

No Child Left Indoors: An Analysis of Local Place-Based Elementary Environmental Education

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ABSTRACT

As children spend less time outdoors, they may lose connections to the natural world - an important aspect to the development of environmental stewardship. In analyzing thirteen local elementary schools, we found that land use (composition of areas adjacent to schools), school resources, and teachers' initiative are the primary factors influencing outdoor experience in science lessons. Teachers' motivation to include experiential outdoor lessons proved the most effective method to remedy this predicament.

INTRODUCTION

Outdoor exploration by children has decreased over the past 40 years as a result of an increase in the development of open natural spaces into built environments, popularity of video games, and a lack of access to natural local open spaces such as forests, wetlands, and fields (Louv 2005). As children spend less time in the wilderness they become less able to make a connection with their natural environment. This phenomenon and its associated consequences have been termed "nature-deficit disorder" (Louv 2005). A remedy can be achieved by re-connecting children to their natural environments, including lesson plans in science curricula focused on local ecological settings. This can foster greater environmental awareness, an ability to understand the damage and persistent threats to our environment, and the development of skills in problem solving and interpretation of data. Subsequently, students will be motivated and empowered to work towards solutions to local environmental problems (Ruiz-Mallen *et al.* 2010). Student involvement in outdoor education programs fosters a conservation-minded attitude and appreciation of nature, which can be incorporated into present and future life decisions (Bogner 1998). If integration of local ecological settings into existing science-based lesson plans can

elevate interest among young children in exploring and appreciating their natural surroundings, understanding the forces that support or constrain such integration is essential.

Many elementary school students are keenly aware of the global matters such as the disappearing Amazon rainforest even as they remain more ignorant of threats to the local plants and wildlife (Bebbington 2005). Since students are learning more from textbooks and the internet, rather than through interaction with their local environment, they are disconnected from the living things found in their own communities. Exploration of the local watershed, for example, offers students the opportunity to ask questions and seek answers through experimentation in their immediate environment. A school's own backyard may be brimming with diverse habitats and wildlife suitable for exploration by curious students. A school may be adjacent to a wetland, small stream, or forested area, presenting a wealth of experiential opportunities. Schools can potentially implement different types of outdoor programs using their very own schoolyard, or adjacent areas. If the outdoor setting is located in close proximity to the school, students may feel a sense of ownership and identity as to the place they are studying (Ruiz-Mallen *et al.* 2010).

The New York state curriculum guidelines require 3rd grade teachers to cover ecosystems and plants and animals, which we consider critical elements of environmental education. The New York State curriculum requires that fourth grade covers matter, weather, climate, rocks and minerals. Fifth grade covers physical, earth and life sciences. These subjects could be enhanced for students by studying their local natural environment. Students can learn to identify different plants, tree species, and a diverse multitude of macro invertebrates, and appreciate their connections to the greater landscape. This can lead to further discussions of the human impacts on the ecosystem, including littering, agriculture, and the development of land. Students can absorb the biological and chemical principles behind a specific ecosystem while also connecting

their human existence and actions to the land. Sites with natural vegetation in close proximity (safe walking distance) to schools can facilitate an outdoor, place-based learning environment for environmental education. This place-based education can contextualize curriculum into the local culture and ecology, bridging the gap between schools and communities (Ebersole and Worster 2007).

Our interest in this topic derives from a desire to understand the relationships between schools, curricula, land use patterns, and environmental education. We describe the current environmental educational practices in the elementary schools of the Saratoga Lake Watershed, thereby helping us and others understand how to improve and increase environmental education locally as well as in schools with similar natural settings and teaching standards. We analyze current curricula in elementary schools in the Saratoga Lake Watershed for ecological content, and review the current and potential incorporation of natural settings as teaching tools. We evaluate thirteen elementary schools, assessing whether these schools contain or are situated near a variety of environmental features beneficial to an environment-based education program. We utilize map data and information from GIS and Google Earth to survey natural land use area, and assess, through interviews, the current use of these areas in environmental studies curricula. We ask teachers and administrators questions such as: Does their school have accessible natural areas? Are these areas utilized in the elementary science curricula? If their schools are not in close proximity to educational areas, do they have other accessible means of environmental education -- do their schools provide field trips to local parks or conservation areas? Is there funding available for such trips?

METHODS

Schools

We focused on thirteen elementary schools in the Saratoga Lake Watershed. Ten are public (Division Street Elementary, Caroline Street Elementary, Dorothy Nolan Elementary, Geyser Road Elementary, Greenfield Elementary, Lake Avenue Elementary, Wood Road Elementary, Malta Avenue Elementary, Milton Terrace North Elementary, and Milton Terrace South Elementary), and three are private (The Waldorf School of Saratoga Springs, St. Mary's Catholic School in Ballston Spa, and Saratoga Independent School). We studied the curricula of third, fourth, and fifth graders as they pertain to environmental science topics.

Surrounding Landscapes

We used geographic information systems (GIS), maps, and Google Earth to quantify the landscapes surrounding these schools. Maps, layers, and data were collected from the New York State GIS Clearinghouse, New York State Department of Environmental Conservation (NYSDEC), NYS Orthos Online aerial imagery, and the USGS Seamless Data Warehouse.

Using ArcMap 10 we drew a 0.5-mile radius around each of the schools and quantified the different land use types from National Land Cover Data created in 2006 by the U.S. Geologic Survey within that 0.5-mile radius. We condensed the land use types into eight land use classifications (open water; wetlands; developed; open space; developed low intensity; developed medium intensity; developed high intensity; and forest) and quantified the percentages of each land use type within the 0.5-mile radius for each of the schools.

Interviews

We conducted interviews with seven elementary school teachers, two student teachers, and two directors of education of elementary science curriculum. The interviews were approximately thirty minutes in length and took place either at the school, by phone, or via email.

Student teachers were interviewed on Skidmore College's campus. The interviews were semi-structured, with open-ended questions providing the interviewees with the opportunity to provide fulsome responses. Our questions included:

- What are the different topics covered in the year-long science curriculum for your class?
- How many minutes per week do students receive science instruction?
- What are the experiential learning aspects of your curriculum?
- Do you ever go outdoors for science lessons, close to the school property? What outside areas are at your disposal? If you do not go outside, is there a particular reason why you do not?
- Does your curriculum include regional and local contents? In what context and how often are they applied?
- Have topics concerning local environmental contexts resonated differently with students?
- Are there any science-based field trips for the school?

RESULTS

Surrounding landscapes

Despite the fact that the 13 elementary schools in our study fall within the same watershed, each school has its own unique land use patterns. Some schools' surrounding areas were over 90% developed, while others were situated in an area containing more than 60% forested land. We designated schools as being in one of three landscape categories: urban, suburban, or rural (Figure 1). Schools which had a greater than 50% developed area and less than 35% forest within a half mile radius were considered "urban" (Lake Avenue; Caroline Street; The Waldorf School of Saratoga Springs; Division Street; Malta Avenue; St. Mary's Elementary

Schools) while those with areas containing greater than 50% forested land and less than 35% developed land were considered to be “rural” (Saratoga Independent; Greenfield Elementary). “Suburban” schools on average have between 35-50% of both forested and developed land, with a more equal distribution between these land use types (Milton Terrace North; Milton Terrace South; Wood Road; Dorothy Nolan; and Geyser Road Elementary Schools) (Table 1). Within our figures, we have combined Milton Terrace North and South, and Wood Road Elementary schools because these schools are located within the same complex in downtown Ballston Spa. We concluded that six of the thirteen schools were “urban,” five were “suburban,” and two were “rural.”

Educator Interviews

Students in public schools receive about 45 minutes of science education twice per week, with a maximum amount of instruction of 90 minutes per week. This is significantly less than language arts and math, which receives about 90 minutes of instruction each day, five days per week. Multiple instructors expressed the opinion that 45 minutes is not a sufficient amount of time to bring students outside for the purpose of observing and exploring their natural surroundings, and most public school teachers articulated time constraints as the primary hindrance in bringing their students outside. With only 45 minutes allocated to science education, teachers have to prioritize and condense lesson plans to fit within a small time frame. All public school teachers expressed enthusiasm about the prospect of bringing their children outside but logistical problems, such as these time constraints, were recognized.

The state testing requirements exerted a strong influence on the curriculum. For example, in the third grade, statewide tests only cover language arts and math, and those two topics are

allocated significantly more time in the classroom during that year. Public school teachers stated that they experience pressure to cover all the material on the test and “teach to the test.” Fourth grade students are state-tested on a science curriculum. However, as one teacher stated, “the science material must be quickly covered and reviewed to make sure the students are adequately prepared for the test questions.” Some teachers make an effort to incorporate science and math into a single lesson plan in order to dedicate more time to science and the links between those two topics. Students at Geyser Road are brought outside twice each year to collect materials such as rocks, leaves, and insects. Students categorize and graph the samples to master graphing skills. One fifth grade teacher at Milton Terrace North teaches her class in units so that the students can become “immersed into a topic” rather than breaking up the day into discrete lessons on science, math, language arts, and social studies. She assigns books that pertain to survival in the outdoor environment in order to prompt discussions on the vastness of the great outdoors and humans’ role and place in their environment.

We also spoke with three private school teachers and administrators. Private schools follow New York State guidelines but do not have to administer annual tests, as public schools do. As a result, private school teachers have more flexibility in their daily schedules and curricula, and thus have greater opportunities to take students outdoors. At the Waldorf School, subjects are taught in three to six-week blocks with one subject (language arts, social studies, math or science) as the focus of classroom study. For the first two hours of each day the designated “block subject” is the only new material covered in class. The rest of the time is spent reviewing subject matter learned during the previous weeks. Therefore, during the course of a science block, the teacher has the ability to bring students outside to experience, explore and interact with nature for a considerable amount of time. The curriculum of Saratoga Independent

School is focused around one general theme each year. For example, this year their theme is "Relationships, Environment and Change." Each grade is taught the same general information but with increased depth at higher-grade levels. At St. Mary's School, 5th grade students receive science instruction for 40 minutes, two days per week and 90 minutes for one day per week. The teacher we spoke with stated, however, that she has the capability to adjust the schedule and spend more time on science instruction.

Since public schools confront temporal challenges, which inhibit their ability to expose students to outdoor activities, they also lack the ability (and, [in some cases](#), funds) to transport their students far from school grounds. Public schools thus rely on their immediate surrounding environments as locations where students may be exposed to nature. A student teacher at Division Street expressed apprehension about bringing her students outside: "Division Street is surrounded on all four sides by streets, so I was always nervous about going outside with them." The proximity of nature trails, open fields, or gardens would enhance the likelihood of teachers attempting to bring students outside. [In fact, an overwhelming development we observed was the creation of school gardens on school properties. Students are typically assigned the responsibility of maintaining the garden for a week -- including watering and weeding. Teachers utilize the garden to teach about requirements of plants, mutualism with animals, and agriculture. Additionally trails on or near school grounds can be utilized for more in-depth ecological study. For example the fifth grade teacher at Milton Terrace North uses trails behind her school, within our designated 0.5 mile radius,](#) for cyber tracking, tree studies, and water testing.

While most school teachers were enthused at the prospect of bringing their students outside, there were a few who expressed aversion to the idea. One teacher at Milton Terrace South said that she would not be comfortable in bringing her students outside [even with trails](#)

situated right behind the school. She has described some past field trips as “nightmarish” and cited having six children in her class with behavioral issues. She has had to modify lesson plans for students in her classroom and, as she said, “You cannot modify the environment.” Other teachers at Greenfield Elementary reported that they did bring their students outside but wanted to explore the trails themselves first to get more comfortable with the environment before bringing their students there. The teacher at Milton Terrace North makes it her priority to bring her students outside as much as possible. She is trained as an outdoor educator and has grown up exploring nature. On a nature walk with her, she pointed out various plants, evidence of forest succession, and different animal tracks. It is apparent that she is very familiar with her surroundings and passionate about sharing her knowledge of the environment with her students. She believes her colleagues express different sentiments, however. Other teachers at the school are nervous bringing children outside into an unstructured environment where they could fall down, get hurt, or even lost. Also, while she used to take her students outside to snowshoe in the winter, there is a new district rule in Ballston Spa that prohibits teachers from taking students outside when the temperature is below 20 degrees. Furthermore, some of her students come to school without outdoor attire such as boots and jackets. She has to leave these students behind when she goes out on the nature trail, and lamented that these students “probably need [the outdoor experience] the most.”

Private school teachers and administrators emphasized outside time and instruction in science classes as a main priority in their teaching. They are not constrained by schedule changes or accessibility to outside, natural areas. The teacher at St. Mary’s has taken her students to Kelley Park, about one mile away, and at the Waldorf school the students walk to Congress Park, about 1 mile from the school. Furthermore, class sizes at the private schools are

smaller (Saratoga Independent has 11-14 students in each class, whereas public schools have about 20-25 students in each class) and the teachers articulated much more personal enthusiasm in being outside with their classes. Even though St. Mary's is located in an urban, highly developed area, the teacher brings her students outside to explore their local surroundings. For one lesson plan called "Investigating your School Grounds" the children walked around the perimeter of the school identifying the areas of blacktop and discussing where rainwater collects and what local body of water it travels to.

DISCUSSION

Current Challenges to Outdoors Exploration

We conclude that there is adequate awareness by teachers of the need for, and general lack of, student interaction with nature. The desire of institutions to foster greater interaction between students and their environment is most clearly demonstrated by the fact that most schools we studied either had a student/community garden on school grounds or plans to incorporate a garden in the future. This is true regardless of the environmental setting of the institution. This is a phenomenon that appears to exist across the country. On-site gardens are simple additions to schools, providing multiple benefits, including providing students with opportunities to experience nature and teach them responsibility and the rewards of hard work, resulting in a rewarding experience and a greater understanding of basic biological principles relating to the third to fifth grade curricula in most schools.

Other themes common across many schools were more sobering. The average time spent on science education in elementary schools was only about 90 minutes per week. Most teachers felt that was insufficient for adequate environmental education at the elementary level, and yet

many teachers believe that science would be among the first lessons to be “cut” due to a lack of time. Time constraints also impact the ability of elementary students to benefit from field trips. However, the administration and teachers are attempting to alleviate these issues by providing more field trips for their students based around outdoor, wilderness experiences. Greenfield Elementary and Saratoga Independent School take their students to “Up Yonda” an environmental education center in Bolton Landing, New York that incorporates programs such as “Natural Heritage: official wildlife species and symbols of NY State” and “Changing Trees: tree parts and function, foliage, species ID.” (Up Yonda Farm 2012). The Ballston Spa public school district, encompassing Wood Road Elementary, Milton North Elementary, Milton South Elementary and Malta Avenue Elementary bring their fifth grade class to the Wild Center in the Adirondacks, providing a forested backdrop to their educational experience on diverse wildlife and habitats in upstate New York. Schools and teachers are aware and cognizant of the need to bring their students outside into the natural world. These trends in outdoor field trips are prevalent across all schools regardless of whether they were located in an urban setting or were considered public or private.

Factors favoring enhanced environmental education

Three factors that influence an elementary school’s ability to teach place-based environmental education are Local Environment, Available Resources, and Teacher Initiative. To our surprise, the local environment is the least relevant factor in predicting the likelihood that a school is providing a place-based environmental education. The factor with the greatest correlation to place-based environmental education is Teacher Initiative, which is closely tied to and influenced by Available Resources.

A school's local environment did not necessarily correlate with a strong outdoor environmental program. Greenfield Elementary has 68.47% forested land around their school, including walking trails right behind their school. However the students do not spend a significant part of their day or many of their lessons outside. The three teachers we spoke with were new to the school and hesitant to bring their students out on the trails before they had explored them first. With limited time to go outdoors, teachers have to prioritize which subjects should receive the most attention according to their teaching method. St. Mary's lies on land that is over 90% developed but the teacher makes it a priority to bring her students outside. Her students will walk over a mile to local parks or walk along their school grounds and investigate where rainwater collects and travels. This teacher is committed to teaching her students about various environmental issues and connecting it to their local environment. She has the time and money available to do this as a private school teacher. And despite the lack of a natural, forested area around the school, she utilizes the local, built environment to teach her students about environmental problems such as runoff, and pervious and impervious surfaces.

Our second most important factor was Available Resources in terms of economic funding (state, federal, and grants) and available time for instruction. These factors can have significant effects on the teaching of a curriculum, as they are often intertwined with the forces of state standards and curriculum guidelines, which are not easily changed. With abundant resources, an urban classroom would be able to participate, for example, in a nationwide online collaborative science project, or to obtain kits to learn about plant growth and life cycles, despite the lack of a favorable local environment, such as forested or natural land. For example, St. Mary's School takes part in an online collaborative project called "River Exchange" with a school located in Santa Fe, New Mexico. Students conduct water testing on their respective local bodies of water

(St. Mary's uses the Kayaderosseras Creek) such as turbidity and water temperature, and then report these findings online to share with students across a great variety of geographic settings. St. Mary's students can learn about particular water issues and ecosystems in New Mexico and compare to their own area in upstate New York. On the other hand, despite available resources, when teachers are constrained by time limitations, or the need to teach towards New York State testing standards, they are likely to cut precious time from science lessons. And even in the best of circumstances, forty-five minutes per week is insufficient for effective science lessons. Ideally, the school's class schedule should be formulated to accommodate longer class periods, so that teachers can dedicate appropriate time for exploration of local environments.

Finally, Teacher Initiative plays the most extensive role in facilitating environmental education. For example, two teachers from the same school area -- a teacher in Milton terrace North and another teacher in Milton Terrace South (both of whom share the same natural environment) -- have differing opinions on the value of bringing their students outdoors. The teacher from Milton Terrace North is a trained outdoor educator and has grown up in the woods. She is familiar with the trails behind the school and is confident in bringing her students out into the environment. She brought up the fact that many of her colleagues may fear the idea of an "unstructured environment" and lack confidence in their ability to respond adequate to a student's environmental question. But a significant aspect of scientific study is observing-- examining what is around you and trying to understand and study environmental processes. Another teacher at Milton Terrace South chooses to not bring her class onto the trails. They have a unit lesson on plants and water, where she has students construct indoor ecosystems demonstrating erosion.

As the Chinese Proverb says: “I hear and I forget. I see and I remember. I do and I understand.” Teachers with the motivation and willingness to go the extra step, and give children a chance to experience nature first-hand, do the most to promote an active and local environmental education, and overcome the limitations of resources and available open spaces. This is not to say that teachers who do not make as much of an effort to bring children outside are less capable – often times these teachers make do with their current situation and bring in as much as they can to the classroom. What these facts demonstrate is that the attitude and drive of a teacher is the most important factor in creating experiences that lead children to understand and appreciate their local environment, and that there is always room for improvement.

Recommendations

Our future recommendations for schools in promoting environmental education are twofold. First, we recommend creating a more equal distribution of time dedicated to each subject within the curriculum. As previously stated, in most public schools language arts and math receive much more time in the classroom due to New York State testing at the end of the year. In order for students to receive a more well-rounded education, all subjects should receive an equal amount of time of instruction in the classroom.

Our second suggestion is for schools, or the school district to provide training opportunities for teachers in outdoor education so they can be more comfortable in bringing their students outside. If teachers are knowledgeable and enthusiastic about their local surroundings, they can encourage their students to take pride in their environment and subsequently environmental issues.

These suggestions would require the support of the administration and parents in order to be feasible options. However, as awareness in the benefits of this type of education grows, various stakeholders may naturally become much more supportive. We are uncertain whether the changes might be best hastened via a top-down (e.g., more time and money), or bottom-up (teachers' training and science advocacy) approach. We are certain of the power and influence demonstrated by teacher initiative in this study of analyzing current environmental education in the Saratoga Lake Watershed.

FIGURES

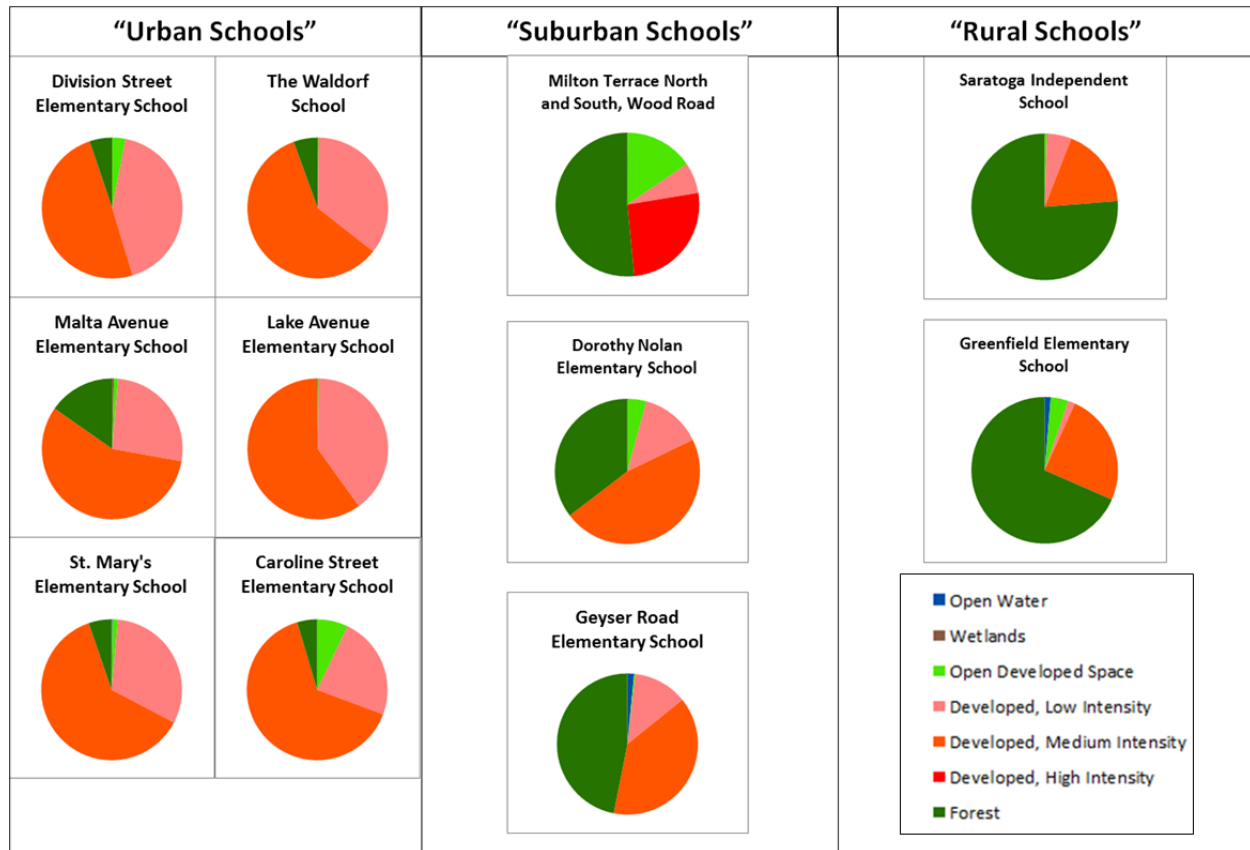


Figure 1: Land Use Pie Charts

School	Radius	Open Water	Wetland	Developed, Low Intensity	Developed, Medium Intensity	Developed, High Intensity	Forest
Geyser Road Elementary	0.5 mi	1.51%	0.00%	0.35%	12.35%	38.91%	0.00%
Ballston Spa (Wood Road, Milton Terrace N/s)	0.5 mi	0.13%	0%	15.37%	6.90%	0%	26.10%
Greenfield Elementary School	0.5 mi	1.33%	0%	3.95%	1.51%	24.75%	0%
Saratoga Independent School	0.5 mi	0%	0%	0.53%	5.40%	17.79%	0%
Division Street Elementary School	0.5 mi	0%	0%	3.06%	42.28%	49.47%	0%
Malta Avenue Elementary School	0.5 mi	0%	0.40%	0.93%	26.48%	56.91%	0%
St. Mary's Elementary School	0.5 mi	0.22%	0%	1.24%	31.22%	62.05%	0%
Dorothy Nolan Elementary School	0.5 mi	0%	0%	4.25%	13.58%	46.79%	0%
Lake Avenue Elementary	.5 mi	0%	0%	0.18%	39.89%	59.75%	0%
Caroline Street Elementary	.5 mi	0%	0%	7.14%	23.54%	64.73%	0%
Waldorf School	.5 mi	0%	0%	0.18%	35.38%	58.88%	0%

Table 1: Land Use Percentages

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