really advocate for themselves in the classroom. They'll kind of let other people do stuff for them. And then, you know, first they're, like, an observer climbing a tree. And then a few days go by and maybe a week, and then they're like, maybe I'll try it. And then they're just kind of like hanging maybe at first and, and then eventually they do it and the confidence that comes with that. And, I see the change in them in the classroom. (“Caroline,” School #5)

“Ben” sees nature-based learning as providing a good introduction to risk taking. He explained that their nature-based lessons, “allow them to try things and succeed, try things and fail, make detailed hypotheses ... they take realistic risks, and the stakes aren't very high.” He added that parents often tell him that their children are eating more fruits and vegetables because of what they learn in class, and that families are trying out new things because of what their children are learning at school.

“Steve” described how his students learn that “even the teacher doesn't know all the answers,” so they have to think about how they can find the knowledge they want to have. They have to take initiative and seek out their own knowledge at times.

Teachers also described benefits to social development. “Beth” explained that COVID and virtual learning left her students with poor social skills and a lack of experience with imaginary play. She said that she felt their school's forest space helped kids improve those skills. She also lets kids engage in risky play, like dueling with sticks. When we observed her at school, we saw two boys dueling, and “Beth” said that activity had really helped one of the boys improve his self-control.

“Sarah” said that she sees that when her class goes outside, it “helps you kind of reset, and then you're we've noticed more focus when we come back in.”

“Cheryl” said she has seen kids who are not successful in the classroom be very successful in nature. She said the kid who does not follow directions or get along with others can get outside and do a great job in the garden. That time

in nature means that, “they have a place in the time that they're being successful. And I can build them up that way.”

“Ben” sees the potential to develop leadership skills as well. His class collects food scraps in their worm bin. The class in the next grade does not currently do this. His hope is that “when they go to the next class, they'll say, ‘Hey, can we get a worm bin?’ or ‘That goes in the recycle bin’ and maybe, you know, they act as their own leaders to the next group.”

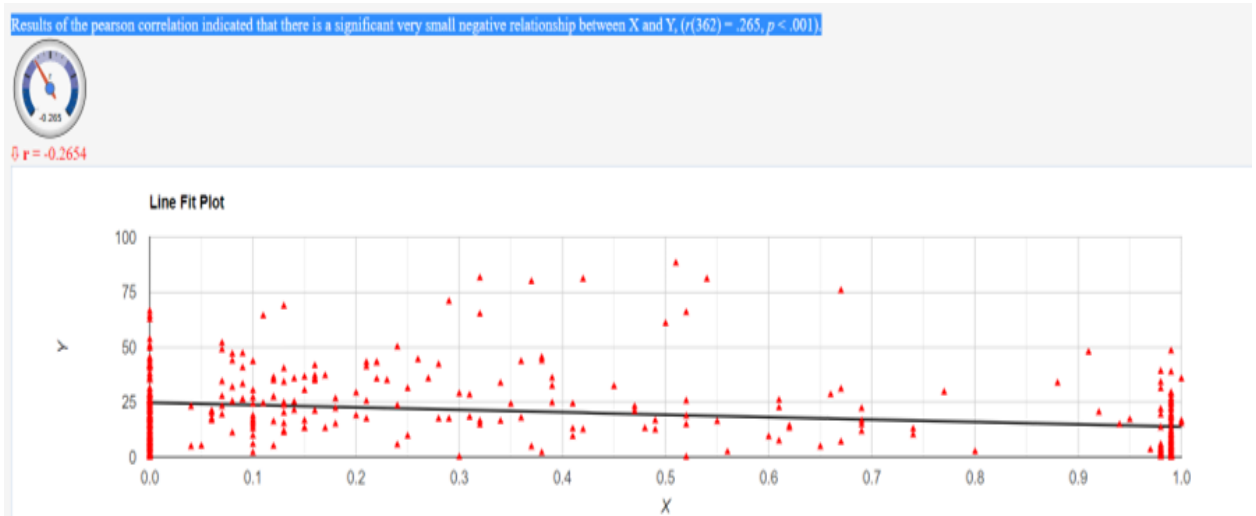
Quantitative Data

Our first research question focused on the relationship, if any, between the economic makeup of schools and available green space. To approximate economic makeup, we used Free and Reduced Lunch data from Niche.com.

We used a Pearson correlation test to test this relationship. We found a significant but very small negative relationship between free and reduced lunch percentage of a school and its available green space. As free and reduced lunch percentage goes up, schools tend to have less green space. The significance is strong at $p < 0.0001$, so it is not likely due to chance. However, in the Pearson correlation test, $r = -0.2654$. This means that only about 26 percent of the variation in green space is explained by the free and reduced lunch rate of a school. Figure 9 shows the line fit plot.

Figure 9

Line-Fit Plot for Pearson Correlation: Green Space and Percentage of Students Eligible for Free and Reduced Lunch



Note: The y-axis represents the percentage of students receiving free and reduced lunch at a school. The x-axis represents the percentage of green space within a quarter mile of the school. Pearson correlation $r = -0.2654$, $p < 0.0001$.

Discussion

Introduction

The purpose of this mixed method study was to find out what value K-2 teachers in the St. Louis region thought nature-based learning had for their students and to discover the specific impacts that K-2 teachers ascribed to their students' engagement in nature-based learning. We will begin by examining the findings in relation to the conceptual model we started with in chapter 2, and we will propose a new model that better reflects our findings.. We will then discuss how this study's findings relate to our new conceptual model and to the existing literature on nature-based learning. We will offer Is engage in nature-based learning. The chapter concludes with a discussion of the studies' limitations and areas for future research.

This chapter contains discussion and future research possibilities based on the research questions:

1. What is the relationship between a school's proximity to green spaces and the economic makeup of students?
2. What value do K-2 teachers in the St. Louis region think nature-based learning has for their students and for themselves?
3. What outcomes do teachers see in themselves, their individual students and in their classroom communities that they attribute to nature-based

learning? Do they see outcomes that build awareness of nature, empathy for nature, responsibility for nature, and enjoyment of nature?

4. What factors influence teachers to implement nature-based learning and how important is proximity to green space as a factor?

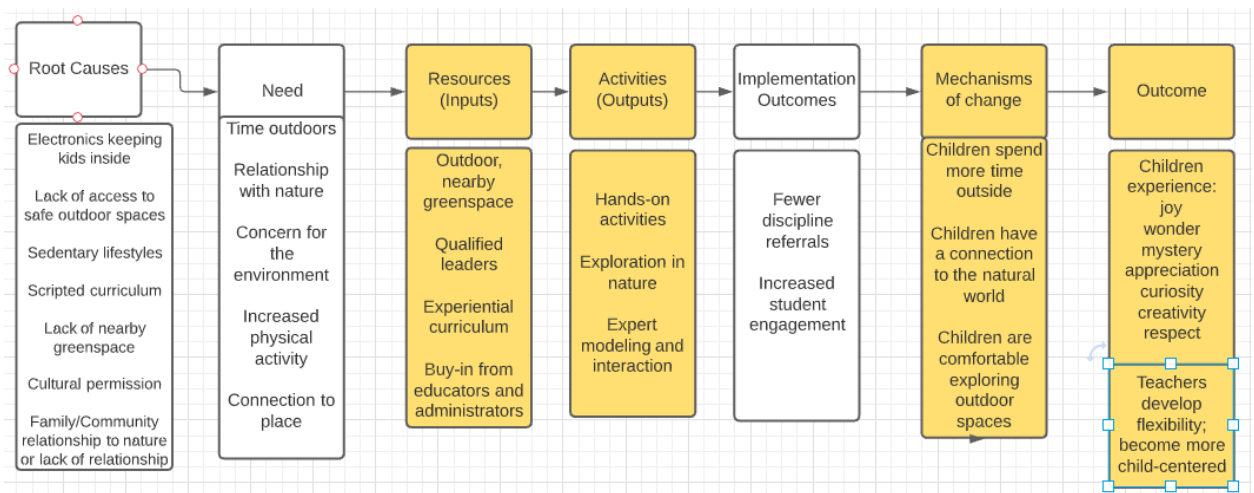
For the first research question, our findings indicate a small, but significant negative relationship between the percentage of students receiving free and reduced lunch in a school and the percentage of space around a school that is green space. This finding indicates that as the percentage of students receiving free and reduced lunch increases, the amount of green space within a quarter mile of the school decreases. For the other research questions, our interviews and observations centered on five themes: (1) green space, regardless of quantity, can provide children with learning through hands-on experiences, careful observation, and rich discussions about the magic of nature and with a connection to their place in nature; (2) nature-based learning occurs outdoor and there are factors that help and hinder teachers from getting children outdoors; (3) schools need at least one adult who is passionate about nature-based learning and who advocates on behalf of students to provide them with child-centered time in the outdoors; (4) teachers and other school personnel can leverage partnerships with community organizations to receive training and resources that improve the quality and quantity of nature-based learning for children; and (5) students experience benefits from nature-based learning that impact their social-emotional development and their engagement with academic subjects.

Our Conceptual Model

Our original framework was based on a theory of change model from Ghate (2018).

Figure 10

Our Original Conceptual Model of Change



However, as we looked at our findings, we began to envision a new model. The third and fourth themes, the presence of a school nature champion and the importance of partnerships with community organizations, seem to be important building blocks for nature-based learning to be successful. The nature leader is the internal factor in a school or district who advocates for nature-based learning. Every teacher we interviewed talked about the person or people within their school who have been those advocates, and they gave specific examples of the differences those leaders have made in their schools. In addition, every teacher we interviewed had benefited from the knowledge and resources of a

community-based organization. These community organizations are the external factor that can enhance nature-based learning. As we discussed in chapter 4, these organizations provide education, materials, money, and experiences for students.

The first two themes, connection to the green space around a school and getting kids outside to learn, are also important pieces in the success of nature-based learning. However, we encountered examples of schools with green space readily available who were not using that space. In one example we shared, we learned that a nature champion was a teacher at the school in the past, but that person was no longer there. It appeared that no one was currently at the school to fill that gap because green space, including a nature trail, was not being used. Our conclusion is that in order to use green space effectively and get kids outside, a school must have a nature champion within the school, and that nature champion knows how to leverage partnerships with the community to enhance nature-based learning.

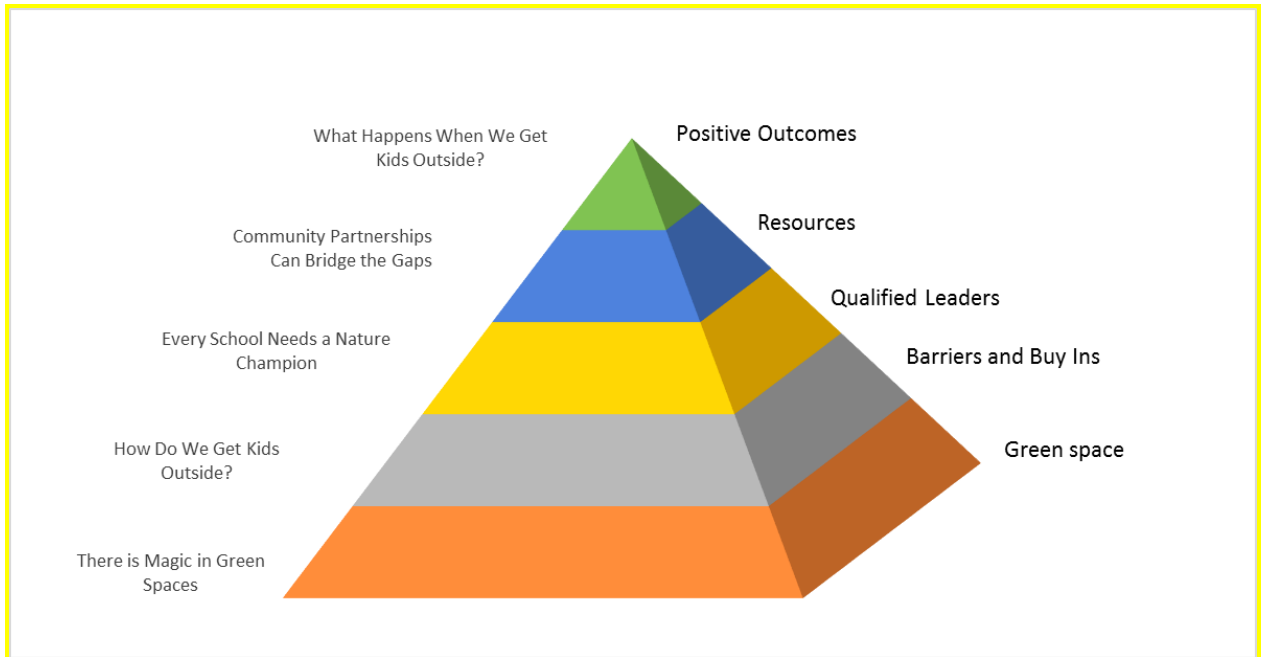
The fifth theme, what happens when kids get outside, represents the ultimate goal of nature-based learning. Children benefit in many ways through experiences in nature. The research provides a great deal of evidence of outcomes for students, and we learned about many outcomes for students through our interviews and observations.

Our new model we envision is a pyramid that builds from must-have components to the ultimate goal of student outcomes. The first three levels of the

model: green space, barriers and enablers of getting kids outside, and the presence of a nature champion represent the ways that a school gets kids outside. These are the base of the model, and they represent the internal factors within a school that get nature-based learning off the ground. Then the fourth layer, community partnerships, help keep kids outside through community organizations that provide the training and resources needed to sustain nature-based learning. Then, the fifth theme represents the top of our new model - all the ways children benefit from consistent, meaningful learning experiences in nature.

Figure 11

Our Revised Conceptual Model for Nature-Based Learning



Interpretation of Findings

Our quantitative research question focused on green space. We found a small but significant negative relationship between free and reduced lunch percentage in a school and the amount of green space around a school. We used the percentage of students receiving free and reduced lunch in a school as a rough representation of income. These findings support research that low-income people are more likely to live in areas with less green space (Rowland-Shea et al., 2020; Engelberg et al., 2016). In addition, a study by Boone et al. (2009) found that income has a positive relationship with the sizes of nearby parks. Our correlation was weak, and it could have been impacted by a couple of factors. First, our data included rural, suburban, and urban schools in the St. Louis area. We know that schools in rural areas can have low-income populations, but they may also have a lot of green space due to location. In addition, we included public and private schools, and we know there are private schools in wealthy, urban areas that will have little to no green space. Therefore, the vast area that our map data represented may have weakened our results. Finally, we used free and reduced lunch data as a proxy for income and that may not be the best representation. This concern is particularly true since we did not have data from private schools that may utilize the free and reduced lunch programs.

While the results of our quantitative data are expected, our qualitative data from interviews suggests that small amounts of green space can still produce big

results. The two schools we interviewed with little green space still offered students valuable experiences in nature.

Keeping our conceptual model in mind, our third theme centered on the idea that a school needs a nature champion to promote and advocate for nature-based learning. We believe that our findings regarding this theme make a significant contribution to the body of research on nature-based learning because we found evidence of the idea of a nature champion in only one study (Miller et al., 2022). All participants in our study mentioned the need for strong leaders who are passionate about nature-based learning and can advocate it. Schools have many competing priorities, so students need an advocate who is educating others and leading the push to offer nature-based learning.

Schools and educators do not have to navigate nature-based learning alone. Our fourth theme focused on partnerships with nature-based organizations to help with training, experiential learning, and resources. Research supports partnering with nature-based organizations to assist teachers (Baillie (2010), Fazio & Karrow (2013)). As we engaged in this study, we learned about so many organizations in the St. Louis area that can support schools with grants, field trips, education, and resources. We were familiar with most of the organizations, but we were unaware of how much assistance they can provide to schools. A couple of the organizations were new to us. Teachers and schools need to know what resources are available to help them move their nature-based learning initiatives forward.

Green space is needed for nature-based learning, but as we stated earlier, schools in our study with little space used what they had effectively. When we observed at school #5, we saw that the “forest space” used by two of the teachers was a small space, but it had a number of trees, bushes, flowers, and insects. Students engaged in imaginative play and interacted a great deal with the natural elements that were present.

Furthermore, several teachers in our study talked about the importance of developing a connection to place with their students. They wanted students to be aware of their environments, make connections between what they were learning and where they live, and find joy in the nature around them. Sobel et al. (2016) discussed the importance of connection to place in order for children to grow up as advocates for the environment. Louv (2006) also cited the importance of children having a relationship with nature. He said, “If children do not attach to the land, they will not reap the psychological and spiritual benefits they can glean from nature, nor will they feel a long-term commitment to the environment, to the place” (p. 157).

Our second theme centered around what factors enable teachers to get children outside for nature-based learning, and this theme ties directly to our fourth research question. Teachers we interviewed talked about how teachers and students need to feel comfortable outside. If they are not comfortable, then they may need to be slowly introduced to outdoor spaces and have time to get acclimated. Two of the teachers that talked about comfort worked with African-American students and co-workers. The literature provides a lot of

evidence that African-Americans often feel less comfortable in nature settings because of historical and current racism. Floyd (2001) examined reasons for this discomfort and suggested factors such as discrimination and violence against them in outdoor settings, a lack of cultural permission to engage in outdoor activities, and a lack of representation in professionals and in advertising for outdoor activities (like camping or fishing) and locations (like in parks). Finney (2014) and Roberts & Chitewere (2011) reported similar reasons in their research for people of color not being comfortable in outdoor spaces.

A metropolitan area like St. Louis, with a large African-American population, needs to be finding ways to help African-Americans feel more welcome and comfortable in outdoor spaces. We know that such efforts are being made, but we see an important role for schools. An important insight in our study came from the interview with “Steve.” He explained that his school district made a commitment to nature-based learning through their Seed to Table program. As a result of the program, every student in the district gets the opportunity to participate in garden activities throughout their schooling. Students do not have to rely on whether they are fortunate enough to have a teacher who provides them with nature-based learning experiences. All the students will get those experiences on a regular basis.

Districts who serve large populations of children of color could greatly improve their students’ comfort in the outdoors through initiatives that give every child frequent experiences in nature starting at a young age. They can also offer activities at schools or with community partners to include families in

nature-based experiences. These experiences will need to be carefully planned to manage barriers that may keep families from participating. They need to consider factors including the transportation needs of families, ensuring that activity leaders include people of color, and ensuring that activities are culturally relevant to families. An abundance of research supports these factors, among others, as being important to making people of color feel welcome (Roberts & Chitewere, 2011; Finney, 2014; Roberts & Rodriguez, 2008; Chronin-de-Chavez et al., 2019).

Of course, large scale initiatives require support from school and district administrators. Teachers in our study cited administrative support as an important factor in the success of nature-based learning. Again, these findings support previous research that cites administrators' support as important to the success of nature-based learning (Dring et al., 2020; Greer et al., 2019).

One way to gain administrator's support for nature-based learning is to educate administrators about how children benefit from it. Our fifth theme, representing the ultimate goal of nature-based learning, focused on the outcomes the teachers in our study saw for their students. Our second and third research questions focused on values and outcomes teachers see with nature-based learning.

Teachers cited academic outcomes such as better engagement, improved learning due to hands-on experiences, and success for students who have not been successful in traditional classroom settings. In addition, the teachers talked

about improvements in social skills, empathy, self-control, creativity, intimacy with nature, and joy. Teachers also noticed that their students practiced taking risks and building their confidence in outdoor natural spaces.

The literature on nature-based learning supports all of these outcomes. Academic gains have been documented by Khan et al. (2019), Szczytko et al. (2018) and Williams et al. (2018). Burris & Burris (2011) explained:

The outdoor classroom (structured events related with curriculum and state standards) provides instruction associated with, among others, science, geography, and language arts. In the outdoors, such curricular integration opportunities allow students to use materials, applications, and motor coordination activities not possible in the indoor classroom (p. 8).

Sobel et al. (2016), Sobko et al. (2018), and Becker et al. (2017) all document benefits of nature-based learning for social development and behavior. In addition, Christensen & Mikkelsen (2008) explained how risk-taking in nature benefits students' problem solving skills.

Implications for Practice

We would recommend educating administrators and teachers about all of the well-documented benefits from nature-based learning, but we would also recommend making a clear distinction between structured learning activities in nature and child-led play in natural settings. We observed both kinds of activities, and we believe both have their advantages. We also believe that all children in

preschool and elementary school need to have the opportunity for both kinds of activities. The structured activities we observed, such as building birdhouses for blue jays and working in school gardens, provided children with knowledge, skills, wonder, and high engagement. Child-led play in nature provides critical opportunities to develop social skills, self-regulation, creativity, and risk taking. Both types of activities can foster joy and connection to place that promote empathy and responsibility for the environment.

One clear implication of our results is that teachers do not need a lot of space or resources to get students outside. Teachers can utilize any green space they have to give students a chance to play and explore. Gardening activities can start with a few pots or one raised bed. Planting a few native plants and/or introducing some water can attract a variety of insects and other animals to a natural space. Teachers can start small and build on successes.

Teachers just getting started with nature-based learning can look for nature leaders within their school or district and look to nature-based organizations to find assistance and training to help their efforts. In addition to local organizations, there are national organizations such as the North American Association for Environmental Education and the Children and Nature Network that can provide resources. One idea that could be implemented locally is the creation of a Facebook page for educators in the St. Louis area engaged in nature-based learning. We could share resources from organizations in the area, and teachers could share ideas and experiences.

Study Limitations and Future Research

Our study focuses on the St. Louis area, so the results may not be generalizable to other areas of the country. In addition, we only interviewed teachers and observed classrooms that agreed to take part in the study. Therefore, our results do not represent all nature-based learning happening in the region. If schools were not doing nature-based learning, they did not want to share their reasoning or participate in any interviews. COVID limited our access to some schools. One principal told us she would not ask her teachers to participate in interviews during this difficult school year. A district cited COVID restrictions when they turned down our request to conduct our research with their schools.

As for future research, the idea of nature champions within a school or district has not been represented in the literature, except for one very recent study we found (Miller et al., 2022). More research is needed on how to best utilize these nature champions and how schools can find and support them. In addition, it would be valuable to research how community organizations can help build nature leaders within schools. In addition, longitudinal studies on the impact of nature-based learning can give more insight into how children benefit.

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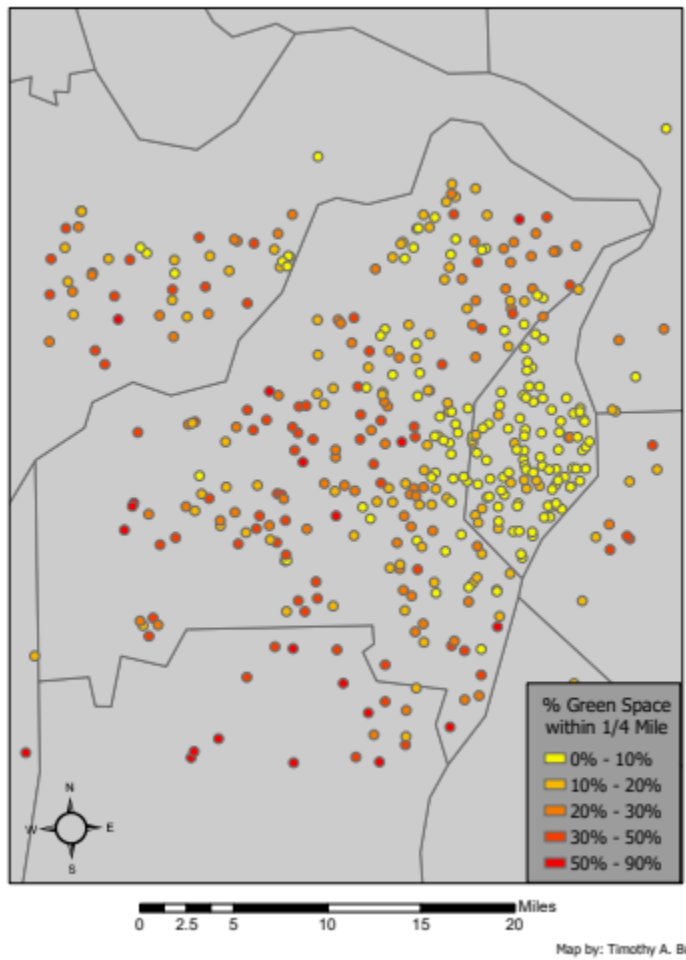
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Appendix A

See [Copy of Forests DevOpen Herb SummaryReport](#) in Dissertation Proposal 2021 Folder for full spreadsheet.

Map:

Research Location: Green Spaces of K-2 Schools in Saint Louis



Appendix B

Teacher Interview Protocol

Project: The relationship between green spaces and nature based learning: A case study on Kindergarten through Second grade programs in the St.Louis metro region.

Time of interview:

Date:

Interviewer:

Position of Interviewee:

Describe the project

- A. The purpose of this study is to find out what value K-2 teachers in the St. Louis region think nature-based learning has for their students and to discover the specific impacts that K-2 teachers ascribe to their students' engagement in nature-based learning.
- B. Data will be collected through interviews using a recording device.
- C. To protect confidentiality, researchers will not disclose interviewee's name or school.
- D. This interview will take between 45-60 minutes.

Have interviewee read and sign form (or verbally consent if on Zoom)

Test and turn on recording device

Questions

:

1. We are interested in how you were influenced by nature as a child. What was your most memorable experience in nature?
 - a. What impact did it have on you?
 - b. How has that experience influenced you as a teacher?
2. What types of activities/lessons do you do with your students in your outdoor space?
 - a. Where did these activities come from?

- b. How do you choose what you do with kids in your outdoor space?
3. As a teacher/administrator, what makes it easier/helps you to get kids outside?
 - a. Why do you think that is?
 - b. Do you think _____ is unique to your situation or could be a factor for other teachers to help get kids outside?
4. Is the availability of green space important? Or are there other factors that are more important?
 - a. What are those factors?
 - b. Why do you think _____ is important?
5. As a teacher/administrator, what has hindered/ prevented you from getting kids outside?
 - a. Why do you think that is?
 - b. Do you think _____ is unique to your situation or could be a factor for other teachers to make it harder to get kids outside?
6. How comfortable are you with nature-based learning? Do you feel that you have the resources you need to feel comfortable?
7. (Show interviewee the first page of the Google Jamboard) These pictures show children's experiences in nature. Do any of these resonate with you? If they do, please share which picture and why you chose it.
8. (Second page of Google Jamboard) Now look at the words that have been added: Nature-based learning, Mystery, Wonder, Joy, Emotions, Appreciation, Exploration, Curiosity, Respect, Knowledge, Creativity, Intimacy. Do any of these images match with any of the words listed? You can move the word to the picture that you connect it with.
 - a. Why did you choose those relationships?
 - b. Do any of these pictures remind you of a time you experienced with your students outside?
9. What positive outcomes do you see for kids as the result of the nature-based learning you are doing?
 - a. Can you tell me more about _____?
 - b. What evidence do you have of these outcomes?
10. Are there any negative outcomes you have seen for kids as a result of nature-based learning?
 - a. Can you tell me more about _____?
 - b. What evidence do you have of these outcomes?
11. What outcomes do you see for yourself as the result of the nature-based learning you are doing?
 - a. Can you tell me more about _____?
 - b. What evidence do you have of these outcomes?

12. Is there a specific nature leader in your school or someone who has been an advocate for nature-based learning?
 - a. How did nature-based learning come about in your school?

Thank the individual for their participation, assure them of confidentiality, discuss any potential of future interviews

(Creswell 2012)

Appendix C

Teacher Interview Images

1.



<https://resilienteducator.com/classroom-resources/outdoor-learning-ece/>

2.



<https://naturalstart.org/feature-stories/nature-field-trips-making-learning-come-alive-young-children>

3.



<https://www.brighthorizons.com/family-resources/children-and-nature>

4.



<https://www.bbc.com/news/uk-wales-5639940>

Z

5.



<https://wonderopolis.org/wonder/are-all-ladybugs-ladies>

6.



<https://activeforlife.com/18-ways-to-get-kids-outside/>

7.



<https://blog.reallygoodstuff.com/leaves-fall-learning-preschool/>

8.



<https://theconversation.com/forest-schools-how-climbing-trees-and-making-dens-can-help-children-develop-resilience-117920>

9.



<https://www.ecomena.org/better-environmental-education/>

10.



<https://www.potentash.com/2017/03/14/reasons-might-want-let-kids-play-dirt/>

11.



<https://www.verywellmind.com/how-to-teach-children-gratitude-4782154>

12.

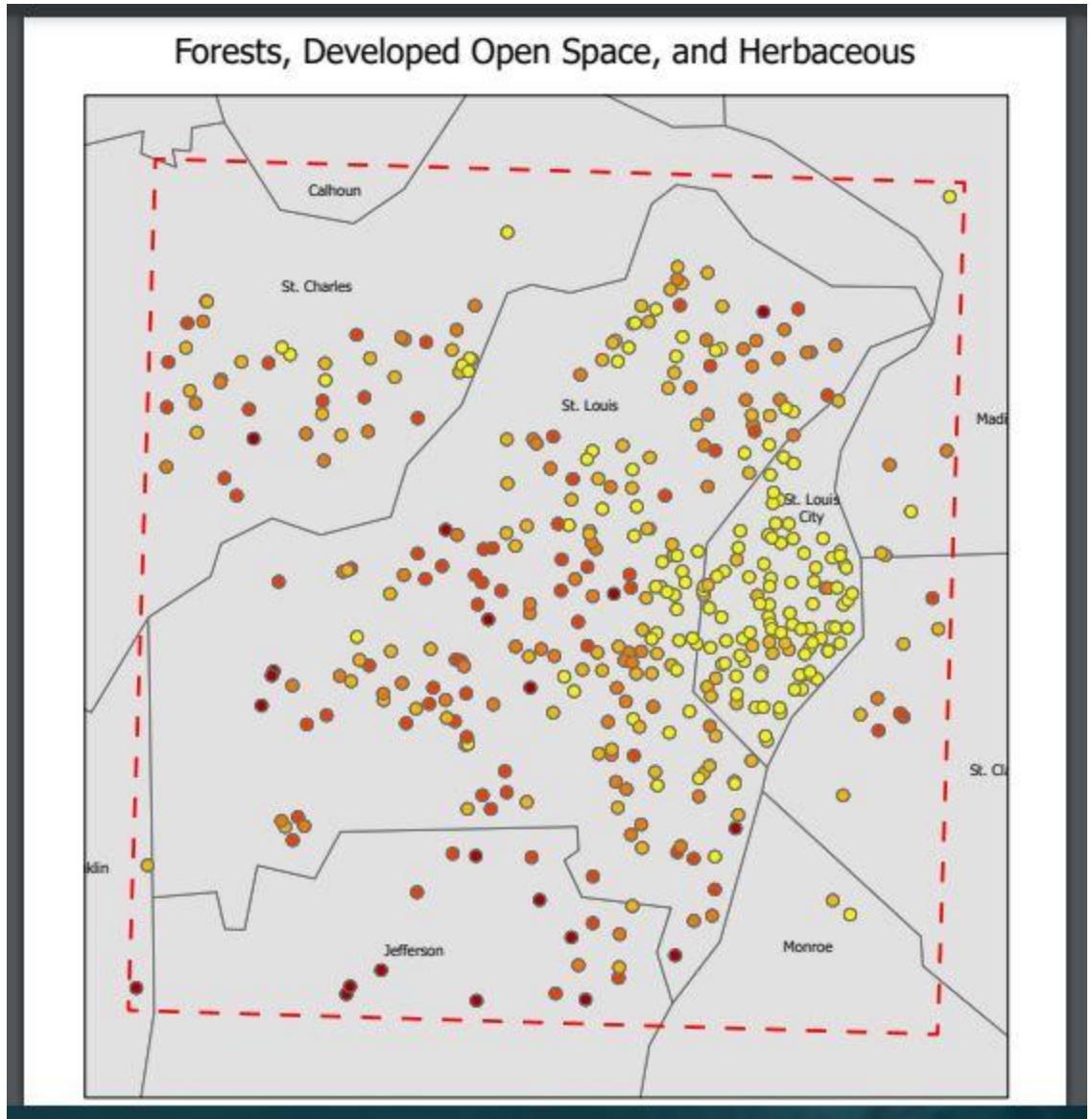


<https://www.activekids.com/parenting-and-family/articles/How-I-Taught-My-Daughter-to-Appreciate-Nature>

Appendix E

Teacher Interview Words

1. Nature-based learning
2. Mystery
3. Wonder
4. Joy
5. Emotions
6. Appreciation
7. Exploration
8. Curiosity
9. Respect
10. Knowledge
11. Creativity
12. Intimacy



References

MSDIS

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