

Expanding Outdoor and Environmental Education in Public Schools

by

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Abstract

Outdoor and environmental education programs in public schools have the potential to change the outcomes for students, targeting academic success, mental health, and physical health. This paper compiles evidence of these outcomes in a variety of topics to support this claim.

Additional long-term research is needed to fully understand the impacts outdoor and environmental education can have on students, but short-term analyses from multiple scholars provide sufficient evidence of benefits to students to support the implementation of programs. I suggest implementing them slowly, beginning with pilot programs at schools to produce data that will encourage other educators and administrators to try it for themselves. This paper addresses benefits to the whole child, impacts on learning in academic content areas, primary and secondary curriculum, types of programs that exist, increasing implementation into public schools, obstacles and limitations, health concerns, supporting students with diverse needs, and the future impacts of outdoor and environmental education in schools. From the compiled research, there are positive implications to conclude that increasing time spent outside will have both short-term and long-term benefits for students, such as increased focus and engagement, and pro-environmental attitudes.

Keywords: outdoor and environmental education, academic success, whole child development, curriculum, pedagogy, programs, students with diverse needs, future impacts, focus, engagement, pro-environmental attitudes

Expanding Outdoor and Environmental Education in Public Schools

More than ever before, there is a great need to get children outside, moving, engaged in meaningful exploration, and connected with nature on a deeper level. Research shows that aside from school recess, “the average American child spends 4-7 minutes a day playing outside”, less than 1 hour outside per week (Cohen, 2021). In fact, the Institute for Social Research study (2009), found that “since the late 1970’s, children have lost 12 hours/week in free time, including a 25% decrease in play and a 50% decrease in unstructured outdoor activities” (Barros, Silver, & Stein, 2009, p. 434). In schools, the average recess is 20-30 minutes, giving kids the opportunity to spend just 3.5 hours outside a week at school, unless they go home to spend more time outside. Some middle and high school students receive no recess, but may spend the same amount of time outside as it relates to physical education. Historically, recess times have been anywhere from 60-90 minutes, but with more focus on academics, recess has been cut down and diminished over time. Louv (2008) describes this shift as well as the potential consequences:

In the United States, as the federal and state governments have pushed for higher test scores in the first decade of the 21st century, nearly 40 percent of American elementary schools either eliminated or were considering eliminating recess... many districts considered recess a waste of potential academic time or too risky... the detachment of education from the physical world not only coincided with the dramatic rise in life-threatening childhood obesity but also with a growing body of evidence that links physical exercise and experience in nature to mental acuity and concentration. (pp. 99-100)

In addition, the average child 8-12 years old spends between 4-6 hours a day and between 28-42 hours a week using an electronic device, with teens spending up to 9 hours a day, and 63

hours a week using a device; far surpassing the hours of a full-time job. Some of the ways children use devices include completing assignments during the day, doing homework, watching tv, playing games, texting, and interacting on social media. While not all are negative uses, there are detrimental effects of too much screen time, including “sleep problems, lower grades, not enough outdoor or physical activity, weight, mood problems, and poor self-image” (Aacap, 2020). These negative effects carry over into their performance in school.

As educators, what can we do? Just increasing the amount of outdoor time to 2 hours a week can make a significant difference, according to a 2014-2016 survey of 19,806 people by White of the European Centre for Environment & Human Health at the University of Exeter. In this study the participants who were in contact with nature in the past seven days, for sixty minutes at a time, “were substantially more likely to report good health and psychological well-being” (2019, p. 1; Robbins, 2020, para. 1). By increasing our time outside to one more hour per week, or twelve more minutes a day, we could shift our current educational habits to improve the health and well-being of our students. Even greater, if we could dedicate time each day to move learning outside, what could we accomplish? While addressing the dissociation from nature that our education system has unintentionally ingrained in our society, Louv (2008) writes,

If educators are to help heal the broken bond between the young and the natural world, they and the rest of us must confront the unintended educational consequences of an overly abstract science education: ecophobia and the death of natural history studies. Equally important, the wave of test-based education reform that became dominant in the late 1990s leaves little room for hands-on experience in nature. Although some pioneering educators are sailing against the wind, participating in an international effort

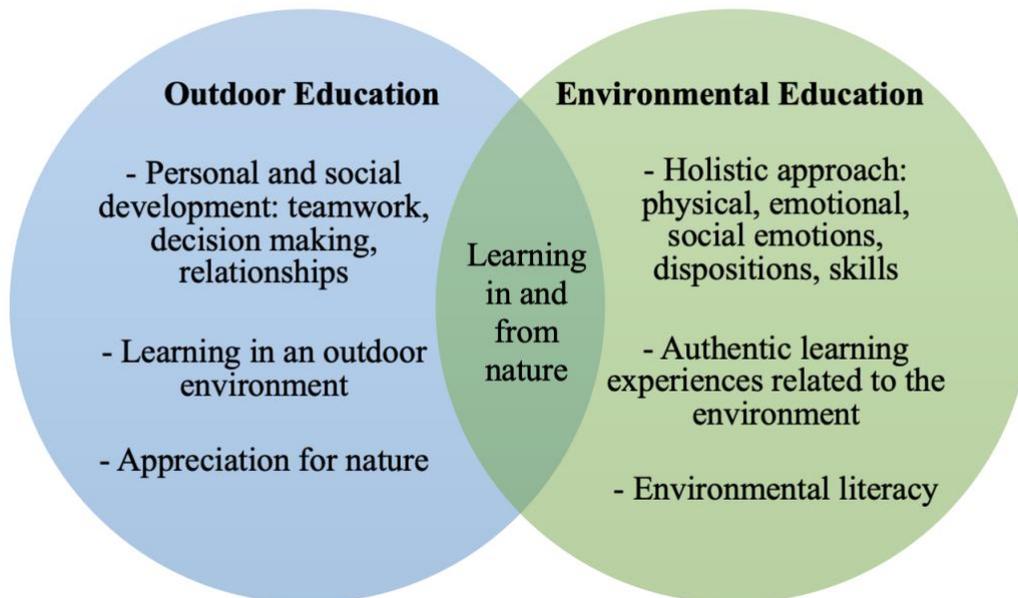
to stimulate the growth of nature education in and outside classrooms, many educational trends are, in fact, part of the problem. (p. 135)

The problem, being that children are disconnected from the world that they are learning about within textbooks and devices used for learning. Students need learning experiences that help them to become more engaged and active participants in learning, focus their attention, and help them understand the content that they are being taught by seeing it firsthand, such as in science. Additionally, children are the future stewards of the earth, and helping them learn about environmentalism and sustainability early on gives them the best chance at becoming responsible caretakers later in life. The proposed solution is to expand outdoor and environmental education programs in public schools, to meet both the academic, physical, and socio-emotional needs of children, while also encouraging a more positive relationship with the environment and sustainability.

To see this solution come to fruition, it is important to understand what is meant by outdoor and environmental education. As defined by the North American Association for Environmental Education, or NAAEE, “Environmental education in early childhood is a holistic concept that encompasses knowledge of the natural world, as well as emotions, dispositions, and skills” (EE Works, 2021; Simmons et al., 2016). An overall goal of environmental education is to develop “a local, regional, and global community of environmentally active people through engaging young children in meaningful, relevant environmental learning experiences” (Davis & Elliot, 2014; EE Works, 2021; Wilson, 1996). On the other hand, outdoor education is most commonly defined as “concerned with personal and social development of young people across a range of areas of interest, such as: ‘self-awareness, teamwork, decision making, environmental

awareness, spiritual and aesthetic awareness, relationship-building, taking responsibility, communication skills, and physical awareness” (Gair 1997; Wattchow & Brown, 2011).

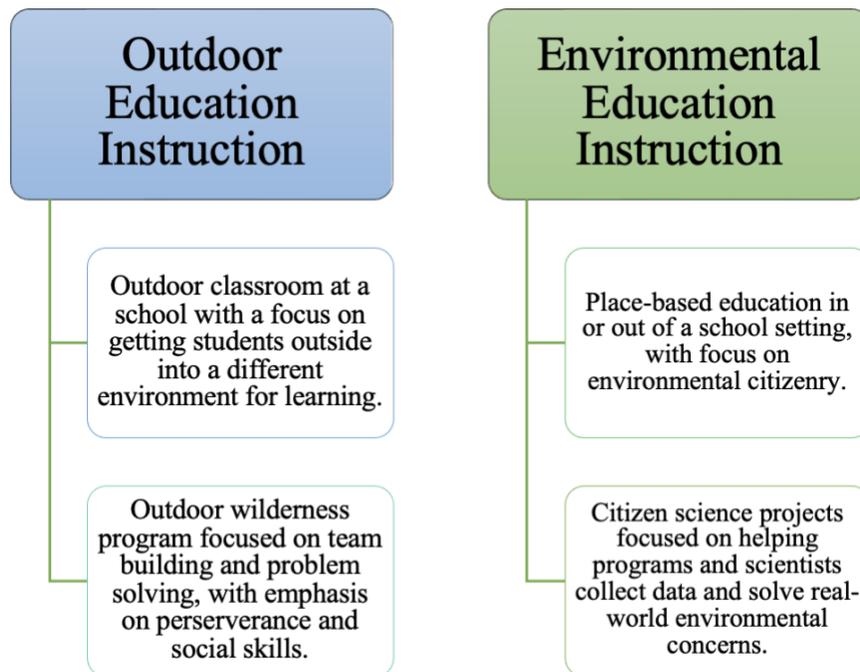
Figure 1. Comparing and contrasting outdoor and environmental education.



As shown above in Figure 1, outdoor and environmental education coincide in some ways, with the obvious being that both are focused on learning in and from nature, but the two differ pedagogically in that environmental education prepares students to be stewards of the earth who are active participants in problem solving, and respecters of environmental literacy, which are, according to the NAAEE, “[people] who, both individually and together with others, make informed decisions concerning the environment; [are] willing to act on these decisions to improve the well-being of other individuals, societies, and the global environment; and participate in civic life” (Hollweg, et. al. 2011; Simmons et al., 2016, para. 6). Outdoor education gives students the foundation of an appreciation of nature with the combination of learning in an outdoor environment. Sometimes this comes in the form of wilderness adventure programs, other times it is nature-based education, or outdoor classrooms that offer a more natural, open

environment for learning academic content. Figure 2 below shows some examples of each type of instruction, illustrating key differences in the types of programs that fall under each term.

Figure 2. Examples of outdoor and environmental education instructional approaches.



While there are multiple approaches and various pedagogy related to outdoor and environmental education, many of which will be highlighted here, the overall benefits are the same. Students with access to nature benefit from a better sense of place, a better sense of self, and a better sense of purpose. The following is intended to argue that introducing or expanding outdoor and environmental education programs in public schools will benefit the whole child, increase retention of academic content, build connections between students' own experiences and the world around them, and elicit inquiry and engagement through hands-on exploration, resulting in children who are overall happier and healthier.

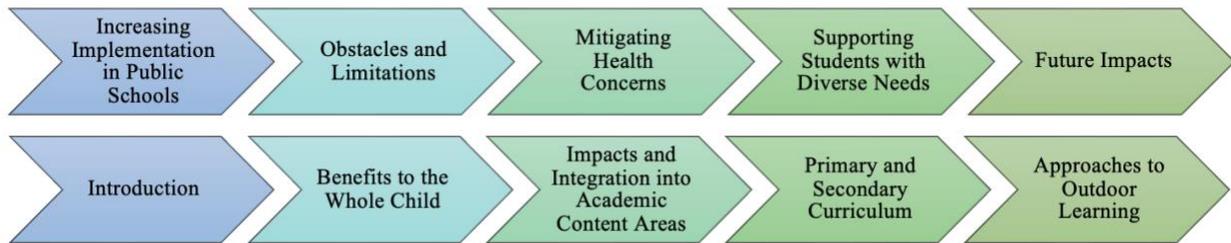
Figure 3. Synthesis of Expanding Outdoor and Environmental Education in Public Schools.

Figure 3 above shows a synthesis of the following paragraphs which detail support and evidence of the goal to expand outdoor and environmental education in public schools, with an overall priority to encourage students to learn in outdoor environments. These topics highlight existing programs and plans for implementation, as well as important factors to consider for equity in these outdoor learning environments.

Benefits to the Whole Child

To provide more well-rounded and developmentally appropriate experiences for our children, we need to understand the benefits of outdoor and environmental education as they relate to the whole child, which includes socio-emotional, mental, cognitive, physical, sensory, and academic development. In a recent review of the literature titled “Early Childhood Environmental Education Delivers Many Benefits to Learners”, Stanford researchers found substantial evidence that early childhood environmental education can:

provide wide-ranging benefits for children, such as increased learning in a range of areas such as mathematics, science, language, and literacy; enhanced social and emotional skills; and improved physical development. (EE Works, 2021, p. 1)

Similarly, the Council of Nature-Based Early Childhood Education Administrators found that, “Natural environments have a positive effect on developing executive functioning skills and reducing ADHD symptoms... Schools with dedicated natural spaces for

student exploration saw improved learning outcomes in math, science, and language arts” (Williams et al., 2020, paras. 5-6). Ironically, oftentimes guidelines for developmentally appropriate practice from leading organizations for the education of young children, such as the National Association for the Education of Young Children (NAEYC) do not include time in nature as a critical component of development, rather it is “associated with outdoor play and its benefits for gross motor development” (Ardoin & Bowers, 2020, p. 11). The subsequent paragraphs examine the integral role nature plays in whole child development beyond academics, such as socio-emotional and cognitive development.

Social-emotional development influences all other areas of development because students are expected to control themselves and interact with others within the learning environment. Without a solid foundation in this area, students cannot be fully successful in other areas of development. While students can develop healthy social-emotional dispositions in a classroom environment, “Experiences in natural environments foster children’s emotional intelligence: self-discovery, -confidence, -esteem, and -regulation... Exposure and contact with natural spaces is emotionally restorative and a wellspring for inner strength and reduction of stress and mental fatigue” (Williams et al., 2020, para. 7). In other words, when children step outside of the fluorescent lights and cinder block walls that impede their full potential for growth, they are able to think more clearly, broaden their perspectives, and self-regulate, therefore becoming more successful in approaching learning and their interactions with others.

Of the experiences that children have with nature, compassion and empathy are some of the most significant qualities that can be developed, which are both reflected in environmental activism and social justice. The authors of “Outdoor education and students’ wellbeing” wrote, “Several studies showed that, to the purpose of an effective behavioral change, educational

approaches that are capable to generate an emotional involvement in environmental problems may be more effective than those focusing on mere knowledge of environmental facts”

(Passafaro et al., 2010; Pirchio et al., 2021, p. 2). As we help students form an emotional connection to the world around them, they are better able to understand the importance of the way the environments around them function and the purpose of the flora and fauna in those environments. In her poem, “Wilder Bond”, Sowder (2019), Founder of Wilder Child, wrote,

May we raise children who love unloved things – the dandelion, the worms, and spiderlings. Children who sense the rose needs the thorn and run into rainswept days the same way they turn towards sun... And when they're grown and someone has to speak for those who have no voice, may they draw upon that wilder bond, those days of tending tender things, and be the ones.

There is power in teaching children to respect nature and understand it, rather than to fear it. They will carry these lessons with them into life and their interactions with others, as well as their feelings about the environment in which they live. When children learn to respect the smallest of organisms and their purpose, they will learn to respect and have empathy for others around them.

Pirchio, et al. (2021), conducted two studies of 745 students ages 9-11 years old, at 6 schools in Italy. There were 324 students in the intervention groups, and 421 students in the control groups. Researchers administered a pre- and post-intervention questionnaire. Researchers used statistical analysis, including correlational analysis and repeated measures ANOVA. Results showed a slight increase in connectedness to nature with the intervention group, but a slight decrease with the control group. Researchers also found a significant increase in psycho-physical wellbeing with the intervention group, but a slight decrease with the control group. there is a

positive association among the two intervention groups, compared to the control groups, showing a connection between nature with “pro-environmental attitudes, psycho-physical wellbeing, pro-social behaviors, empathy, students’ life satisfaction, anxiety... and connectedness to nature” (Pirchio et al., 2021, pp. 4-5). This positive correlation shows promise in exposing students to “restorative environments”, which are natural spaces that can help a person feel more renewed.

Research by Sprague and Ekenga (2021) further supports the findings of Pirchio et al. In their research Sprague and Ekenga found that, “Nature experiences have been found to produce several health benefits, including mental health promotion, happiness and well-being promotion, aggression reduction, increased social cohesion, and cognitive and motor development in children” (p. 5).

Another area of development in which outdoor or environmental education can have a significant impact is cognitive development – how children and adults understand the world around them, sensory experiences, executive function, memory, risk-taking, and problem-solving. As cited in “Ecopsychology”, Louv (2005) is quoted as saying, “[The studies] point in one direction: Nature is not only nice to have, but it’s a have-to-have for physical health and cognitive function” (Robbins, 2020, para. 5). When students can exercise both their minds and bodies, they will be stronger both mentally and physically. “Outdoor education also more nimbly fosters traits like adaptability, perseverance, grit, and resilience – equally important to sustained academics” (Williams et al., 2020, para. 6). In addition to mental acuity, students will become better apt to face challenges and recognize where they need to be psychologically flexible, making them more likely to be successful.

One of the biggest ways that adaptability, perseverance, grit, and resilience are developed is through nature play, specifically open-ended. Play has an essential role in outdoor and

environmental education because being outdoors, in nature, encourages exploration, creativity, and ingenuity. Therefore, outdoor play has significant impacts on the development of the whole child, as seen in Figure 4 below. These impacts stretch across all domains of child development, including socio-emotional, mental, cognitive, physical, sensory, and academic development.

Figure 4. The Power of Nature Play on the Development of the Whole Child.



Play should not only be in our pre-kindergarten settings but continue into adulthood. “Play is not frivolous; it is brain building. Play has been shown to have direct and indirect effects on brain structure and functioning” (Yogman et al., 2018, p. 5). There are lessons to be learned and growth to be had through play. We process emotions and experiences through play and lightheartedness, by taking a step back from the harshness of life, making sense of our reality, and letting go. Gray (2013) emphasizes the power of play:

Play is nature's way of teaching children how to solve their own problems, control their impulses, modulate their emotions, see from others' perspectives, negotiate differences, and get along with others as equals. There is no substitute for play as a means of learning these skills. (p. 175)

Play comes in many forms, beyond our common conception of what play means. Students play and experiment with toys, interactions with others, ideas, instructional materials, and the learning environment. As children move into formal schooling, some of these are acceptable while others are not. In teaching children to become students, we hinder their desire to explore, to manipulate, and to think critically. "Critical thinking is founded in creativity, and creativity always requires a degree of playfulness... Anxiety prevents such play and forces thought along well worn channels... [it] inhibits the generation of new ideas or insights" (Gray, 2013, pp. 80-81). When considering the role that stress and anxiety play in limiting the function of the brain, we should acknowledge that relieving stress and anxiety through play would be beneficial to children in academic settings.

Play and stress are closely linked. High amounts of play are associated with low levels of cortisol, suggesting either that play reduces stress or that unstressed animals play more. Play also activates norepinephrine, which facilitates learning at synapses and improves brain plasticity... In human children, play usually enhances curiosity, which facilitates memory and learning. (Yogman et al., 2018, pp. 5-6)

Allowing our students time to play, whether through open-ended, unstructured opportunities, or curriculum-based exploration will allow them to release some of the stress that they hold, and prepare to engage their frontal lobe, which as explained by Collins and Koechlin (2012), are responsible for executive functioning, "reasoning, learning, and creative abilities in the service of

decision-making and adaptive behavior.” Their research further shows that “the ability to adapt to uncertain, changing, and open-ended environments is a hallmark of human intelligence” (p. 1). This adaptability is supported by the structure of outdoor, natural environments where student learning is based in exploration rather than instruction.

Beyond the cognitive skills that play supports, the fine motor skills necessary for writing are also crucial for development. These skills are developed through hands-on play-based experiences, through manipulating materials in the natural environment, and testing the capabilities of our bodies. Morgan, author of the blog “Not Just Cute - Intentional Whole Child Development” writes, “Before we ever put a pencil in a child’s hand, those hands should dig, climb, press, pull, squish, twist, and pinch in a wide array of environments and with a variety of materials” (2017, para. 4). In addition to fine motor skills, the development of students’ gross motor skills, balance, and risk assessment are well supported in nature.

When students are active in their learning environment, especially in outdoor settings, they have opportunities to cross the midline, or use both the left and right sides of the body and brain to complete tasks, walk on various surfaces, problem-solve, and test their abilities in a safe environment. Students who are self-directed learners take initiative and become self-advocates. Through whole body learning, students are more engaged and more likely to remember what they have learned. Not only do children learn at their fullest potential, but educators also get to see students from a more authentic perspective, better understanding how their students learn and what their students enjoy. “Teachers are reported by Waite (2010) to value the outdoor environment strongly as they have the ‘chance to observe the whole child in contrast to their more narrowly-focused teaching role within the classroom” (Orr, 2004; Gray, Lloyd, & Truong, 2018, p. 50). By limiting our students, we miss out on opportunities to understand them.

Furthermore, when students can take risks and make choices about safety in a controlled natural environment, they will be able to make better choices for themselves in the great big world. In “Supporting the development of risk-taking behaviors in the early years”, authors Waters and Begley (2007) write, “In contrast to the commonly held negative view of risk-taking, Smith suggests ‘a kind of risk-taking that is most physically, emotionally, socially, intellectually, and possibly even financially worthwhile’” (Smith, 1998, p.11; p. 366). Waters and Begley sought to show that risk-taking behaviors were well supported in a forest school environment through an exploratory study of two four-year-old’s, a boy and a girl, in South Wales. Their purpose was to show whether the forest school environment “supports the development of children’s positive risk-taking behaviors”, compared to a primary school outdoor environment (pp. 365, 369). The results indicated that one child demonstrated risk-taking behaviors in both a primary school environment and forest school environment, but that only in the forest school environment were his behaviors acceptable, and the environment was conducive to those risk-taking behaviors. The second student demonstrated engagement with the environment and risk-taking behaviors in the forest school environment, but not in the primary school environment. Both children ultimately “developed positive dispositions toward physical risk and challenge in this setting” (p. 374). Another important note from the study—rules within a primary school environment, even in the United States, are commonly based around limiting risk-taking behavior, and do not encourage children to explore what their bodies are capable of. Regarding providing these opportunities, Waters and Begley (2007) write,

Because of the curtailment of outdoor play outside school and children’s limited access to diverse natural environments, time spent at Forest School or similar outdoor projects may be the only opportunity some children have to develop positive learning dispositions

towards physical risk, persistence and challenge, and to acquire the possible benefits this could produce in terms of their future learning. (pp. 371-374)

It is important for us as educators to consider how we are limiting our students' opportunities to fully develop the skills that they need to be successful, beyond academics. These skills do play a role in academics and will support the progress that we intend on making. Beyond the physical, social-emotional, and cognitive benefits of outdoor and environmental education, there are also health benefits to moving learning outdoors on a more regular basis.

Researchers and advocates for outdoor and environmental education have found significant benefits to children's development across multiple domains including socio-emotional, mental, cognitive, physical, sensory, and academic development. Furthermore, they have found that outdoor environments where open-ended exploration and play are available to children facilitate positive outcomes in the development of the whole child rather than simply academic success. Being that academics are the top priority of schools, it is important to consider how outdoor and environmental education can play a role in academic success, and what it will look like to apply outdoor and environmental education to each content area.

Impacts and Integration into Academic Content Areas

Research shows that outdoor and environmental education have positive effects on academics. When students are engaged and in environments that are more naturally conducive to learning, their ability to be successful in academics increases. In fact, the National Environmental Education and Training Foundation (2000) found that "when schools utilize the context of local areas and naturalized schoolyards... academic performance improves reading, [math], science, social studies and writing." Another study of 40 California schools found that when students did project-based learning in a natural environment, "student performance

improved in standardized test scores, grade point average, willingness to stay on task, adaptability of different learning styles and problem-solving ability” (Leiberman & Hoody, 1998; Gustafsson et al., 2012, p. 65). Some studies have shown positive effects on individual content areas, and even standardized testing scores. In the Roundtable’s Report, “Closing the Achievement Gap”, issued in 2002, the findings showed that “environment-based education produces student gains in social studies, science, language arts, and math; improves standardized test scores and grade-point averages; and develops skills in problem-solving, critical thinking, and decision-making” (Louv, 2008, p. 206).

Moving beyond the classroom walls requires us to rethink how we currently teach some of our content areas and the tools we use. It requires us to recognize that the only real difference between being inside and out are the comforts that we have come to know as essential for education, but that are not truly essential. It does not mean we need to abandon those tools all together, but to introduce other tools, or simplify what we are using on a daily basis. It also requires us to look at each content area that we teach through a different lens. What if some students who struggle went from seeing science or math as a sleepy subject that is contained in a textbook, to seeing them as subjects that are alive in the world around us? What if making those connections to the real world helped them understand the purpose and application a little more than before, and bring them to life right in front of their eyes?

Research has detailed increasing opportunities to include interdisciplinary outdoor learning within the formal school curriculum. School grounds, gardens, and green spaces provide rich opportunities for teaching across the curriculum, and possibilities for children to bridge the nature/culture binary themselves... Students were found to be more motivated within the outdoor environment, and the motivation continued in the indoor

environment if the content was related to the outdoor learning experience. (Gray, Lloyd, & Truong, 2018, pp. 50, 52)

Thinking outside of the box, quite literally, can help us open up more opportunities for students to become engaged in their learning experiences and retain more information. In the following sections, for each content area, are detailed examples of how outdoor and environmental education can be integrated into academic content areas for greater success in academic performance. These detailed experiences show that teachers can provide authentic experiences for students while meeting the curriculum and testing requirements.

Science

Science, the foundation for outdoor and environmental education, is one of the most overlooked and under-taught subjects in primary grades, yet there are endless opportunities for students to become familiar with and appreciate the world around us firsthand, beginning early on. There are plenty of programs and curricula targeting older students, but younger students also need to be instructed and exposed to the natural world before they develop negative feelings about the world around them or disconnect from nature. According to Ardoin and Bowers (2020):

Environmental education has a lifelong impact. Yet environmental education researchers and practitioners identify early childhood, defined as ages birth to eight, as a particularly crucial time for developing environmental literacy... whereby educators can start young children on their journey toward becoming environmentally responsive youth and adults... the infant and toddler stages... [represent] a foundational period for environmental identify where a lack of positive nature-rich experiences can lead to mistrust or fear of the natural environment. (pp. 2, 10)

Environmental literacy, or EL, is one of the key components to improving global health and environmental challenges. “Direct responses to global environmental crises can slow the tide of environmental degradation, but reversing the trend will require an environmentally literate citizenry” The four components of environmental literacy (EL) are, identified by Stevenson et al. (2013), knowledge, or understanding of environmental issues, affect, or change in environmental issues, cognitive skills, or the ability to analyze and evaluate information regarding environmental issues, and behavior, or an attitude of care and concern for environmental issues (p. 1). To be successful in creating environmentally literate students, we need curriculum and further educational opportunities for teachers that will later be addressed, as well as opportunities to change students’ dispositions regarding their roles as scientists.

Students often feel that others are scientists, but that they themselves are not, because they do not have the qualifications. Students most often imagine a man in a lab coat performing experiments, rather than themselves participating in scientific exploration. Furthermore, according to Stevenson et al. (2021), girls often outperform boys in science, yet do not tend to go into scientific fields nearly as often:

Decades of reform efforts have aimed to eliminate the gender gap in science, technology, engineering, and mathematics (STEM) fields, including science specifically...

Addressing these gender gaps will likely require employing instructional practices that encourage girls to see themselves as scientists from a young age. (p. 1090)

If we develop a space where all students see themselves as scientists from an early age and show them that they are just as valued as adult scientists, by allowing them to participate in experiments and data collection, their dispositions are more likely to change, and even greater, the number of girls going into fields of science will increase.

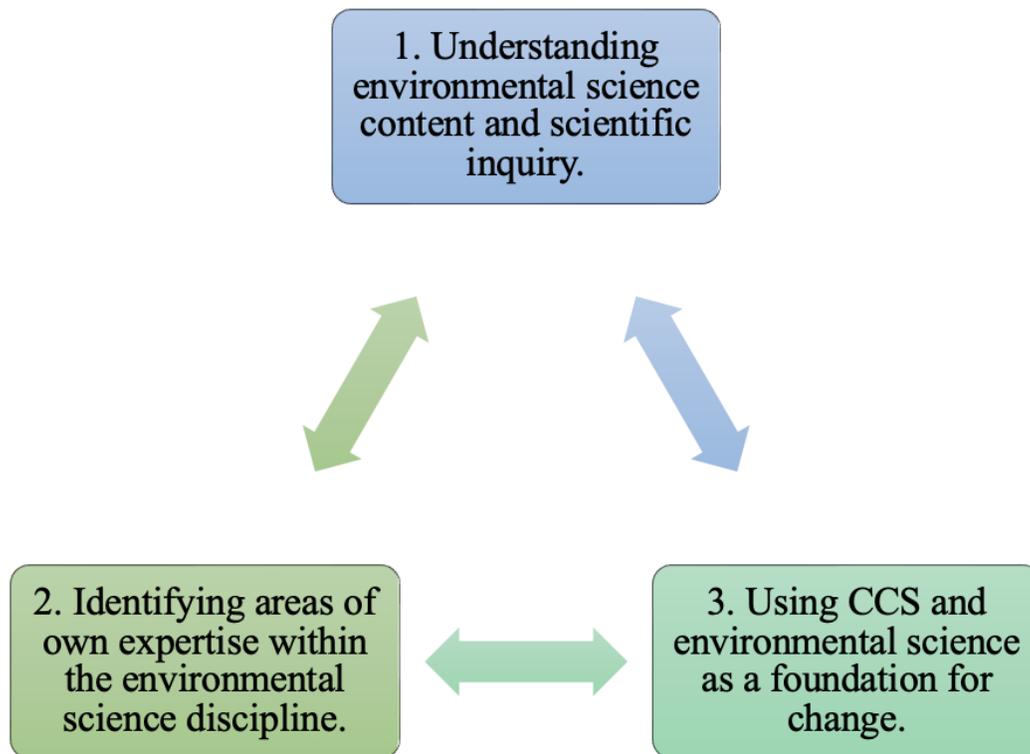
A study by Stevenson et al. (2021), “investigates the potential for [outdoor science education] OSE to effectively engage all students in science learning, but particularly girls.” They encourage educators to consider OSE, as a “promising instructional practice... that [gives students the] opportunity to engage in authentic science learning for which unpredictable environments, uncertainty, and trial-and-error are hallmarks” (p.1091). The study featured “1290 fifth-grade students, ages 9-12 years old, in North Carolina... as this age is the period when students typically begin to disengage from science”, according to Archer et al. (2010) (p.1097). Additionally, this study was aimed at understanding the impacts of OSE on the science content area, performance, and understanding for students overall. Researchers found that OSE has positive effects on engaging girls in science learning, and overall promotion of science learning for boys, but that further long-term research is needed to really understand the effects OSE may have on student science achievement (p. 1104). If we are to try to understand the effects learning outdoors can have, we must jump in and try it for ourselves. However, it is logical to trust that learning science first-hand would improve student engagement, performance, and self-efficacy.

In the book “Taking Inquiry Outdoors”, Barbara Bourne discusses the Elementary Science Integration Project, or ESIP, and her own lifelong journey of “coming home to science”, through the realization that science can be fascinating and exciting outside of the classroom to those who are not science-minded inside of the classroom. She says,

Over the past nine years, ESIP records have documented how a large number of participants have turned to the outdoors as a comfortable place to begin their entry into classroom science. Perhaps they do so because they, too, harbor an unrealized ‘science self,’ one that is already in tune with science and aesthetics of the natural world. (Bourne, et al., 2000, pp. 1-2)

The idea of scientific inquiry is something that many teachers struggle to execute in their classrooms, because in order to do so, teachers must help lay the foundation for success, and take a step back while students dig in and investigate. “Fear of chaos, confusion, and disorder keeps many teachers from inviting inquiry into their classrooms and many administrators from encouraging its use in their schools.” However, according to Bourne (2000), with planning and purpose, it is possible to make scientific inquiry a success. Reardon, author of “Beyond the Science Kit: Inquiry in Action”, says that it must be “real, relevant, and rigorous” (1996 as cited in Bourne et al., 2000, p. 7). To plan purposeful experiences, we must make sure that they are also meaningful and engaging, allowing students to initiate scientific inquiry in an authentic way.

One of the ways that we can engage students with first-hand science experiences and help them become scientists at a young age is through community and citizen science, or CCS, which are “activities or programs in which members of the public collaborate with professional scientists on scientific research and monitoring in either science-led or community-led endeavors” (Ballard et al., 2017, p. 65). Rather than having students study data collected by others, CCS helps students realize they are scientists by having them participate in the data collection, analysis, and questioning that scientists in the field do every day. The intention is to involve students in conservation and environmentalism, using the framework of environmental science agency, or ESA (Shirk et al., 2012; Bonney et al., 2014; Ballard, Dixon, & Harris, 2017).

Figure 5. Environmental science agency, or ESA, components.

This framework, shown in Figure 5 above, includes three areas. The first, “understanding environmental science content and scientific inquiry”, is looking at “engagement with environmental sciences and conservation particular to ecosystem health”; the second, “identifying areas of their own expertise within the environmental science discipline” pertains to “the ways that young people develop particular roles within their project groups and environmental science more generally”; the third, “using CCS [community and citizen science] and environmental science as a foundation for change” refers to “shifts in identity that extend beyond project work” (p. 67). For the purpose of applying this framework to science education in public schools, Ballard, Dixon, and Harris (2017) suggest the focus is that:

young people use science learning and participation as a foundation for action related to environmental sustainability... [to] support young people in acting (individually and

collectively) with the tools of science in ways that are purposeful, personally consequential, and in service of more sustainable social-ecological systems. (p. 67)

During the study, Ballard, Dixon and Harris (2017) found that participation in data collection, projects, and interacting with various environments did contribute to students' environmental science agency (p. 69). If students learn, understand, and explore scientific concepts early on, discover their own passions within the many fields of science, and apply it to their lives, they will be stewards of change in their own communities and in our society. Citizen science builds these future leaders through meaningful and authentic science experiences.

Social Studies

Another form of direct experiences in nature, outdoor experiential education, or OEE, crosses over into social justice in many ways. Through OEE, students have opportunities to learn about social justice issues that are also relevant to environmental issues. Warren et al. (2014) points out that there are many social justice issues rooted within OEE, such as the history and ownership of land, oppression of marginalized people, specifically the indigenous and people of color, ability and accessibility, gender norms, and misappropriation. By addressing and getting past these issues, as well as acknowledging the land on which we have our outdoor experiences, we can move toward making outdoor spaces equitable for all, "and to emphasize improved quality of life, autonomy, and self-determination, human rights, and fairness" (Taylor, 2002 as cited in Warren et al, 2014, pp. 90-91, 94). Teaching students about these issues is a key component to our social studies curriculum, social justice, and to environmentalism. Some of the very threats to our global health are directly related to social justice and environmentalism. When we teach students about the difficult issues of the past and present, we help them move

forward as informed citizens who can work to prevent other injustices from happening in the future.

In addition to social justice, there are many other fields of social studies that can be taught within outdoor experiential education, such as political science, geography, anthropology, history, and archaeology. Just as with science, many of these topics can be taught through first-hand, authentic experiences that engage students and promote a desire to go into those careers. For example, future politicians would benefit from extensive experiences in environmental science and social justice throughout their educational careers because they are ultimately responsible for the legislation regarding these topics. Future park rangers would benefit from extensive experiences in anthropology, geography, archaeology, and history because they are responsible for caring for and protecting the land of those who have come before us.

Geography, like science, is one of the more direct subjects to teach in relation to outdoor and environmental education. Going back to place-based outdoor learning, or PBOL,

[Geography] include[s] direct experiences, mapping environments and the use of geographic equipment... The most significant finding in this subject area was that when children were learning about local landscapes the place-essential activities successfully accomplished the set of academic outcomes relating to identifying types of environments.

(Gray, Lloyd, & Truong, 2018, p. 53)

Sobel (2008) shared in his book “Childhood and Nature: Design Principles for Educators”, a project that a middle school teacher from Vermont, Jennifer Kramer, assigned that is an excellent example of how geography can be applied in a place-based scenario. She regularly teaches students about the local history and landscapes. She wanted the students to learn more about how

farmland was developed out of forests in the local area during colonial times. To accomplish this:

[She] gave the students a blank outline map of a Vermont town. Groups of four students had to locate a mill, a meetinghouse, a store, and their own house. Next, a transparency of the rivers, lakes, and streams was layered over their maps, and the students had to decide if this changed their proposed locations. Then a transparency of topography was added and the students could change their locations one last time.

The project was then taken a step further, incorporating a “small world challenge”, where the students had to use a four by six rectangle on the school’s nature trail to create their own historically accurate farm, by clearing out the land and building on it (Sobel, 2008, pp. 4-5). The project became a history, geography, reading, writing lesson, and sensory experience. This example shows us how we can take almost any topic and make it cross-curricular and engaging.

English Language Arts

There is still more research and long-term studies to be done on how exactly going into nature to learn helps students, but there are many teachers and schools currently testing the theory that outdoor and environmental education positively impact all content areas, not just science. Susan, a pseudonym for a teacher who participated in a study by Eick (2011), “viewed her students’ science and nature studies as the content upon which they learned to better read and write, and in turn how reading and writing helped them learn the science content” (pp. 796-797). Reflecting on the positive influence of the outdoor classroom, Susan believed that the “lower achieving children” benefited the most from the outdoor classroom experience and were more motivated than ever before. Susan’s state testing scores reflect that 94% of her third-grade students passed the state reading proficiency test. There were no students who did not pass,

which was comparable to the overall school and the school district's scores on the state assessment.

While Susan had the support from administration, there was pressure to improve reading scores within the school. Ultimately, she was successful in implementing her outdoor classroom while also meeting those goals. "High-stakes test results affirmed this approach through comparable high reading scores to other third grade classrooms." Susan saw positive effects on her students' overall learning dispositions, "[witnessing] a heightened motivation to read, write, and draw in those children who struggled most with engaging literacy activities" (Eick, 2011, pp. 800-801). Susan was able to be an exemplar for how cross-curricular and interdisciplinary approaches in education are well supported in outdoor and environmental education. It required her to abandon what she had previously done as an educator, approach learning from a fresh new perspective, and persist in her belief that bringing learning outdoors would be beneficial to students, teachers, and the school.

In "Taking Inquiry Outdoors", by Bourne et al. (2000), Saul discusses the many ways that reading can connect us to nature and the world around us, by reading words on a page, that come to life through our senses. Reading does not have to be about the natural world or science to be experienced outside. She says, "in the act of reading and rereading such books, even individuals can recreate and revive memories of the world outside, even when they are not able to leave the confines of home or school" (p.105). Taking reading outside can help students focus more, and transport them to other places that they are not able to physically go. Saul explains how she traveled to the Everglades through the pages of a book before she ever went there in person, and that once she finally did go, her reading experience prepared her for what she would experience. In the same way, students can learn about other places when they cannot physically

go there, and just being outside can help them feel more connected to that experience, or associate what they read with the feelings and senses that they had outside (pp. 106-109).

As with reading, the same is true for writing. Writing activities outside could simply be the same writing activities within the classroom, but there is also a greater opportunity for students to connect to the world around them, and practice writing through journaling, according to Karen Pearce, another author of “Taking Inquiry Outdoors”. This combines scientific observation, art, and writing into a cross-curricular approach that combines objectives in a way “that the students do not differentiate between science and language arts.” Pearce shares that when deciding to take writing outside, she follows two guidelines, “plan ahead and simplify”. She incorporates writing and literature objectives by tying in the nature themes. Oftentimes, lessons tie into environmental issues. Pearce uses the example of the short story “Autumntime” where the students ponder a world without trees, and dive into inquiry centered around the environmental issues of the story. The students end up writing about their ideas, and producing beautiful pieces of poetry (Bourne et al., 2000, p. 127-133). By approaching reading and writing in this way, students gain a richer experience that extends their learning far beyond the pages of the book, connecting them to the world that surrounds them.

Mathematics

Mathematics is based on order and formulas. The design of the universe follows patterns and framework for how nature develops and functions. We often think of science when we consider all the natural elements and everything functions, but there is so much more for us to study, which we can do through mathematics. Adams (2003) writes about his book,

“From rainbows, river meanders, and shadows to spider webs, honeycombs, and the markings on animal coats, the visible world is full of patterns that can be described

mathematically. Examining such readily observable phenomena, [Mathematics in Nature] introduces readers to the beauty of nature as revealed by mathematics and the beauty of mathematics as revealed in nature.” (Para. 1)

Mathematics at an early age requires exploration of materials, tools, and manipulatives. Olson, Mazzocco, and Ridge (2021) suggest that “Early math is playful, in part because it involves creative problem solving that children naturally engage in during free play—especially if their environment is set up for it!”. Nature provides natural manipulatives and materials to explore in an authentic way. The authors continue by saying, “By using math to solve problems that arise through play, children begin to understand the importance of math in everyday life” (p. 2).

For older students, Watson (2022) details opportunities for students to study the geometry of nature in patterns, shapes, and angles of plants and other organisms. Fractals, “self-repeating patterns... made of smaller and smaller copies of themselves... explain how complexity is born out of simplicity” (pp. 5-6). Watson continues pointing out more patterns in nature, eventually coming to Fibonacci numbers, “where each number in the sequence is the sum of the previous two” (p. 9). She points out that the laws of nature are repeated infinitely as patterns in nature. For students in mathematics, there are limitless opportunities to study these patterns in nature and relate them to mathematical concepts—and to be mathematicians in nature, just as there are endless opportunities for them to be scientists in nature.

Expanding on the content areas mentioned above - science, social studies, English language arts, and mathematics, Table 1 below illustrates the vast opportunities there are for cross-curricular and targeted learning within each content area. It shows topics that can be taught in each content area, both with the use of nature as a tool for learning, but also just moving outside into a more natural environment such as an outdoor classroom.

Table 1. Opportunities for outdoor learning within academic content areas.

English Language Arts	writing, reading, poetry, creating letters/words from natural objects, nature journaling
Math	natural manipulatives, patterns in nature, word problems, data calculations, measurement
Science	field study, specimen and data collection, diagrams, life cycles, ecosystem, geology, dependency, food chains, adaptations, evolution, class, family, species, genus, fossils, artifacts, tree identification, maple tapping, biomes, climates, microscopic organisms, patterns in climate and weather, natural disasters, erosion, experiments, ecology
Social Studies	cartography, historical sites like battlefields, archeology, social justice, inequality, topography, native land and indigenous people, past and present, primitive tools, elevation, orienteering, geography, erosion, biomes, climates, citizenship, community action and involvement, anthropology, political science
Art	nature journaling, painting, drawing, diagrams, various mediums, using natural materials for brushes, pigment/paint, clay, printmaking, figure drawing, mandalas, weaving, photography
Music	making instruments using natural materials, sounds of nature, singing songs and fingerplays, creative writing, song writing
Physical Education	movement, hiking, bouldering, balance, risk assessment, moving across the midline, fine and gross motor skills
Health	local, seasonal ingredients for cooking, culinary skills, nutrition, balanced meals, food sources, how to grow and harvest food, medicinal herbs
Environmentalism & Sustainability	pollution, microplastics, water collection and sampling, climate change, food scarcity, insecurity, causes of global warming, habitat destruction and conservation
Self-Sufficiency & Life Skills	making tools, culinary, foraging, water collection and filtration, navigation and orienteering – map and compass skills, first aid

Using the cross-curricular approaches mentioned above, educators can offer students endless opportunities for exploration, while connecting those experiences to our core curriculum in reading, writing, and math. There are emergent curriculum programs that do this.

Primary and Secondary Curriculum

Curriculum in our education system and programs is the framework for all teaching and learning. Our curriculum must meet the needs of both the students and the standards by which the school system functions. Unfortunately, some current curricula do not include opportunities

for learning outside of the classroom. For this reason, it is important to consider well-rounded emergent curriculum programs that include outdoor or environmental education opportunities. The curriculum will vary based on the pedagogy of the program, such as Reggio Emilia, Montessori, and Waldorf to name a few. Regardless of pedagogy, the curriculum is intended to meet both the content area standards as well as incorporating the elements of the natural environment in which they are taught. Marchant et al. (2019) explains:

The school setting provides an opportunity to deliver a curriculum that engages children to reach their academic potential and define their future health outcomes and socio-economic pathway, reducing inequalities and health in education... there is a need for learning experiences that simultaneously improve health, wellbeing and school engagement whilst addressing curriculum needs. (p. 2)

While there are some wonderful emergent curriculum programs centered around outdoor and environmental education, many public schools do not currently use these programs. The following are developmentally appropriate curriculum programs that should be considered.

The most common curriculum program that is used both in public schools and private programs is Project Learning Tree, or PLT, which was founded in 1976. This curriculum also connects students to environmental education and K-12 standards. PLT provides materials, professional development, and is widely known across North America. PLT also has the GreenSchools program that provides equipment for schools where students can engage in an action project where they investigate “Energy, Water, Waste & Recycling, School Site, and Environmental Quality.” Project Learning Tree curriculum provides lessons in which the students can learn content standards in a hands-on way within their own school environment. In addition to the curriculum and GreenSchools program, they also offer a grant funding program.

According to the website, “PLT’s GreenWorks! program has provided thousands of dollars in grants for gardening projects over the years... [providing] hands-on opportunities to learn science, math, and other subjects, while also strengthening collaboration, leadership, and responsibility” (Sustainable Forestry Initiative, 2019).

Other curriculum programs that are lesser known are Project WILD and Project WET, which are according to the Wisconsin Department of Public Instruction website, “nationwide programs managed at the state level that assist PreK-12 educators in teaching about water stewardship and wildlife” (2017). Project WET, or Water Education Today, provides publications, training, projects, and networking for education regarding water issues (2020). Project WILD (2019), developed by the Association of Fish and Wildlife Agencies, and provides “wildlife-based conservation and environmental education that fosters responsible actions toward wildlife and related natural resources.” They provide workshops and educational materials that align with both Next Generation Science Standards, Common Core State Standards, and citizen science projects.

When considering curriculum for outdoor and environmental education, it is important to consider how well it fits both the standards of public education, as well as “the four components of EL: Knowledge, Affect, Cognitive Skills, and Behavior” (Stevenson et al., 2013, p. 1). David Sobel describes his own coined term, authentic curriculum, which “refers... to the process of movement from the inside out, taking curriculum impulses from the inside of the child and bringing them out into the light of day, in the classroom” (2008, pp. 78-79). From rainy day exploration, into discussion about dams and floodwaters, the students and Sobel jumped into an engaging, authentic learning experience, centered around the students’ interests. We can give our students these types of experiences by exposing them to opportunities that cause them to become

immersed, with awe and wonder, that leads to questioning and discovery. The good news is, there are already programs and pedagogy in which this type of learning is well supported.

Approaches to Outdoor Learning

There are many different approaches to outdoor and environmental education, some of which are utilized in public schools, others that are private. We can learn a great deal from the success of these programs and continue to expand those that are already a part of public education. Ardoin et al. (2018) looked at outcomes of EE, or environmental education programs and found “that many existing EE programs, which occur across a range of settings and in various configurations, have positive outcomes in terms of environmental knowledge, attitudes, dispositions, and skills” (p. 14). The highlighted pedagogy and programs below are: Early Childhood Environmental Education, or ECEE, nature-based schools, urban environmental education, public environmental education programs, environmental charter schools, place-based outdoor learning, or PBOL, citizen science programs, and forest schools. Figure 6 below illustrates the various approaches and highlights of each.

Figure 6. Approaches to outdoor learning and program types.

<p>Early Childhood Environmental Education (ECEE)</p> <ul style="list-style-type: none"> • Teaching environmental literacy in early childhood • Focus on whole child: cognitive, social emotional, language and literacy 	<p>Nature-based Schools</p> <ul style="list-style-type: none"> • Nature as a guiding principal in whole child development • Does not always take place outside, but included in daily routine 	<p>Urban Environmental Education</p> <ul style="list-style-type: none"> • Exposing students to natural spaces within urban spaces, such as New York City • Educating and connecting students to the environment in which they live 	<p>Public Environmental Education</p> <ul style="list-style-type: none"> • Efforts to connect content standards with place-based experiences in the community • Green School programs that give schools funding for green spaces
<p>Environmental Charter Schools</p> <ul style="list-style-type: none"> • Dedicated to providing students with environmental science and agriculture • Participate in citizen science 	<p>Place-based Outdoor Learning</p> <ul style="list-style-type: none"> • Common approach for public school programs • Connect students to the place they are learning in and about, helping students develop a relationship with the place 	<p>Forest Schools</p> <ul style="list-style-type: none"> • Fully immersive experience where students spend time in a forest setting • Open-ended supplemented by curriculum 	<p>Citizen Science</p> <ul style="list-style-type: none"> • Public participation in scientific research, data collection, and problem-solving • Authentic experiences that help students become scientists early on

The overarching pedagogy of environmental education, or EE, is “an approach, a philosophy, a tool, and a profession with the aim of creating an environmentally literate citizenry well-suited to address environment and resource sustainability issues” (Ardoin & Bowers, 2020, p. 2; Monroe, Andrews, & Biedenweg, 2006; UNESCO, 1978; Wheaton, Kannan, & Ardoin, 2018a). Typically, environmental education targets older students, “yet environmental education researchers and practitioners identify early childhood, defined as ages birth to eight, as a particularly crucial time for developing environmental literacy” (Ardoin & Bowers, 2020, p. 2). After reviewing a sample of studies and programs, Ardoin and Bowers identified important outcomes for ECEE programs, including “environmental literacy development, cognitive development, social and emotional development, physical development, and language and literacy development” (p. 9). They also identified nine practices: “time in nature, play and movement, knowledge and skill development, social interaction, creative arts, time to reflect, think, and observe, action taking, family connection, and personal connection” (p. 11). The authors found that there were positive implications of early childhood environmental education programs who focused on these areas, and that “the combination of early childhood education and environmental education is more powerful together than each by itself” (p. 13). These programs encompass other models that are to follow.

Nature-based schools are another program structure that umbrella a large range of program types. Nature-based schools often have a large emphasis on nature as a guiding principle, but not always being located solely outside. Nature-based programs recognize the importance of nature in the role of the development of children and make efforts to include time in nature in their daily routines. An example of such a school is Lucy School, a Green Ribbon School, located in Middletown, Maryland. The school is located “on a 17-acre farm setting that

integrates the elements and aesthetics of nature into the learning process” (Lucy School, 2021). The school’s curriculum is project-based, and arts-integrated, and takes place both in the classroom, as well as outside. Children are encouraged to be inspired by nature and environmental education, by participating in place-based education, tending to the nature around them, go on nature walks, explore, and practice an eco-friendly mindset. Another example of a nature-based program is The Waldorf School of Baltimore, a Certified Green School, also located in Maryland. The school follows one of the core principles of Waldorf education, “maintain[ing] a strong focus on immersing children in the outdoors to promote a love of nature”. Furthermore, their playground is “a certified Wildlife Habitat, with food, shelter, and water sources for indigenous species” (Waldorf School of Baltimore, 2018). Their curriculum is interdisciplinary and collaborative, focused on exploration and hands-on opportunities for learning both inside and outside of the classroom. Other nature-based programs include those who participate in environmental and place-based education, such as public environmental education programs, and environmental charter schools.

Despite the limitations that we often associate with urban environments, there has been an effort to educate students in urban areas for quite a while. For example, Kudryavtsev, Krasny, and Stedman (2012) describe the history of outdoor education in New York City:

Urban environmental education programs, in which inner-city students explore local natural phenomena or participate in stewardship, have existed in the Bronx for many years. In the early 1950s, students from kindergarten to the upper grades were using urban natural trails in the Bronx to learn about natural science, and over the last four decades school groups have taken part in environmental monitoring and wetlands restoration near the Bronx River. (p. 2)

More recently, Chris Carter, a New York City public school teacher, began by walking students to the Zucker Natural Exploration Area in Prospect Park, Brooklyn once a month as a field trip, eventually becoming a regular occurrence and extension of his own classroom. He worked to gain support of administration and parents, while also seeking out his own funding. He has been able to teach students about native land and participate in Trout in the Classroom through the NY Department of Environmental Protection. Furthermore, he has influenced other colleagues to step outside of the classroom and become more comfortable with exploration (C. Carter, forum panelist, June 22, 2021). When students in urban areas have opportunities within their communities to explore, they “see ecological aspects of the urban landscape as legitimate and worthwhile... as places to interact with nature, grow food, and engage in outdoor recreation and learning” (Kudryavtsev et al., 2012, p. 11). In other words, those in urban environments who are introduced to urban environmental education have the opportunity to find belonging and appreciation within the environment and community in which they live.

As for public school programs in existence, there are efforts to get students involved in environmental education by giving them opportunities for place-based education. In Frederick County Public Schools, located in Maryland, there is the FCPS Outdoor School, which “offers out-of-school field experiences for 5th and 6th grade students”. This program targets students in conjunction with the curriculum standards that have been assigned to these grades, which are earth systems and ecosystems. From the FCPS Outdoor School website, “students are exposed to environmental issues that encourage them to become environmental stewards for our local watersheds and the Chesapeake Bay. Throughout the outdoor experience students also meet Maryland requirements for Student Service Learning and Environmental Literacy” (FCPS, 2021). Students also typically experience a multi-day hiking trip to Catocin Mountain and

Catoctin Furnace. Another example out of Maryland, the Carroll County Outdoor School Program “see[s] students as emerging adults, preparing for the future. They are environmentally aware and value natural systems. They possess the knowledge, skills, and motivation to make responsible decisions and to take action.” These 6th grade students participate in Environmental Issue Investigation, or E.I.I., where the students, “[ask] a question, collect data, answer the question, and take action.” The week-long Outdoor School takes place at Hashawha Environmental Center, where the students and staff live in cabins for the program, and participate in learning experiences (CCPS, 2022). A new public charter school in Maryland that is opening in Fall 2022, Sabillasville Environmental School, plans to “use a classical curriculum with a focus on environmental science and agriculture.” According to their website, they will be using Project Learning Tree curriculum to guide their environmental learning goal, and the campus will include a greenhouse and garden space (SES, 2022). Many of these learning models and programs mentioned above approach environmental learning from the perspective of place, or where they learn, impacting their education and outlook moving forward.

Research has shown that students who find meaning with and identify with the place in which they are learning, have more positive views toward the environment of a specific place, and proactive attitudes toward protecting those environments. “Factors influencing sense of place have been reasonably well explored and can be organized in two groups: direct experience of settings and learning about places from other people or interpretive materials” (Kudryavtsev et al., 2012, p. 3). Reasonably, students are going to have a stronger association with places and environments in which they interact physically, over those experiences they are simply taught through presentations or textbooks. This idea of place meaning is supported by the findings from the Bronx study completed by Kudryavtsev, Krasny, and Stedman. On the other hand, place

attachment is something that may develop after an extended period in an environment (2012, p. 10). When we apply this to our classroom structure, it would be recommended to try to teach about the places and topics we are learning about firsthand as often as possible. These experiences can come in the form of place-based experiences and partnerships with local organizations. A sense of place “represents ties between people and places, and place meaning is the essence of places or symbolic associations of places that define people’s individual and cultural identity” (Kudryavtsev et al., 2012, p. 2). Some experiences will develop place meaning, or the association with an environment based on experiences within that environment, while other experiences in more consistent long-term natural environments, will develop place attachment, or the bond with an environment based on the emotional connection and experiences within that environment.

One approach to developing this place meaning or place attachment, in an array of environments, is through place-based learning. Place-based learning is not an approach in which students go to a place one time, such as a field trip, these are places where the students can develop a relationship with the place on multiple occasions.

Place-based learning occurs in local environments and focuses on the social, cultural, economic, political, and natural contexts in which it takes place. Delivery, content and focus depend on where the learning program is situated... Place-based education does not come pre-packaged. Its curriculum and activities rise from the individual qualities of specific communities and the creative impulses of particular teachers and students. (Gray and Birrell, 2015; Gray, Lloyd, and Truong, 2018, p. 47; Gray and Thomson, 2016; Smith, 2002)

In “Place-based outdoor learning: More than a drag and drop approach”, the authors argue that place-based learning is not simply finding a space to learn outside and never connecting to the “local place, environment, or culture” Place-based learning focuses on the meaning of the place in which the learning happens, along with the purpose for which the learning is taking place. Of the theories that drive place-based learning, Vygotsky’s social constructivist theory is at the forefront, with the teacher being the “guide, facilitator, and co-explorer”, and the students developing their own observations, inquiries, and ideas about the way our world works.

Additionally, “authentic learning is a constructivist learning theory with an emphasis on real life experiences... and Dewey’s modern experiential learning [in which] students are engaged as active learners”. According to these theories and the authors, learning should be based on exploration within the environment, that is student-led, and representative of diverse experiences among learners and learning environments. “[Place-based outdoor learning] follows the guiding principle that if we want people to live well in this world, they need to be educated in this world”. Within place-based learning, “Beames et al. (2012) propose[d] the four ‘zones’ of outdoor learning... zone one: school grounds; zone two: local neighborhoods; zone three: day trips; zone four: overnight experiences”. Place-based learning can occur in any of these zones, making it accessible to all students and schools (Gray, Lloyd, and Truong, 2018, pp. 46-49; Orr, 2004). Place-based education is the most common approach that schools take to environmental learning because they can both learn in the classroom and go into the field to learn.

Gray et al. (2018) compared the similarities between place-based outdoor learning and forest schools, finding that both promote motivation, independence, self-confidence, communication, leadership skills, written and oral language (p. 52). Forest schools are a fully

immersive learning experience where the students are in an outdoor setting for the entire length of their learning period, despite the weather or other obstacles. According to Robbins (2020):

The number of “forest schools” – which have long been a tradition in Scandinavia and where much of the learning takes place in natural settings in the outdoors – has mushroomed in the United States, up by 500 percent since 2012, according to Louv.

Oregon recently passed a ballot measure to raise money for outdoor schools, and the state of Washington just became the first state to license outdoor preschools, where much of the play and learning occurs outside. (Para. 9)

Forest schools are more open-ended in nature, encouraging play, exploration, and risk-taking, however many programs do utilize a curriculum to guide their academic experiences.

One program out of Boise, Idaho, EverWild Forest School, has seen a huge amount of growth in the last two years. Erica Hermsen, the founder and director, has been able to open campuses all over the valley with programs ranging from Pre-K-12 years old. EverWild, also incorporates place-based education in the development of the curriculum, which “certified teachers and experienced educators have carefully developed targeted lesson plans that utilize the local community and environment to teach concepts in language arts, mathematics, social studies, science, and other subjects across the curriculum”. EverWild is hosted in local environments around the Boise area that allow students to explore freely in diverse environments with nature surrounding them (EverWild Forest School, 2022).

A third-grade teacher at Dothan Brook Elementary in Vermont was able to apply the forest school model to her own classroom, beginning with a “PBIS (Positive Behavioral Interventions and Supports) reward, [implementing] weekly visits, [such as] Wednesdays in the Woods, and Forest Fridays”. What began as an outdoor classroom during COVID soon became a

full-time forest school classroom. Nicolette Raney says she was able to “influence colleagues to show it’s possible and ok – the community accepts it. It’s ok to learn inside or outside the walls, [and] let go of pressure.” She also says that this experience “absolutely impacted behavior in a positive way... [the students became] caring, safe, [and] responsible” (N. Raney, forum panelist, June 22, 2021). One of the most important notes taken from this was that it does not have to be the entire school participating, or an entire grade to get started. Moving forward with implementing outdoor and environmental programs into schools, educators and administrators need to consider the best route for introducing these experiences. Like Raney, one teacher can test out the waters, collect data, problem-solve, and become experienced before everyone jumps in. Other teachers may not be on board at first, but as the effectiveness is proven, others might become more comfortable with the idea. One of the ways that teachers can become comfortable with getting outside is through citizen science, where students can be scientists.

Citizen science gives students and other members of the public opportunities to participate in projects where they help scientists conduct research, collect data, and come up with solutions to issues in our environments. An emerging program for citizen science is Mountain to Sea Education, or M2S, which “works with schools and organizations eager to connect students creatively to real world phenomena, to better understand how we can all work together to sustain healthy land, air, water, and life on Earth”, through projects that give students authentic experiences that connect them to the world around them, as well as to the K-12 standards. Founded in 2014 by Anne Haywood, M2S gives students opportunities “to participate in citizen science projects where students can [collect] and [analyze] scientific data in order to help tackle challenges at local and global scales.” Some of these projects are BioBlitz Education, Crowd the Tap, and Debris Tracker. M2S also provides teacher training and professional development

through The Citizen Science Project in conjunction with California State University Bakersfield and National Geographic. Haywood says on her website, Mountain to Sea Education comes from the idea that, “Mountain summits and ocean depths inspire endless curiosity. The land, water, air, and people at altitudes between the summits and depths can too.” M2S Education reflects this idea that students should be learning in and from nature, for the best chance possible at promoting environmental literacy and citizens of the world who have the desire to make a difference (Haywood, 2021). Taking the citizen science approach, which many participating schools do, puts students into the field at a young age and helps them engage in meaningful learning experiences that contribute to the impacts of many on environmental conservation and research. This is one of the most authentic experiences students can be given related to outdoor and environmental education.

Increasing Implementation in Public Schools

When considering how to take this information and implement it into public schools, there are many important aspects to consider, such as training, community involvement, funding, educational settings, space, curriculum, and materials. We also need to consider how to get started. It is ok to take small steps toward the goal we want to accomplish, otherwise it can become too overwhelming and unattainable. David Sobel, author of “Childhood and Nature: Design Principles for Educators” uses a metaphor inspired by Richard Louv:

What’s the relationship between School and Mother Nature? Are they getting divorced or are they committed to working on a long-term relationship? There have been many times in the past... when School and Mother Nature were at least friends. But nowadays in this No Child Left Behind era, they’re quite alienated from each other. To get them back together, School and Mother Nature first need to get to know each other again, then

maybe start dating. Eventually they might want to go steady, even consider tying the knot. (2008, p. 1)

It does not need to be a grand event that will soon become unsustainable or forgotten. We can simply start by taking our students outside for one subject or incorporating a nature component into a lesson plan. We can start a community garden and practice falling in love with nature. In taking these small steps, the community can get involved with donating time, materials, or seeds. Eventually funding can be provided through grants or fundraisers, while maintenance can be volunteer based, by the students, staff, parents, guardians, and surrounding community.

Being able to start taking steps toward this will also require teachers to be both interested and have the training they need to participate. This may also mean shifting some of the professional development toward this goal. It could mean having interested teachers complete training and taking on the role as environmental educators, within the school, and opportunities for those teachers to work with students throughout the school, rather than expecting all teachers to fulfill these requirements; like how the math or reading specialists support teachers and supplement instruction. For these roles to be sustainable, “[school-wide EE] programs [will need to] include tangible changes to curricula in classrooms... [There will be a] need for training, administrative, and structural support for teachers that maintains their enthusiasm and commitment to EE” (Stevenson et al., 2013, pp. 9-10). There are many opportunities for teachers to receive training, and scholarships for them to do so. In Maryland, the Maryland Association for Environmental and Outdoor Education (n.d) hosts an annual conference for educators, professional development opportunities, certification, and the Maryland Green School Program, established in 1999 (n.d). There are programs such as this in every state, as well as alternative training programs such as the Eastern Region Association of Forest and Nature Schools (n.d).

Depending on the goals of the school, programs like this will meet the professional development needs of their teachers.

As mentioned before, there are many approaches to outdoor and environmental education. These approaches are often characterized by the space in which the learning takes place. But the number one place that schools have right outside is hardly utilized for environmental education experiences:

Some school districts insist they don't have room on their campuses. But public schools are among the top three land holders in most communities, a resource largely underutilized. Then there's the rest of the community. As I reported in "Vitamin N," nearby nature can become the school of [a] million acres. (Louv, 2021, para. 16)

Often, schools have green spaces or urban spaces that can be made green right outside their doors. But if not, taking Louv's words into consideration, there are endless opportunities beyond the schoolyard for students. Some programs have utilized place-based education in local areas around their school or community where students can go to learn on multiple occasions. There are also opportunities with organizations such as National Geographic's BioBlitz (2022), "an event that focuses on finding and identifying as many species as possible in a specific area over a short period of time", and the Chesapeake Bay Program (2022), which "Enable[s] students in the region to graduate with the knowledge and skills to act responsibly to protect and restore their local watershed". Both experiences allow students to participate in place-based experiences and/or citizen science. "Since the ecosystems surrounding schools and their communities vary as dramatically as the nation's landscape, the term 'environment' may mean different things at every school; it may be a river, a city park, or a garden carved out of an asphalt playground"

(Lieberman & Hoody, 1998; Louv 2008, p. 206). Whatever the chosen outdoor environment may be, the materials needed will vary slightly from materials needed indoors:

Some familiar indoor materials serve equally well in the outdoor classroom. Others must be exchanged for items that are more portable and weather-proof. For example, whiteboards and dry erase markers don't function once the temperature drops. Chalkboards, individual writing slates and chalk work perfectly well. Plastic buckets with lids serve a dual purpose: they can haul and store supplies and serve as portable seating. Padded lids provide some outdoor luxury. A heavy-duty sled, able to glide along a gravel path or weedy trail as well as over snow, is a versatile means of transporting large or heavy items... Zip-lock bags protect field guides and other books when not in use. Pencils won't smudge or run in damp weather, as many pens and markers do, and waterproof paper makes it possible to record data or write poetry even when it's snowing or raining. (Bailie et al., 2020, p. 2)

Below, in table 2, is a list of materials that could be used in an outdoor environment, that are both versatile and simplistic for getting students outside when there is not a dedicated outdoor classroom or expansive budget for outdoor learning. Some of these materials are mentioned above in the excerpt from "Outdoor Learning in Cold Weather".

Table 2. Materials necessary for successful out door learning experiences.

Item	Purpose
wagon	transporting classroom materials outside
buckets	these can be stacked, materials stored out of the weather, seating
clipboards	writing surface
waterproof bags	storage for books and paper materials
cameras	taking photos of plants, animals, or other discoveries

journals	recording observations or data
art supplies	illustrations and recording observations
tools	gardening, exploration, or collecting specimens for observation
shelter	for coverage in precipitation or high temperatures

By beginning with this simple framework of materials, teachers can begin getting comfortable with getting students outside. A few of these materials may require funding, while others are already available or can be donated. Other issues with trying to get students outside may arise, however there are solutions to many of these as mentioned in the following section.

Obstacles and Limitations

One of the most common reasons for not getting students outside, especially during recess is the weather. When temperatures fall below freezing or precipitation falls from the sky, everyone is keen on staying inside. But this can be problematic for parts of the United States that experience harsh winters, rainy seasons, or both. It negatively affects our health, making us more sedentary, and this further impacts the attention of our students when they cannot go outside to take a break and get fresh air. There are places both in the US and around the world that are so acclimated to the weather that it does not prevent them from going outside. In fact, “Cold weather hasn’t prevented outdoor learning in Finland, which ranks near or at the top of all nations in math and science scores” (Louv, 2021, para. 16). These places, like Finland, have demonstrated their success at achieving quality outdoor time despite the weather. One of the ways to address this is to get everyone more comfortable with the idea of experiencing all types of weather, beginning with the clothes they are wearing. A base layer, rain gear, or rain boots can make such a drastic difference in how comfortable someone is outside. Yet, there are many students who do not have the means to acquire them. Bailie et al. (2020) argue:

All children and teachers deserve access to the high quality clothing that makes outdoor learning possible. Equitable access must become a regional priority, supported by education policy and funding. As we work to achieve this, we recognize the many ways that individual schools and communities are providing for their children. These include organizing gear swaps, developing gear libraries at schools, purchasing clothing with parent-teacher organization support or grant funds, and fundraising for particular items such as outerwear. (p. 1)

While opportunities for learning during the winter months may seem more limited due to bare trees and foliage, or the movement of animals around us decreasing, there is still much to explore. Some recommendations from Bailie et al. (2020) include:

Set up a bird feeding station. What can we learn from watching bird behavior? Find, follow, and map animal tracks and evidence to see who uses the school grounds besides the children. Figure out how squirrels communicate or create ephemeral art with ice and snow. Where is the deepest snow near our school? Where does ice form at the school? Where are the warmest places outside? The coldest? Investigate seed dispersal, shadows, microclimates and more. Observe twigs, explore friction, force and motion on the sledding hill, and write stories inspired by outdoor adventures. (p. 2)

In some places around the world, whether because of the temperature, air quality, or physical safety, there are environmental restrictions on how much time can be spent outside. In these cases, it is important to consider bringing the outdoors in. In an example from Australia, Ardoin and Bowers (2020) pointed out:

In certain places, simply ‘going outside’ or finding a proximal nature-rich context may be difficult or may not create a platform for universally positive experiences. [By exposing

children to natural materials and nature-inspired themes], the role played by nature and nature-rich experiences can be enhanced even when teaching and learning indoors, or with limited access to nature. (p. 11)

In these situations, and beyond, it would be beneficial to have a nature collection with specimens that students can study within the classroom to bring them closer to nature, and experience first-hand the amazing opportunity to hold those pieces of our world in the palm of their hands, and look deeper through the lens of a microscope or magnifying glass. Even in our classrooms where we can go outside, bringing nature in can be beneficial, with respect to protected areas and Leave No Trace Principle 4, “leave what you find”. These natural tools and materials enrich the learning experience, while others can take away from it, or limit it.

A challenge that many teachers face today is the shift in the use of digital technology within the classroom. Since the 1990’s digital technology in the classroom has evolved from computer labs to overhead projectors, to Promethean boards, individual student computers, and classroom management sites. Add in the rapid shift into virtual learning during COVID, and adjustments with how materials are presented virtually, teachers have had to become comfortable with these tools in a short amount of time. Digital literacy is most certainly important, considering the many jobs that rely on it and the advancements that we will continue to have as a society. However, as Louv (2008) explains:

The problem with computers isn’t computers—they’re just tools; the problem is that overdependence on them displaces other sources of education, from the arts to nature... Here’s one example: We know for a fact that the arts stimulate learning... Nonetheless, over the past decade, one-third of the nation’s public school music programs were dropped. During the same period, annual spending on school technology tripled, to \$6.2

billion... Meanwhile, many public-school districts continue to shortchange the arts. Even more districts fail to offer anything approaching experiential, environment-based, or place-based education (Louv, 2008, pp. 137-138)

This push for digital literacy presents the challenge of how it will be incorporated with outdoor or environmental learning, especially in outdoor environments, and how much of it is really considered a priority. We certainly cannot supplement authentic experiences in nature with virtual experiences. This creates a disconnect from nature that results in students being environmentally illiterate—the opposite of what we are trying to accomplish. In Sobel’s book, “Childhood and Nature”, he quotes Levi and Kocher who suggest that “by using virtual nature to satisfy our psychological desires we become less aware of what we as humans are doing to our environment” (2008, p. 112). With this in mind, we can consider that finding a balance between the use of digital technology and the natural world is our solution. Siskind et al. argue that “technology and outdoor learning have the potential to foster positive developmental outcomes and learning in young children and teachers should work to integrate both into teaching practices” (2020, p. 8). We need to consider the purpose and application of technology when considering how to incorporate it into our teaching.

Levi and Kocher (2020) suggested three practices: “integration of media devices while outdoors; use of devices to engage children in physical activity; and monitoring and supporting the balance of daily technology and outdoor time”. While some digital technology requires an internet connection, there are many opportunities to use technology without needing to be connected. Intentional use of devices can support learning, such as cameras and iPads to create projects, record their own progress for physical goals, or share experiences with their families (pp. 11-12). One example of a safe and purposeful application that students can use is Seek,

which is connected to National Geographic's BioBlitz program. This program allows students to participate in collecting data on a variety of organisms. Technology can also be used in supporting students with diverse needs in outdoor learning experiences. Supporting these students can seem like yet another challenge, but they deserve to be given the same effort as other students in promoting outdoor and environmental education.

When considering obstacles and limitations to getting outside, we also want to consider the alternative reasons that outweigh the challenges. There are a number of health concerns that are faced among students that can be addressed or mitigated by moving learning outside.

Mitigating Health Concerns

Some of the concerns that will be addressed below are COVID and other highly transmissible viruses, attention deficit hyperactivity disorder (ADHD), obesity and related diseases, mental health, health related quality of life (HRQoL), and myopia. The first issue addressed is the most current and prevalent that has challenged our education system in the past 2 years.

With the wave of COVID-19 coming out of seemingly nowhere, we witnessed panic regarding public education more than any of us have experienced in our lifetimes. We were not prepared for schools to shut down or to be taken away in an instant. When the pandemic hit, we focused our attention on how to limit the spread of the virus indoors, but very few recognized the opportunity to move learning outdoors. Louv wrote a powerful article during the pandemic that communicates just what our education system has been adjusting to. He said,

In 2020, against the odds, teachers, parents, and students rose to the challenge. They adapted to distance learning and the paradox of Zoom – a gift of connection in a time of isolation, but one that also divides attention and drains warmth and touch. They struggled

with shifting public health recommendations. They improvised complex schedules to reduce the number of students present in a classroom at any one time. Some schools staggered the positions of desks, a few created outdoor classrooms. Most of all, they grappled with ever changing rules in an absence of a workable plan for responding to a pandemic. (Louv, 2021, para. 8)

While going virtual was a temporary solution, and some students may in fact learn better virtually, we cannot expect that most students will be successful long term. Additionally, as we have continued to try to socially distance ourselves and wear masks, and the virus has become more contagious, we have recognized that there are but a few solutions to limit the spread of the virus. If we have learned anything from this pandemic, it is that we do not know how long a global health threat may last. What came to our attention in January 2020 as a 6 month to 1 year pandemic, turned 2 years old in January 2022.

In the past, there was a solution for controlling and limiting infectious diseases, such as tuberculosis, that we can turn to again today. “Open air schools, built on philosophical orientations of health and wellness, gained popularity as a way to escape illness in the 20th century” (Bryder, 1992; Ardoin & Bowers, 2020, p. 10). Bringing students outside where there is a much lower risk of transmission, opportunities to go maskless and social distance, take advantage of airflow, and boost their immune system, is an excellent way to reduce exposure to COVID-19. Baile et al. (2021) writes, “Participating in outdoor learning is not a one-size fits all process. There is no one right way. We do know, however, that more time outdoors reduces health-risks and enhances overall learning, with a host of related benefits”. The authors share experiences from Inside-Outside, a network of nature-based educators and institutions in the U.S., in which participants who began outdoor learning during the pandemic have proved

successful. They have also shown how communities can come together to support educators in developing outdoor environments.

Workdays brought dozens of masked and physically-distanced volunteers to school campuses, resulting not only in safer spaces for learning, but also in a deeper connection between community and school... People were grateful to help contribute to protecting and enhancing the important role of our schools not just in the lives of our children, but for the well-being of entire communities. (p. 1)

Those in education who had never considered outdoor learning before soon began to realize how meaningful the outdoor learning experience could be. A principal from Vermont who rose to the challenge shared,

As I sat in multiple meetings about bringing students back to school, I knew we were so fortunate. We had options. The guidance said learning outdoors was encouraged, and I knew we were more prepared than most. And so, the students and staff embarked on a school year life no other ...and headed for the forest... In a year where everything got turned on its head, we went outside to find the balance. (Mandy Couturier, Principal; Bailie et al., 2021, p. 2)

As we consider alternatives to learning in the classroom, we should consider that inside is not always the safest and healthiest option for numerous reasons. Students' physical, mental, and socio-emotional needs must be considered just as much, and in addition to their academic needs.

One of the next health challenges is ADHD, a condition that is becoming more prevalent and is one of the most common diagnoses during childhood. "Nearly 8 million children in the U.S. suffer from mental disorders, and ADHD is one of the more prevalent ones. The disorder often develops before age seven and is usually diagnosed between the ages of eight and ten"

(Louv, 2008, p. 100). It is afflicting our children, not because those who are diagnosed have something wrong with them, but because something is wrong with the system in which we expect neurodiverse children to function “normally”. We must change our ideas and expectations of behaviors, while offering alternative environments that work well with the learning differences and attention-spans of our students. Gray, author of “Free to Learn” (2013) addresses the importance of finding alternatives beyond medication to help students thrive in the academic setting, whether inside or outside, since there are potential health effects of medication on some. It is certainly curious that many students who are diagnosed with ADHD are pegged as kids who cannot control themselves, when oftentimes they simply do not fit the environment that they are in. If we took a step back and met the needs of the child first, whether it be through movement, exploration, or other instructional approaches, we may find that each student can be successful. It requires us to shift our perspective, rather than trying to change the child who is not broken to begin with. Louv writes in his book “Last Child in the Woods”:

Studies suggest that nature may be useful as therapy for Attention Deficit Hyperactivity Disorder (ADHD), used with or, when appropriate, even replacing medications or behavioral therapies. Some researchers now recommend that parents and educators make available more nature experiences – especially green places – to children with ADHD, and thereby support their attentional functioning and minimize their symptoms. Indeed, this research inspires use of the broader term “nature deficit disorder”, as a way to help us better understand what many children experience, whether or not they have been diagnosed with ADHD. (2008, p.100)

Unlike Gray, Louv (2008) acknowledges that medication is helpful and necessary to many. As families, and psychiatrists work together to find the right combination of medication, it is

powerful to think that as educators, changing our learning environment and expectations could dramatically change the way we approach and supplement ADHD treatment within schools.

There is the potential to positively impact millions of children and give them the space to learn in their own unique way, while also improving academic outcomes. Not only to increase opportunities for movement, but to introduce what is called the “restorative environment” that is found in nature and beneficial to overall health (pp. 101-103).

In a national study of natural treatment for ADHD by Kuo and Taylor (2004), a sample of 452 parents of children ages 5-18 who were diagnosed with ADHD were surveyed rating effects of afterschool and weekend activities on ADHD symptoms. They compared both indoor and outdoor activities “for the sample as a whole and for each of 28 subsamples” (p. 1582). Kuo and Taylor “found the children who participated in outdoor activities, who spent structured and unstructured time in nature, appeared to have a reduction in their ADHD symptoms” and furthermore, found that “green outdoor activities significantly reduce symptoms” (p. 1583). This evidence supports Louv’s idea that the restorative environment can help students’ overall health.

Another issue that affects students’ ability to learn, but that can be positively influenced by outdoor and environmental education is the lack of physical activity and an increase in processed foods which directly relates to the rise in obesity rates and related diseases. Our society has increasingly placed focus on easier, more convenient ways of living, and reduced the healthier, more simple options that we once relied on. This transition over time has had potential effects on student focus and achievement. Louv (2008) writes:

While children in many parts of the world endure hunger and famine, the World Health Organization warns that the sedentary lifestyle is also a global public health problem;

inactivity is seen as a major factor in noncommunicable diseases, which cause 60 percent of global deaths and 47 percent of the burden of disease. (2008, p. 47)

The decrease in time spent outside and increase in screen time also contributes to sedentary lifestyles, thus contributing to obesity and related diseases. Increased time spent on social media or watching television also contributes to unhealthy body image issues in pre-teens to young adults. Louv (2008) also argues that the increase in organized sports, rather than unstructured playtime also contributes to this epidemic, especially when you consider the controlled environment in which sports take place, hindering children's ability to be creative, imaginative, and use their bodies in a variety of ways rather than the same perpetual motion (p. 48). These organized sports are not bad, however at times they may take over our schedules, limiting the amount of open-ended and unstructured play that children should partake in. In addition, introducing the outdoor environment to students, and giving them opportunities to grow their own food can also have a significant impact on nutritional health and food security.

Relative to sedentary lifestyles, and just as ADHD has been on the rise, is the increase in mental health issues that many, especially young children, face today. "In addition to the potential beneficial effects of physical activity, a growing body of literature also suggests that the natural environment has profound effects on well-being, particularly in children as a result of their greater plasticity" (Wells & Evans, 2003; Gustafsson et al., 2012, p. 65). With this continual increase, we need to consider what else can be done beyond medication. Louv (2008) continues in his book, "Last Child in the Woods" by stating:

Although countless children who suffer from mental illness and attention disorders do benefit from medication, the use of nature as an alternative, additional, or preventative therapy is being overlooked. In fact, new evidence suggests that the need for such

medications is intensified by children's disconnection from nature. Although exposure to nature may have no impact on the most severe depressions, we do know that nature experiences can relieve some of the everyday pressures that may lead to childhood depression. (p. 50)

The restorative environment, as used by Louv, has the potential to increase positive mental health outcomes and decrease negative mental health outcomes. This restorative environment, or nature, tends to bring people back to a more peaceful and neutral state. Ultimately, nature therapy can be a beneficial supplement to medication and other forms of therapy. Gustafsson et al. (2012) point out that there are efforts to come up with programs that address the mental health of individual students, however,

Less common are interventions aimed at changing the environment, even though there are strong theoretical grounds that environment-centered interventions may produce broader psychosocial benefits for children... Instead, when new programmes... are implemented, focus is more often placed on the impact of achievement. (pp. 64-66; Brondenbrenner, 1979; Berryhill & Prinz, 2003)

With increase in physical activity, and a change in the environment, students are more likely to experience the positive effects of "stress buffering", which helps to regulate the stress tolerance of individuals. Gustafsson et al. (2012) researched the effects of outdoor education on mental health. In the study they focused on two elementary schools in Sweden over 12 months, one as the control group, and the other as the intervention group. Outdoor education pedagogy was introduced to the intervention group, while the control group remained the same. After completing a strengths and difficulties questionnaire, focusing on different aspects of mental health, and collecting data over 12 months, the authors "found a significant differential effect on

boys and girls; while boys... generally displayed a decrease in mental health problems... the girls... rather showed a non-change in mental health problems” (pp. 67-69, 72).

The authors point out that gender can play a role in mental health, as well as where schools are located, whether urban, suburban, or rural. This, unfortunately, is also influenced by social-economic status and race, due to historical segregation that continues to impact where people live today, what jobs are available, and how much money they make. All of these aspects contribute to overall mental health, as well as the health-related quality of life.

Additionally, Sprague and Ekenga (2021) researched how the health-related quality of life, or HRQoL, affects youth disproportionately in the United States. “Prior studies have found that high-income youth have higher levels of HRQoL than their low-income counterparts and that non-Hispanic White youth have higher levels than their Black and Hispanic counterparts.” These levels have future health impacts, which will continue to widen the disparity. Sprague and Ekenga argue that “Nature experiences have been recognized as potential health promotion interventions” (2021, p. 1). There is often also a disparity in the access to nature that low-income and Black and Hispanic children can benefit from. Because of this, we have a responsibility as educators to facilitate these experiences within our school environment, where they may have more opportunities to interact with nature daily. Even within urban areas, it is possible to create spaces for outdoor learning to exist.

Hartman, of Baltimore City schools, has been successful at creating a green space for his students, where he turned an underused section of the schoolyard into a nature-based space with wildflowers, steppingstones, picnic tables, chalkboards, and raised beds. It is sized for kids pre-k to 2nd grade, to help them be active participants in caring for and engaging with the environment. It is used for everyday class; some others use it for their classes. It leads to

authentic learning, such as when learning about Monarch butterflies firsthand. There is also a nature path that the students designed, laid it out, and planted a garden with native plants. The older kids, grades 3rd-8th, use space for cooking class using the garden and store-bought produce, connecting their cooking to a source and nutrition. Hartman says, “Kids will eat almost anything that they grow” (S. Hartman, panel interview, July 1, 2021). Following Hartman’s example, we can transform even the most concrete, urban spaces into natural learning environments that foster independence, curiosity, and engagement in academic content.

To reach students who may not have access to the opportunities that those in more suburban or rural areas do, Sprague and Ekenga suggest a nature-based education, or NBE intervention to:

increase access to nature and provide mentorship and tutoring to low-income youth... also [to] promote HRQoL [health-related quality of life] in youth as it combines classroom instruction with nature experiences... The hypothesized pathways through which NBE could promote HRQoL may include increased exposure to the natural environment, the development of valuable life skills such as networking and self-advocating, and the learning of positive health behaviors. (2021, p. 2)

Upon completion of their study and 15-week intervention of low-income youth in St. Louis, Missouri, Sprague and Ekenga (2021) found a positive correlation between NBE intervention and the health-related quality of life (HRQoL) results. The most interesting part of these results is the overall increase in emotional, school, social, and family skills rather than the physical health that is an expected outcome. This shows significant promise for supporting student needs in interpersonal relationships that are foundational for life.

An additional rising health concern that many are unaware of is myopia, or nearsightedness. It has been proven to be affected by time spent outdoors, especially with exposure to sunlight, in childhood. “We know from a 2018 study that school-based promotion of outdoor activity can decrease myopia progression, which has been on the rise at an alarming rate... Vitamin D levels are supported with more time outdoors” (Williams et al., 2020, para. 8). Researchers Lingham et al. completed a study (2021) where they:

investigated the relationship between time spent outdoors in childhood, adolescence and young adulthood and risk of myopia in young adulthood... and spending more time outdoors in later adolescence and young adulthood was associated with reduced risk of late-onset myopia. (p.1)

According to Lingham et al. (2021), it is recommended to spend more time outside to reduce the risk of future visual impairment related to myopia. If we consider the benefit of being outside, and looking further into nature, past a limited distance, while also having objects within closer view, it makes sense that being outside and having the added dose of Vitamin D, would have a positive effect on eyesight.

In addition to health concerns, there are many students who experience other disorders and disabilities, like ADHD, that may benefit from time outside. However, there are also students who have, in the past, been limited in their use of outdoor spaces. The following paragraphs highlight the importance of making outdoor spaces accessible and equitable to all.

Supporting Students with Diverse Needs

For some students with diverse needs, bringing instruction outside can support the students in being successful by giving them more opportunities for movement, exploration, and hands-on learning experiences that they may not have within the classroom. Such students are

those who may struggle to focus and sit still for long periods inside of the classroom. Others may need further tactile experiences to enrich their learning. One group that has been shown to benefit is those that are categorized as having emotional, cognitive, and behavioral disabilities (ECBD).

There are over 4 million students with reported emotional, cognitive, and behavioral disabilities (ECBD) in the United States... The phrasing ‘emotional/behavioral/learning disability’ under the Individuals with Disabilities Education Act (IDEA) includes students with... impairments-such as Attention Deficit Hyperactivity Disorder (ADHD), autism, and dyslexia. (National Center for Education Statistics, 2017; 108th Congress, 2004; Szczytko, Carrier, & Stevenson, 2018, p. 1)

Results from the study conducted by Szczytko et al. (2018) sampling 161 fifth-grade students with ECBD in North Carolina, indicated that the EE programs in which the students were participating helped to “increase attention and diminish disruptive behaviors”. The treatment group sampled featured 28 teachers and 99 students from an environmental education program in southeastern U.S. This sampling also doubled as an evaluation of that program. The study required schools to “participate in the program 4 to 10 full school days throughout the school year with an average of six lessons spread across the school year” (p. 3). The results indicated “that teachers of ECBD students should consider the outdoors as a useful setting to increase attention and diminish disruptive behaviors.” The authors came up with three explanations for the results; first, that although teachers went in expecting the students to be disruptive outside, the opposite was true; second, teachers’ perceptions of disruptive behavior may have changed; and third, outdoor instruction helps improve these behaviors (p. 7).

Similarly, students with social, emotional, and behavioral difficulties, or SEBD, “defined as, ‘a child who is in receipt of an individual plan, that contains a specific target to enhance SEL (social and emotional learning) skills’, may also benefit from outdoor learning. Alan Price (2018) found evidence to support that:

participants in the year-long SEL intervention were found to have developed the social-emotional skills of; agreement, contributing, responsibility, planning, problem-solving, coping with difficult situations outside individual control and alternative perspectives... [and that] outdoor learning has the potential to be an effective medium for SEL intervention. (2018, pp. 326-327)

Taking both groups mentioned above into consideration, it is important to consider that outdoor learning may not only improve academic outcomes for all students but improve outcomes for students who need targeted intervention and that have the potential to function more successfully.

Another group of students who may be impacted by outdoor instruction, and whose needs should be carefully considered are those students with physical disabilities or impairments. Woolley (2013) addresses barriers that students with disabilities face when utilizing outdoor play spaces, such as getting on to play equipment and navigating the space. Since this article was published in 2013, many efforts have been made to protect the rights and dignity of people with disabilities, including increased awareness of the need for inclusive and accessible outdoor spaces, but there is still more needed. Woolley states:

The right to access the physical environment for all people is expressed at an international level in the United Nations Standard Rules on the Equalization of Opportunities for Persons with Disabilities. This states that ‘for persons with disabilities

of any kind, States should introduce programmes of actions to make the physical environment accessible... accessibility requirements should be included in the design and construction of the physical environment from the beginning of the design process. (p. 450)

This right is sometimes considered when designing new spaces, however when considering going into older or more natural spaces, students need assistive or adaptable technology to be able to participate and access these areas, such as wheelchairs with large wheels, pathways, or accessible features.

Other barriers include “lack of specific knowledge and understanding of the needs of [children with disabilities] by planners and designers of outdoor spaces” (Woolley, 2013, p. 451). Woolley explains how the terms ‘accessible’ and ‘inclusive’ have not always been clearly defined, resulting in some confusion about what these terms mean and how they should be used. Inclusive play spaces encourage and allow all children to play together, and for their families, who may have disabilities, to also be able to access those spaces. Accessible means that there are no barriers preventing a person from accessing the physical environment or experience that is being offered. Woolley suggests that involving children and families who are affected by disabilities and being sure design companies utilize the knowledge they are given are solutions to overcoming these barriers.

When considering groups of marginalized people in planning, we also need to include those within cities, who often do not have as much immediate access to nature as those who live outside of the city, in towns or suburbs where there are greater areas of undeveloped land and/or and natural areas. These voices are important for thinking of unconventional spaces within the

city that meet both the need for natural environments for community members to enjoy, as well as access to garden spaces with sustainable food sources that address food scarcity.

However, changing systems to become more inclusive is not a simple matter... while the ‘why’ behind [redressing exclusion] is important and has become more commonly accepted among conservation leaders and land management agencies, the ‘how-to’ is often less understood and, at times, more challenging to implement (Roberts, 2008 as cited in Waite et al., 2021, p. 16).

Just as with addressing accessibility for people with disabilities, involving the people who are part of marginalized communities will help address the issue of inclusivity. Waite et al. (2021) suggests that appointing a diverse group of community members with different backgrounds, including those of different abilities, and setting up programs for youth “would enable experiential learning across communities and a meeting of minds to allow cross-cultural meaning making across more diverse sections of society” (p. 16). Investing in the youth of these communities will allow more people to participate in outdoor and environmental education, while ensuring successful futures as world changers.

Future Impacts

Students who are exposed to outdoor and environmental education have a unique and powerful opportunity to become advocates and catalysts for environmentalism and conservation. In order to have an impact on our future and involve all members of our society in taking control of our future, we must make sure that outdoor and environmental education is inclusive, equitable, and accessible. We need to start developing these attitudes early on, and provide opportunities for our children to be immersed in nature. As Bailie writes:

‘The combination of early childhood education and environmental education is more powerful together than by itself.’ Such a synergistic relationship offers promise to enhance the quality of the human experience in the world with beneficial impacts for spaces and species, for generations to come. (Bailie, 2012, p. 132; Ardoin & Bowers, 2020, p. 13)

Research from Evans et al. (2018) suggests that pro-environmental attitudes begin in childhood by the amount of time spent outdoors, or are influenced by parental pro-environmental attitudes, specifically in mothers who are educated and engaged in those behaviors (p. 679). “Given the central contributions of human decision making and behavior to local, regional, and global environmental challenges, better insight into the early origins of adult environmental behavior is fundamental to understanding and ultimately changing environmentally destructive human activity” (p. 684). These origins are the experiences that children have in nature beginning early on, and the adults in their lives that shape their feelings about the natural world. Oftentimes adults will tell children how “yucky” something in nature may be, which in turn shapes the attitude they have toward the flora and fauna that play important roles in our ecosystem.

Numerous studies have associated positive childhood experiences in nature with the nascence of adult environmental concern and participation in environmental behaviors. Researchers have also investigated how environmental behavior more broadly – as well as its antecedents, such as ecological awareness, environmental attitudes, environmental consciousness, and nature relatedness – begin to develop and form in early childhood. (Ardoin & Bowers, 2020, p. 2)

We can look to current environmentalists and conservationists to determine how these experiences shape what they become, and what approaches to learning are effective in developing these attitudes moving forward.

In “Yesterday’s conservationists: How were they educated about the outdoors and the environment?” Greg Place conducts a study “to discover whether there are common characteristics of early-life educational experiences in individuals who developed a desire to protect and conserve the natural environment.” He looks at key figures who were considered influential in conservation and environmentalism, and studies their early experiences in their family, nature, and education. These figures are John Muir, Aldo Leopold, Rachel Carson, Theodore Roosevelt, and Henry David Thoreau. As seen below, in Figure 7, all of these people were influenced by experiences that they had with family and friends, along with their exposure to literature and education that shaped who they became.

Figure 7. Comparison of the life of influential figures in conservation and environmentalism.

Table 1. Comparison of early-life outdoor experiences of historical figures.

Name	Residence	Family	OE alone	OE friends	Media	Education
Muir	Dunbar shores and Wisconsin Frontier	Father's cruelty to animals	Time would be spent with brother	Explore and discover with brother	Enjoyed reading Audubon	Disliked school
Leopold	City of Burlington, Iowa	Father's example of sportsmanship	Schedule courses to spend time alone in outdoors	Spent time with siblings and friend Edwin	Loved reading outdoor stories	Enjoyed Lawrenceville because of surrounding areas
Carson	City of Springdale, PA	Mother taught the joy of the outdoors	Great deal of time exploring the farm	With friend would read and hike	Passionate love of books and writing	Won awards for writing abilities
Roosevelt	New York City and Oyster Bay, Maine	Multiple family vacations and trips	Sickly child who loved exploring and collecting specimens	Founded a museum with cousin	Loved books on natural history	Was tutored focusing on natural history
Thoreau	City of Concord, MA	Close to his mother	Stoic and quiet child who loved to explore and discover	Most time outdoors spent alone	Would copy passages from books	Concord Academy and Harvard exposed him to many books

Note: OE, outdoor experiences.

“As educators today, it is important to include ‘hands-on’ experience with the outdoors, which will instill environmental values to students” (Place, 2016, pp. 368-369). In Muir’s experience, he disliked school, just as many children do today. When pondering why students dislike school, we should consider the pressures that they feel to be successful in academics while adhering to classroom expectations that do not fit the neurodivergence that some students experience.

The very students who are underappreciated or overlooked within the classroom have the potential to be leaders outside of the classroom. These students have the spunk that is needed to make changes within our society. If we do not make changes to our learning environments, instruction, and the opportunities we provide to students, we may never know what our students are truly capable of. We may miss out on the changes they could start making today.

I can't tell you how many teachers have come to me... and said that the troublemakers in their classrooms become the leaders when they head outside to learn. Not just better behaved. The leaders. In the coming years, we'll need more than a few good leaders. Today, they may be hiding in plain sight at the back of the classroom. Some become truly visible only when their feet touch the grass and their eyes scan the clouds. So, in itself, the cultivation of a new generation of earth-connected leaders seems reason enough to create outdoor classrooms and green schoolyards on every campus in the nation. (Louv, 2021, Para. 19)

There are many approaches we take to educating students that ultimately shape their feelings about themselves and the world around them. We have the potential to better educate young minds into adults who become free-thinkers, problem-solvers, and eco-friendly global citizens, who have compassion and empathy for even the smallest creatures, and in turn, one another.

Conclusion

There is no time left to sit and ponder what educational approaches may be best moving forward. “It is time to pivot towards teaching and learning in outdoor environments” (Bailie et al., 2020, p. 1). The local and global impacts of outdoor and environmental education outweigh the obstacles of implementing these programs. By piloting programs in more schools, we will witness change in student attitudes, relationships, behaviors, and academic progress. We will promote healthy lifestyles that get children back outside and exploring, giving them the experiences that many of us had the privilege of experiencing in childhood. We will help students reach their fullest potential by meeting the needs of the whole child, rather than strictly academics. “Children come alive by being outdoors. It awakens their minds, centers their hearts, and gives them depth of soul. It is not an abandonment of academic work, but rather a help to it” (Arment, 2021). We will experience more creativity, exploration, observation, and inquiry as educators. Our students will grow up to be environmentalists, conservationists, and anything else they dream of, because they will witness the joy and power that comes from an empowering and engaging education experience. Thus, it is vital to take this step toward expanding outdoor and environmental education programs in our public schools.

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