HOW DO INQUIRY-FOCUSED NATURE WALKS INFLUENCE PRE-SCHOOL STUDENTS' UNDERSTANDING OF THEIR ENVIRONMENT, ENGAGEMENT IN NATURE, AND EMOTIONAL REGULATION?

by

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DEDICATION

To Eleanor and Rosie, who sometimes had to wait for things while Mama was working. I hope you remember that I taught by example the value of education, work/life balance, and a deep love of nature.

And finally, to my husband Michael, without whose help none of this would have been possible. Thank you for editing this albatross even when you did not want too. “See me doing this thing which I hate, that is love.”

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ABSTRACT

The purpose of this study is to discover whether there is measurable value in adding elements of nature school philosophy to a traditional Montessori preschool, even in an imperfect or transitional environment. Do inquiry-focused nature walks influence preschool students' understanding of their environment, engagement in nature, or emotional regulation? In this project I attempted to measure the impact of a daily inquiry walk, through several data streams: a parent survey, a nature inquiry checklist based on the NGSS kindergarten science standards, and by direct observation of nap and walk time and quality. Despite many setbacks and school closures, our initial findings suggest positive results in the areas of healthy sleep, knowledge and understanding of the natural world, and emotional and behavioral health.

INTRODUCTION AND BACKGROUND

Context of the Study

Green Arts Global Montessori is a Helena, Montana institution, one of the longest running Montessori programs in our community. Founded by Candace Swan in 2007, Green Arts has encouraged preschool students' physical and academic development, as well as independence, practical life skills, cultural awareness, and global citizenship. In 2017, this program expanded to include a toddler school next door. Formerly known as "The Treehouse," it is now Green Earth Montessori Nature School, located in historic downtown Helena (which means that our building is on the historic register and our pipes frequency freeze). We have a shady enclosed yard, with three large trees and several lilac bushes. Our location in the urban core of Helena allows us to walk to two playgrounds, the public library, the walking mall, and the courthouse grounds. Our neighborhood is highly walkable, with interesting historic homes and gardens, but it is not a typical nature or outdoor school setting.

Although I am an experienced teacher with a diverse resume, I was relatively new to preschool. I have an undergraduate degree in Biology (natural history emphasis) with a minor in Geology. I am licensed as a 5th-12th biology teacher. I have taught a variety of ages and subjects including 7th-grade life science, 10th-grade biology, mid-high special education, and a pullout gifted and talented program (4th-10th grade). I became interested in preschool outdoor education when I volunteered to lead a weekly "tyke hike" for the Helena Moms Club when my own children were preschool age. The Mom's Club provides support for stay-at-home parents and offers fun, and educational socialization

opportunities for preschool children. After other parents in the club started thanking me for a variety of positive changes, that they attributed to the outdoor education program, I began wondering about how children in full-time preschool would benefit from similar opportunities. These experiences influenced my teaching philosophy and career choices, culminating in my becoming the lead toddler teacher at Green Earth.

The long-term plans at Green Earth included moving to an ideal outdoor school setting. We had a vision of a property on the southwest side of town, within walking distance to both downtown and the Mount Helena Trail system, but just outside of city limits. We considered looking for a large lot, with a small barn for goats and chickens, a community garden, a bike course with natural obstacles, a teepee for an outdoor classroom, and a little red schoolhouse for the winter. The Green Earth Montessori Nature School would be a year-round nonprofit nature preschool and toddler program, as well as an afterschool program for school-aged students. We planned to partner with an early childhood music educator and offer music and movement classes as well.

The essence of long-term goals, however, is that they are long-term. The real question for educators is what do we do in our less-than-perfect environments with our less-than-perfect resources for our students, who deserve the very best? This question took on even greater significance, when it turned out that almost every part of this project was heavily influenced by the Covid-19 global pandemic of 2020 and 2021.

We had already begun to make a series of changes at Green Earth that were leading us in the direction of a true nature school. We committed to taking our students outside every day, a simple step that many preschools are unable to do. We took a daily

inquiry walk around our urban environment, noticing the changes in the gardens, listening to birds, picking apples from our friendly neighbors, and identifying tracks in the snow. We were slowly transitioning our playground to a nature sanctuary by replacing traditional play equipment like slides and gyms with obstacles like logs, a treehouse, and upcycled items like an old canoe and a tire course. We created a nature classroom where the Montessori materials/works and literature were inspired by the science and naturalist lessons we conducted at circle time.

One example of this transition was when we explored a bear skull while studying bear tracks. The students were most interested in removing the bear's canine tooth and replacing it in the socket and then removing the tooth and replacing it in the socket again. This was very similar to the kind of hand-eye coordination work that Montessori preschools emphasize, but this did not demonstrate that the children understood the connection between the bear skull and bear tracks. Does going outside in the winter (even though it may take 45 minutes for the students to dress themselves) only to go out for 20 minutes, still encourage the development of independence and resiliency? Did using that bear skull, instead of an educational toy commercially produced to teach hand-eye coordination, increase my students' knowledge of early-science concepts and inspire a love of nature?



Figure 1. A friend working with the bear tooth.

My goal, as I undertook this action research project, was to study whether each incremental step, while not perfect or ideal, could still produce positive results.

Focus Question

In this project, I approached this problem with the following research questions. First, how do inquiry focused nature walks influence preschool students' understanding of their environment? Second, how do inquiry focused nature walks influence preschool students' engagement in nature? Third, how do inquiry focused nature walks influence preschool students' emotional regulation?

CONCEPTUAL FRAMEWORK

At the beginning of this project, we looked at the best practices that define quality outdoor education and how they can be assessed. What separates outdoor education from recess or free play? How can you evaluate a student outside the realm of a pen and paper assessment? What if your student is pre-literate or pre-verbal? There are few greater joys than to watch children freely engaged and deeply immersed in the natural world. As Maria Montessori said

> Let the children be free, encourage them; let them run outside when it's raining, let them remove their shoes when they find a puddle of water; and when the grass of the meadows is wet with dew, let them run on it, and trample it with their bare feet; let them rest peacefully when a tree invites them to sleep beneath its shade, let them shout and laugh when the sun wakes them in the morning.

But are the benefits of outdoor education, more than the sum of the aesthetic? Can you teach science concepts outside of a traditional classroom setting? What about the important soft skills such as having the independence to take healthy risks, and the grit, resiliency, and self-control to face adversity and setbacks? Can we intentionally teach children how to connect with nature, and learn to care for our shared world?

Outdoor Education: Best Practices

It can be difficult to define outdoor education. Every teacher, parent, and student will tell you the importance of recess and outdoor time for cognitive, social, physical, and emotional development. (Burriss & Burriss, 2011) While no teacher stuck inside with 30 wiggly bodies on a day with below-zero temperature or restricted air quality would doubt the value of recess, but what makes outdoor education different?

The Association of Outdoor Recreation and Education has literally written the book on Outdoor Education best practices, which is Outdoor Program Administration: Principles and Practices (Association of Outdoor Recreation and Education, 2012). To sum up a complicated issue in a few broad strokes, consider these points. Think of outdoor education not just as a separate subject area, but as a teaching tool for all subjects. Use the natural environment as your classroom. Allow children to learn by hands-on engagement in authentic challenges. Outdoor education does not have to just supplement traditional classroom teaching, with creativity it can replace some pen and paper methods of reaching educational goals.

In the "Guide for High Quality Outdoor Leaning" published by The Institute for Outdoor Leaning, these ten objectives were listed as the ultimate goals of outdoor education: "enjoyment, confidence and character, health and wellbeing, social-emotional awareness, environmental awareness, activity skills, personal qualities, skills for life, increased motivation and appetite for learning, and broadened horizons" (Institute for Outdoor Learning, para. 2). It seems like a lofty goal to expect one tool to bring all these benefits to your students, as well as the basic science concepts on the Next Generation Science Standards (NGSS) standards, but that is exactly what we set out to attempt in this project.

Outdoor Education: Assessments

Many teachers of all age groups are reluctant to teach outdoor education, because they do not know how to assess these skills. Most outdoor education assessments are subjective. For example, Anne Casson found in her 2009 master's thesis Assessment in

Outdoor Education, "a wide range of assessment practices were used by the teachers in the study, with an emphasis on student-centered assessment practices such as self-assessment, peer-assessment, group debriefing, and authentic assessment" (Casson, 2009). In addition, the "Curriculum of Excellence in Outdoor Education" encourages a variety of self-assessments, both for students and teachers (Learning and Teaching Scotland, 2010).

Self-assessment can lead to its own positive outcomes. Studies have shown that in college-age students the benefits of self-assessment can include higher motivation and increased critical thinking skills (Hanrahan & Isaacs, 2001). However, many of the common assessment practices in outdoor education—such as self or peer assessment, or group debriefing—require a level of self-reflection and self-awareness that is not developmentally present in preschoolers and toddlers.

Additionally, traditional written assessment such as tests, assignments, and quizzes are not an option for either outdoor skills or science concepts in a pre-literate (sometimes even pre-verbal) student. For the purposes of this project, I try to circumvent this challenge by offering a Nature Inquiry Checklist which asks an observing adult to question students interview style about material and share quotes or observations for thematic analysis. Also, a practical skill assessment, where a student is asked to perform a task for the purpose of being evaluated, is a hit and miss goal with busy and distractable preschool student (Casson, 2009). However, a teacher or parent may be sensitive to an authentic performance of a skill or use of a concept in a real life context, making thematic data analysis one of the more telling (Casson, 2009). This kind of assessment is often

referred to as a "play-based" assessment (Bufkin & Bryde, 1996). Many other researchers and teachers have also found authentic assessment to be a particularly effective way of evaluating outdoor education (Moorcraft et al., 2001).

Outdoor Education: Independence and Health Risks

Ask almost any parent or educator and they will agree that children spend too much time inside, spend too much time watching screens, and are too sheltered and protected. However, in the same breath we write grants to buy more screens for our schools, declare many outside activities too dangerous, and cram more inside time into our days. Pediatricians are seeing "fewer broken bones, but more repetitive stress injuries from computers and video games" (Cleaver, 2007). A recent study of 173 school districts found that while some schools reported an increase in daily outdoor time, many more schools reported a decrease (Burris & Burris, 2001). Furthermore, when you compare data from 1981 to 1997, it shows that the typical school week has increased by an average of 8 hours, and many students follow that with an additional hour of schoolwork at home (Hofferth & Sandberg, 2000). Our culture is suffering a disconnect between what we know we need and how we are trying to get there.

It is tricky trying to open an outdoor toddler program in a city where other comparable programs have only indoor environments, and these indoor spaces don't even have furniture because climbing on couches is seen as too dangerous. In his watershed book, *Last Child in the Woods: Saving our Children from Nature Deficit Disorder*, Richard Louv (2005) writes, "An indoor (or backseat) childhood does reduce some dangers to children; but other risks are heightened, including risks to physical and

psychological health, risk to children's concept and perception of community, risk to self-confidence and the ability to discern true danger."

It has been suggested that students exposed to healthy risks would show an increase in independence and resilience. Early advocates for unstructured outdoor play learning, Bev Bos and Jenny Chapman, write in their book *Tumbling Over the Edge: A Rant For Childrens' Play* about the benefits of exactly the kind of outdoor time that is being slowly eliminated from our children's experience (Bos & Chapman, 2005). Students at their Roseville Community Preschool use woodworking tools, cook lunch from the school garden, and dig holes in the playground and fill them with water. These are all activities that would seem too dangerous to many educational professionals. Bos and Chapman describe these risk-adverse teacher behaviors as "paralyzing statements that undermine the evolution of independence." Examples of ways teachers unintentionally hinder student development include simple statements like, "Be careful! Look out! You'll get hurt! Don't fall! Don't run! Watch out! Don't get wet! Walking feet!" etc…." Additionally, studies show that even in preschool girls are much more likely to be on the receiving end of these restrictive boundaries (Martin, 1998).

Whether the decrease in support for outdoor play is caused by lack of time, under-emphasis in teacher training, competing educational priorities, or safety fears, it is certainly a national trend (Burris & Burris, 2011). This trend continues even though the vast body of literature supports the importance of outdoor play for children's "cognitive, social, emotional, and physical development" (Burris & Burris, 2011). Psychologist Jean Piaget famously said, "play is the work of childhood." In fact, some authors argue that

depriving children of opportunities for healthy and developmentally appropriate play can cause some of the same damage as child abuse, negatively impacting development (Frost, Wortham & Reifel, 2008). Many studies show that learning in an outdoor setting can reduce attention deficit disorder symptoms and behaviors for children as young as five (Cleaver, 2007). Once again, a perfect wilderness environment is not necessary; encouraging results show that simply taking a walk outside can improve concentration for many students with attention deficit hyperactivity disorder (Taylor & Kuo, 2009).

One of the major benefits of nature school can be the opportunity to experience healthy risks. Outward Bound, a program whose name is almost synonymous with outdoor education, opens their website with this quote by Caroline Myss: "Always go with the choice that scares you the most, because that is the one that is going to require the most from you."

Outdoor Education: Science Concepts

There are few sights more joyful than a child relishing their outdoor independence as they stretch themselves to climb a tree, run flat-out for the joy of it, or wallow in the mud. But what is that happy little piggy learning? Shouldn't they be back in the classroom, engaged in real academics? Well, for example, "in mud play, the children develop concepts of mass, volume, and the nature of change" (Stone, 2005). It is easy to dismiss outdoor time as simply recess, a break from learning and a time for physical activity. However, in a large-scale study of nature-based kindergartens in Denmark, Finland, and Scotland, researchers found cross-curricular benefits from meeting the kinesthetic needs of students with outdoor education (Nugent, 2018). While physical

activity is a benefit, it does not account for the whole value of outdoor time. Nature and outdoor education offer all kinds of intellectual challenges. What begins as an opportunity to test ideas becomes the solid background in scientific concepts and methods.

These effects can be particularly striking. According to a study on outdoor classrooms from the California Department of Education, when you "use the environment as an integrating theme across the curriculum, test scores go way up" (Cleaver, 2007). That study found that test scores increased by up to 27 percent in science alone, and also showed gains in math and reading (Cleaver, 2007). Once again, this study found that a perfect outdoor classroom is not necessary to get these results. Summer and afterschool programs can be a powerful tool for introducing outdoor education into students' lives and have been proven to increase test scores in scientific and environmental knowledge (Erdogan, 2011).

Going outside is a helpful tool, but you can see the full power of an outdoor classroom when the whole curriculum is grounded in nature. Liberman and Hoody (1998) call this using the "Environment as Integrating Context (EIC)." They found that the advantages of an EIC include not just better test scores in science, math, writing, reading, and social studies, but also that their students had fewer behavioral struggles and higher engagement and interest. Supporting work documents that "kids who play on naturalized schoolyards tend to have fewer antisocial interactions" (Cleaver, 2007). However, most experienced teachers would say they did not need a study to tell them that

a few days of indoor recess negatively impacts student (and teacher) attitude and behavior.

Outdoor Education: Love of Nature

> Passion is lifted from the earth itself by the muddy hands of the young; it travels along grass-stained sleeves to the heart. If we are going to save environmentalism and the environment, we must also save an endangered indicator species: the child in nature.

Richard Louv.

To assess the health of an ecosystem, you check in with an indicator species. A healthy population of coral supports a whole reef. River ecologists and anglers carefully watch each hatch of mayflies to get a feel for the health of the water. Here in Montana, our growing grizzly bear population shows an ecosystem that in some areas is robust enough to support a keystone predator. Richard Louv argues that the future of conservation lies in the hands of the most endangered of creatures: a child playing and learning freely in the woods.

Simply put, students who are exposed to outdoor education are more likely to care about the natural environment (Kenney, Militana, & Donohue, 2003). Outdoor education gives students both background knowledge and personal experience which help them develop empathy for environmental issues (Lieberman & Hoody, 1998). Previously, we discussed how outdoor summer programs can increase student test scores, but that same study also “showed that ecology-based nature education programs contributed significantly to children's responsible environmental behavior” (Erdogan, 2011).

Interestingly, empathy can be a double-edged sword. Much environmental education centers on disturbing and shocking fact displays, with starving polar bears and burning rainforests. While some students feel inspired by this introduction, other students become fearful, anxious, and shutdown. Sobel (1999) called this condition ecophobia, or "fear for the planet's future." While good citizens need to know and understand the very real challenges we must solve for our planet, we can burden children too soon with too much. Outdoor education that prioritizes negative realities, but doesn't offer students positive connections with nature, may cause student to withdraw instead. That is where nature school can be such a powerful tool. Students who build a positive relationship with nature early in life may have the strength and resiliency to not feel overwhelmed by ecological problems. That ability to get back up when you get down and overcome defeatist feelings when you suffer a set-back comes from practicing resiliency and grit.

Outdoor Education: Grit Mindset, Resiliency, and Self Control

Famous child educator Maria Montessori once wrote that:

> [t]he essence of independence is to be able to do something for one's self. Adults work to finish a task, but the child works in order to grow, and is working to create the adult, the person that is to be. Such experience is not just play…it's the work he must do in order to grow up.

As this quote indicates, one way that outdoor education helps build student independence is by having students practice the skills that lead to the mindset of resiliency and grit. Many teachers use these words interchangeably, but while they are related, they are not quite the same. Resiliency allows you to get back up after a setback,

without being overwhelmed by defeat. Resilient people can "shake it off" and continue no matter what life throws at them. This skill, like all others, is acquired through practice, which means both exposing students to challenges and allowing them to fail. Some authors have broken resiliency down into six different individual skills that can be improved: "executive functions, inhibitory control, planning and problem-solving skills, emotional regulation, and attentional capacities" (Greenberg, 2006). Outdoor education challenges students both physically and mentally and allows opportunity to try again.

Social scientist Brené Brown has written extensively on the role of failure in resiliency. While our culture recognizes the role of failure in building resiliency, we often try to soften its blow for our children and minimize the role of failure in our own lives. In her bestselling book *Rising Strong*, Brown writes, "We much prefer stories about falling and rising back up to be inspirational and sanitized … In a thirty-minute speech, there's normally thirty second dedicated to 'And I fought my way back…'" (Brown, 2015). This leads to empty myths about great success that skip the real pain of adversity. Outdoor education offers one of the few authentic challenges where students may experience healthy risk and failure. Do we trust them to sort it out themselves? Can they learn from their mistakes and solve their own problems? Just letting them try not only encourages the development of crucial skills but shows students we have faith in their abilities.

Resiliency can be difficult to measure, and many different rubrics and scales have been proposed. One paper compared 19 different resiliency scales before it concluded that the most useful and complete measures were the Connor-Davidson Resilience Scale,

the Resilience Scale for Adults, and the Brief Resilience Scale (Windle, Bennett & Noyes, 2011).

While resiliency is an important part of grit, grit includes other pieces, most notably an end goal. A resilient person moves past obstacles, while grit allows a person to pass those obstacles and continue to a predetermined goal. Measuring grit is not an easy thing to do. Like resiliency, many different scales and rubrics have been used.

One of the leading voices in this field, Angela Duckworth, published a bestselling book called *Grit: The Power of Passion and Perseverance* that changed the dialogue about success. Duckworth proposed that the achievement has more to do with "passion and perseverance," or grit, than innate talent or gifts. She states that without effort "your talent is nothing more than unmet potential" and "your skill is nothing more than what you could have done but didn't" (Duckworth, 2016). Many people begin with gusto and enthusiasm, but what specific traits help a person endure setbacks and disappointment, or simply stay focused in the long term? Duckworth released a modern and shorter version of the original grit scale in 2009. This grit scale is defined as measuring "trait-level perseverance and passion for long-term goals" (Duckworth & Quinn, 2009). Interestingly, students with higher grit scores not only scored higher academically, but also logged less personal screen time. Adults with higher grit scores achieved more education and changed careers fewer times. In this same fascinating study, the finalists of a national spelling bee were predicted in advance, based not on a spelling-ability test but on their grit scores. The authors suggest that this metric can be used to estimate a lifetime of practice.

Another word that is sometimes used interchangeably with grit is self-control. While grit and self-control often overlap, they have a few crucial differences. Duckworth and Gross define self-control as "the capacity to regulate attention, emotion, and behavior in the presence of temptation" (Duckworth & Gross, 2014). Grit is defined as "the tenacious pursuit of a dominant superordinate goal despite setbacks." Although the authors suggest that there is often a strong correlation between self-control and grit, it is not always the case. The ability to walk away from temptations on a small-time scale does not universally correspond with the ability to focus on an overarching, final goal. Likewise, the ability to stridently pursue a goal despite failures does not always translate into resisting other, perhaps daily, temptations. This suggests that if we want to help students translate grit into other domains, it may be important to also teach self-control.

The Outward Bound website cites founder Kurt Hahn for the proposition, "I regard it as the foremost task of education to ensure the survival of these qualities: an enterprising curiosity, an undefeatable spirit, tenacity in pursuit, and readiness for sensible self-denial, and above all compassion." This quote suggests that another benefit of outdoor education can be the development of self-control. Outdoor education offers many challenges in self-denial and delayed gratification. Can your tech-obsessed teen unplug for the weekend? Can a frustrated toddler trying to pull herself up on a log, hold out a little longer and try once more before calling for help? In the 1960's, Stanford University tested the abilities of toddlers to delay gratification by conducting the controversial marshmallow test (Carlson et al., 2018). In this famous experiment, students were offered either one marshmallow right way or a second treat if they could

wait unsupervised for fifteen minutes. Mischel's early results claiming that delayed gratification was a strong predictor for later success in life have been difficult to replicate. However, many educators anecdotally observe that willpower, self-control, and delayed gratification are powerful skills in the development of grit.

Teaching resiliency and self-control are important because some studies show that grit can be domain-specific, meaning that grit in one area of life doesn't necessarily translate into other spheres. In a fascinating study of collegiate athletes, researchers found that their domain-specific grit did not translate into their academic or personal lives (Cormier, Dunn & Causgrove, 2019). Teachers are understandably very interested in whether grit in one area can be used or applied in other areas. I would be interested in a study comparing whether this was true in situations where grit had been taught, increased, or acquired. We know that outdoor education builds physical strength and skills that can be used across the board. Can outdoor education build strength of character that allows students resiliency, independence, self-control, and grit, as they move forward to other adventures and challenges?

METHODOLOGY

Demographics

At the beginning of this study, our class consisted of 11 students—5 boys and 6 girls—ranging in age from 1 to 3. Two of our students are fraternal twins and we have no other siblings. By the end of the study, we had 12 students—5 boys and 7 girls—ranging in ages from 10 months to 4 years. In addition to the twins, we had one set of sibling brothers. All of our students and families self-identify as Caucasian. We have no students with identified special needs during this study. Helena has a population of almost 31,000 so we are a large city by Montana standards. Our culture and population are heavily influenced by being in the state capital, with many of our families having some professional connection to state government.

Treatment

As we transitioned our traditional Montessori school to a nature school, we set a wide range of goals for our teaching practices. It can be difficult to narrow down your life's work into a few actionable data instruments that paint a clear picture of whether you are meeting your goals. With much help from my coworkers, MSSE peers, and instructors, I was finally able to narrow in on the daily inquiry walk. Although we do teach traditional Montessori science lessons in the classroom, and we have a challenging nature-school style outdoor playground where we encourage free play, one truly unique part of our school day (at least in our community) is our inquiry walk. Every day—rain, snow, sleet, or shine—we load up the wagons with the pre-walkers. All children that can

walk do, and they pull and push their wagon-riding peers on a walk that can range from 45 minutes in challenging weather to a two-hour romp.

On these inquiry walks we do many different activities. We explore the neighborhood, observing the gardens. We track the neighborhood wildlife, observing signs and scat. We learn bird calls. We pick the apples in the fall and flowers in the spring. We identify plants and study the weather. We create mental maps. We hike south-west towards the mountains downtown, or we head north to our favorite park. We turn left or right. We practice being safe while meeting strange dogs and cats. We brace ourselves and push the wagons up the hill, and lean back and drag our feet going downhill. We visit our friends and return our library books. One day, we followed a family of deer for almost twenty minutes. Basically, we observe, interact, label, and discuss our experiences, whatever we may encounter.



Figure 2. Winter nature inquiry walk.

Is this “doing science”? It requires no special equipment or training, just the commitment to spend the time, to go out in all kinds of weather, and be mindfully present to notice and discuss. In Douglas Llewellyn’s helpful text, “Teaching High School Science Through Inquiry and Argumentation”, he begins by asking teachers to think of inquiry as practicing some “habits of the mind” (2013). Some examples of these habits include curiosity, flexibility, imagination, innovation, persistence, reflection, skepticism,

thoughtfulness, and wonder. It struck me that toddlers and preschoolers naturally explore their world through this lens and only need to be given the space to practice these habits. Llewellyn further breaks down a formal scientific inquiry into three main parts: the question, the procedure, and the results. Clearly, my class was not going to self-design experiments to answer their questions or publish the results. But what would happen if, instead of ignoring or quickly answering a toddler's persistent "why, why, why", we redirected them to uncover it themselves? If we gave them the space to observe and the vocabulary to describe, would they make and share discoveries?

When we first started this practice, it was kind of shocking to our community. People had forgotten what it looked like to see such young children outside. Cars stopped and people took pictures of the wagon train. But less than one year in, we noticed a cultural shift in our community when we ran into other preschools walking downtown. My coworkers and I anecdotally noticed differences in our students and in ourselves. But could I use this project to narrow my focus in on how this practice has helped our students and revolutionized our school? We hope to answer the question of how do inquiry focused nature walks influence preschool student's understanding of their environment, engagement with nature, and emotional regulation?

As I mentioned earlier, most outdoor education programs rely heavily on self- and peer-assessments, which are unfortunately not developmentally appropriate for toddlers and preschoolers (Casson, 2009). Initially, I floated the idea of offering a series of "feeling faces" for students to use to identify their experiences. I tried both emoji/cartoon faces and photos of actual children, but my class did not make the connection between

the board of faces and their own emotions. Practical assessment and authentic assessment seemed to be the best fit for this age group. However, a preschool student may be unwilling or unable to perform a practical assessment on demand. While this data is useful, in my experience it is not as complete as authentic assessment. Many other researchers also used play-based or authentic assessment and had positive results with older students. Bufkin & Bryde (1996) used play-based assessment to test a variety of skills successfully with special-needs elementary students, finding that they could more easily assess verbal and cognitive gains though observation of games such as "playing house" than through traditional testing. Through their work at an ecology education center, Moorcraft et al. (2001), used a series of specific teaching objectives to create authentic student assessment.

I endeavored to do something similar to these approaches using the NGSS Kindergarten Science standards as objectives for assessment. But I also tried to be mindful not to let them dominate our daily inquiry. Many of the studies focused on engagement in nature or ecological stewardship used a traditional written pre/post-test assessment, which unfortunately is not an effective model for preschool (Erodogan, 2011).

Data Collection and Analysis Strategies

There were four different sources of data to analyze the three main questions of this study, as outlined below.

Table 1. Data streams.

Research Questions	Data Stream 1	Data Stream 2	Data Stream 3	Data Stream 4
Sub Q1	Qual: Nature Inquiry Concepts Checklist	Quan: Parent Interviews/Survey	Qual: Parent Interviews/Survey	Qual: Instructor Observation
Sub Q2		Quan: Parent Interviews/ Survey	Qual: Parent Interviews/Survey	Qual: Instructor Observation
Sub Q3	Quan: Inquiry Walk Data Record	Quan: Parent Interviews/ Survey	Qual: Parent Interviews/Survey	Qual: Instructor Observation

Sub Q 1: How do inquiry-focused nature walks influence preschool students' understanding of their environment?

One of the struggles of collecting data in a pre-literate teaching environment is that it is not possible to administer a traditional pre-test or post-test. In the chart above, you can see some qualitative and quantitative methods that will be used to collect data showing growth in early science concepts.

The basic principles of what a science teacher might call "inquiry" overlap a great deal with what preschool and Montessori professionals might call "place-based learning" or simply "following the child." It was challenging to assess our progress on early science concepts without trying to create top-down evaluation, because of the temptation to interrupt the pure inquiry process and "teach to the test." As I explored this idea, I became curious about whether my class of toddler and preschoolers would meet any of the Next Generation Science Standards (NGSS) for early elementary school. In an informal, conversational assessment with a 4-year-old student, even I was surprised to discover that she could freely discuss all of the kindergarten science standards with real

understanding. This student also evidenced understanding of many of the 1st, 2nd, and even 3rd-grade standards.

From this experience I formulated a simple checklist that I could discuss with my verbal students in a conservational way to assess their understanding of the kindergarten science standards. For the purposes of this study this data instrument is called the "Nature Inquiry Concepts Checklist" (Appendix D). This checklist features the six NGSS standards highlighted for kindergarteners: Motions and Stability, Energy, Molecules to Organisms, Earth's Systems, Earth and Human Activity, Engineering and Design. I originally intended to ask a series of questions to determine student understanding of these concepts. A rubric was provided to score student mastery of each. I planned to administer this checklist in a friendly, non-stressful manner by asking these questions to the student that is walking with me on our inquiry walk. Each student would get a quarterly chance to walk with me one-on-one and discuss these concepts. My hope was to show both a surprising level of mastery in my students from the previous year, as well as continued growth and improvement from every student.

Unfortunately, as will be discussed later in the paper, I was unable to administer the Nature Inquiry checklist personally or more than once, due to school closure resulting from the pandemic. As you will see, however, I was able to persuade a few families to run through the checklist with their children at home. This provided at least some subjective, but still relevant stream of quantitative and qualitative data from our parents. However, the most telling data might be qualitative. Toddlers and preschoolers have a long processing time, and information that might seem too advanced or uninteresting to

them may show up later in unexpected ways. This makes parent and staff observation a key part of thematic analysis. Additionally, I put together a parent survey to ask quantitative questions using a Likert scale (Appendix C). For example, we asked the question: "My child exhibits a difference in knowledge about the natural world and early science concepts." It then has five potential responses, which can be scored quantitatively. The survey also included opportunities for parents to share qualitative examples from their own experiences with their child and the school.

Sub Q 2: How do inquiry-focused nature walks influence preschool students' engagement in nature?

For each of the teachers at our nature school, our desire to share our love and respect for nature is one of the driving passions behind our work as educators. For many of our parents, this was an important core value and part of why they chose Green Earth over other, more economical and convenient options. The vast body of literature says that outdoor school programs that emphasize these values have a broad spectrum of positive outcomes for students. However, whether Green Earth actually gave this gift to the students is extremely subjective.

Teacher observations and the parent surveys were a useful tool to document these special moments and little breakthroughs. My parent survey contained many questions, using answers in a Likert scale, designed to provide quantitative and easily analyzable data (Appendix C). These questions included: "I have noticed a change in my child's enjoyment, confidence, and comfort when exploring the natural world" (Appendix C). Once again, space was provided where parents were encouraged to share personal

antidotes about their child's changing relationship with nature. For example, one metric was tracking which younger students wanted to be held and which played independently. Many students came to nature school programs needing to be taught how to play outside. Were they excited to climb and run in natural environments? How tolerant were students of getting dirty? Could they entertain themselves with mud, sticks, and rocks, or did they need commercially developed toys?

Sub Q 3: How do inquiry-focused nature walks influence preschool students' emotional regulation?

The major work of a toddler's or preschooler's day is all about regulation and control of his or her own body. Can they handle their emotions, manage their physical tasks, and exercise age-appropriate independence? Does our daily inquiry walk help them manage their development of these skills?

I devised many different data streams to try and answer this difficult question. I needed to remain mindful that child development does not happen on a straight and predictable trajectory, but instead is a process with starts and stops. Additionally, many things that can cause a child to lose his or her ability to self-regulate are beyond both parent, teacher, and student control, such as illness or changes in schedule at home. One example of this would be how daylight savings time shook up our little school for an entire week. But the best example, is, of course, the pandemic and closure of the school.

The first and most ambitious data instrument addressing this question was the Inquiry Walk Data Sheet (Appendix F). The data sheet was designed to be filled out daily, tracking both walk and nap time. I also set out to record the number of "emotional

regulation" incidents. For the purposes of this study, an emotional regulation incident was defined as a student becoming so overwhelmed by their own emotions that he or she cannot be distracted and redirected, and a teacher had to directly intervene to help the student find a safe place to rest or calm down.

Napping data was added to this study as a result of parent feedback. I was told by several parents that they noticed one of the main benefits of our inquiry walks was an increase in both the time and quality of their student's sleep. I was very interested to see if the data supposed this anecdotal observation. A quick perusal of the bestselling books on childcare shows that many parents struggle to help their children learn to sleep. Healthy sleep is essential to students' ability to grow and develop, manage their emotions, and succeed in school.

Length is clearly not the only valuable factor in either a walk or a nap, so I created a rubric to measure quality as well (Appendix G). A note section was added to the table to leave a space for important factors that might explain outliers, such as an outbreak of sickness or substitute teachers on a particular day.

Again, I attempted to use the parent survey to address several of these issues. Parents were asked: "I notice a difference in my child's ability to regulate their own emotions when they spend more time outdoors" (Appendix C). Another example question is: "My child shows a difference in their ability to self-rescue and try again when they spend more time outside" (Appendix C). The hope was that not only would the insights of parents give us more understanding of their own unique child, but that

answers to these questions would help us determine whether skills we saw at school were transferring to their home.

The Pandemic's Effect on Data Collection

It is important to recognize the ways that the international pandemic of 2020 and 2021 effected this study. First, data collection for the winter begins on January 31st, and ends on March 13, 2020. Little did we guess, as we locked up the school that Friday, that it would be almost three months before a scaled-back version of Green Earth opened in the summer. The parent survey data is almost complete because that data was collected prior to the pandemic closing. However, I have a very small sample set of three Nature Inquiry Concepts Checklists. I had originally planned to administer this checklist personally. But after the preschool closed, I was able to collect a small sample of this data by asking three families to fill it out themselves. While this data set is small and highly subjective, it does tell part of our story.

I collected the Winter Inquiry Walk Data with the particular goals of my capstone in mind (Appendix F). The Summer Inquiry Walk data collected from June 8-July 17, 2020, was collected by different teachers, on a different group of students, and in a new location (Appendix F). Not only was this class made up of different students, but they were younger, and all of them had been at home and become unfamiliar with the routines of preschool. Like many working mothers, I was unable to return to my work as the head toddler teacher because I was needed by my own elementary-aged children. Even the location of our school changed because it was impractical to pay rent on an empty

location. Luckily, Green Earth was able to exit its old location and find a more affordable option to reopen as a smaller program that summer.

Although some quantitative data is not subjective (such as time spent sleeping or outdoors), other factors like nap and walk quality, may depend on the teacher collecting the data. This is an important factor to consider because the data was collected by three different teachers. While I worked closely with one of the remaining teachers during the time of my original study and held training for the other, we may have influenced the data we separately collected. I could speculate that this is the sole reason for our different results, but it is likely more impactful that the data sets are very small and involve different children. A more complete study should start with longer data collection on the same class and with the same teachers. However, one of the lessons of the pandemic is that you can do much more than you think, with much less. I believe we can draw conclusions, even from the truncated and interrupted data in this study.

DATA ANALYSIS

In this section we will review, without interpretation, all the data collected during this study in relation to the specific research questions. Clearly there are overarching themes in this study that relate to more than one question, causing overlap in the research instruments. However, I have separated out the data in a way that will hopefully increase clarity.

Inquiry-focused Nature Walks and Understanding of the Environment

To answer whether inquiry-focused nature walks influenced pre-school student's understanding of their environment, the first data stream was the Nature Inquiry Checklist (Appendix D). Students were assessed by their parents on a series of questions and prompts taken from 6 of the NGSS Kindergarten science standards. They were scored on a rubric ranging from 0 (No Answer), 1 (Minimal engagement), 2 (Correct use of some concepts, but some misconceptions), to 3 (Mastery) (Table 2).

Table 2. Nature inquiry concepts scoring rubric.

Score	Checklist Response
0	No answer
1	Minimal engagement with questions, struggled with concepts or vocabulary
2	Correct use of some concepts, some struggles or misconceptions
3	Mastery, answers correct, detailed, and enthusiastic

The data was collected from three parents (Appendix D), and the results were averaged (Table 3).

Table 3. Nature inquiry checklist individual and average rubric scores.

NSSG Standard	E. A.	C.W.	T. W.	Average Score
K-PS2-1 Motions and Stability	2	3	3	2.67
K-PS-1 Energy	2	3	3	2.67
K-LS1 Molecules to Organisms	3	3	3	3
K-ESS2 Earth's System	2	2	3	2.34
K-ESS3 Earth and Human Activity	1	2	2	1.67
K-2-ETS1 Engineering and design	2	3	3	2.67

Looking at the results, you can see that the highest scoring standard was K-LS1 with an average score of 3, or mastery (Table 3). The lowest scoring standard was K-ESS3 with a score between minimal engagement and correct use of some concepts, 1.67. Three of the other standards (K-PS2-1, K-PS-1, K-2-ETS1) scored just 2.67 slightly closer to mastery than correct use of some concepts. The final standard K-ESS2 received a score of 2.34 slightly closer to correct use of some concepts. Three students were evaluated on this rubric by their parents, who also submitted quotes and comments for thematic analysis (Appendix D).

The second data stream for the first research question was taken from the Parent Survey (Appendix C). This Likert-style survey offered scoring options ranging from -2 strongly disagree, -1 disagree, zero indicating no opinion, +1 agree, to +2 strongly agree was filled out by 15 different families. On each question, there was space to share quotes or observations for thematic analysis. Again, these results were averaged.

Table 4. Parent survey data average responses.

Survey Question	Average
1) The daily outside emphasis of Green Earth is important to my family.	1.63
2) I believe that it is important to encourage toddler and preschoolers to take developmentally appropriate risks.	1.72
3) Green Earth's commitment to being screen free is important to my family.	1.64
4) I believe Green Earth has been successfully teaching nature school without a expensive travel or facility budget.	1.54
5) I notice a difference in my child's ability to focus when they spend more time outdoors.	1.59
6) I notice a difference in my child's ability to regulate their own emotions (self soothe) when they spend more time outdoors.	1.54
7) I notice a difference in my child's sleep when they spend more time outdoors.	1.63
8) I notice a difference in my child's age appropriate independence.	1.54
9) My child exhibits a difference in knowledge about the natural world and early science concepts.	1.71
10) My child shows a difference in their ability to self-rescue and try again when they spend more time outside.	1.27
11) I have noticed a change in my child's confidence, comfort, and enjoyment of the natural world.	1.73

One of the questions on this survey addressed the first research question. Question 9 states, "My child exhibits a difference in knowledge about the natural world and early science concepts." This question received an average score of 1.71 between agree and strongly agree.

Inquiry-Focused Nature Walks and Engagement in Nature

The primary data streams for this research question are the parent survey (Appendix C), as well as the thematic analysis of quotations, comments, and parent and

teacher observations (Appendix D). The parent survey questions directly focused on this issue are questions 1-4 and 11 (Table 4). Question 11 ("I have noticed a change in my child's confidence, comfort, and enjoyment of the natural world") had the highest average score of 1.73 (Table 4). The other three questions had scores ranging from the 1.72 to 1.54, all scoring between agree and highly agree (Table 4).

Inquiry-focused Nature Walks and Students' Emotional Regulation

The first data stream for the third research question was the parent survey (Table 4). Specifically, questions 5-10 were targeted at this question. The highest scoring question was question 9 ("My child exhibits a difference in their knowledge about the natural world and early science concepts") with a average score of 1.71 (Table 4). The lowest scoring question was number 10 ("My child shows a difference in their ability to self-rescue and try again when they spend more time outside") with a score of 1.27 (Table 4). The other 4 questions had scores ranging from 1.63 to 1.54, all between agree and highly agree (Table 4).

The second data streams for the third research question, were the inquiry walk data sheets for the winter and the summer (Appendix F). This data is summarized below in two tables comparing averages (Table 5) and showing correlations (Table 6).

Table 5. Average inquiry walk data.

Data Category	Winter	Summer
#ER	0.86	0.31
Walk Time	41.72	34.31
W Quality	3.07	2.79
Nap Time	99.66	84.31
Nap Quality	3.31	3.21
Total Time	N/A	222.41

In the winter there was a slightly higher number of emotional regulation incidents, with an average of .86 a day as opposed to the summer where there were 0.31 (Table 5). In winter the inquiry walks were on average 7.41 minutes longer than the summer (Table 5). Walk quality estimates were similar at 3.07 for the winter and 2.79 for the summer (Table 5). Naps in the winter were, on average, 15.35 minutes longer (Table 5). Nap quality was almost identical at 3.31 in the winter and 3.21 in the summer (Table 5). We did not record total outdoor time in the winter, but in the summer the average outdoor time was 222.41 minutes a day (Table 5).

Table 6. Correlations of inquiry walk data.

Correlation	Winter	Summer
Walk Time/ Nap Time	0.61	-0.36
Walk Time/#ER	-0.63	0.06
Walk Time/ Nap Quality	0.42	-0.42

As you can see, in the winter there was a strong positive correlation between walk time and nap time of 0.61 (Table 6). There was also a strong negative correlation between walk time and number of emotional regulation incidents of -0.63 (Table 6). There was moderate or weak positive correlation between walk time and walk quality of .042 (Table 6). These results were not repeated in the summer. In the summer the walk time and nap time correlation was a weak negative coming in at -0.36 (Table 6). No correlation at all was show between walk time and emotional regulation incident with a score of 0.06 (Table 6). Finally, the walk time and nap quality had the exact opposite score, a weak negative correlation of -0.42 (Table 6).

CLAIMS, EVIDENCE, AND REASONING

Claims From the Study

Inquiry-focused Nature Walks Positively Influence Student's Understanding of Their Environment.

My first research question was, "How do inquiry-focused nature walks influence preschool students' understanding of their environment?" I directly addressed this issue in the parent survey with the statement: "My child exhibits a difference in knowledge about the natural world and early science concepts" (Appendix C). Parents gave this statement an average score of 1.63 (Table 4). They offered specific examples like a 15-month-old identifying birds by their calls (Appendix C). I was reminded of one experience I had with a (mostly) non-verbal toddler, who pointed through the window at a chickadee on our feeder and exclaimed, "Deedee!" Another family wrote, "We love that she can teacher us about the birds and plants. She also takes a lot of interest in the moon and seasonal changes etc… Which seems to come from the influence at Green Earth" (Appendix C). The data from this question seems to echo the response from the Nature Inquiry Checklist showing growth and mastery of many of the Next Generation Science standards for kindergarten.

Now let's explore this research question through the lens of the Nature Inquiry Checklist, keeping in mind that we are using the NGSS science standards for kindergarteners on toddler and preschoolers. Students were accessed by their parents on six science standards: Motions and Stability; Energy; Molecules to Organisms; Earth's Systems; Earth and Human Activity; and Engineering and Design (Appendix D). Each

category was scored on a rubric between 0 and 3 (Appendix E). On standard K-L1 (Molecules to Organisms), all three students received a score of 3 meaning they showed "mastery, answers correct, detailed, and enthusiastic" (Table 3). On three standards, K-PS2-1(Motion and Stability), K-PS-1 (Energy), and K-2-ETS1 (Engineering and Design), the students received an average score of 2.67; two students received a 3 and one student received a 2 showing they had "correct use of some concepts, some struggles, or misconceptions" (Table 3). Standard K-ESS2 (Earth's Systems) received a slight lower score of 2.34, with two students scoring 2 and one student scoring 3 (Table 3). Finally, standard K-ESS3 (Earth and Human Activity) received the lowest average score of 1.67 (Table 3). Two students scored at 2 and a single student scored a 1, or "minimal engagement with questions, struggled with concepts or vocabulary" (Table 3).

Parents were encouraged to provide quoted qualitative material for thematic analysis, which can be both enlightening and entertaining. For example, when you look at the highest scoring standard, K-L1 (Molecules to Organisms), you find some interesting insights and fun questions. When asked what plants need to live, one student gave the detailed answer, "We put water on them, pack soil around them, and then they grow very strong" (Appendix D). Gardening was a major hands-on activity at Green Earth, so it was gratifying to hear the process accurately described. When asked about what animals in her neighborhood eat, one daughter of a frustrated gardener said, "The deer eat the fallen apples and the bunnies eat Mommy's garden" (Appendix D). When asked what animals are, one student replied perhaps humorously (but correctly) that, "People are animals, also neighbors, and bugs" (Appendix D). When asked to name

specific living things in our neighborhood, students listed many specific species and their identifying factors. For example, one student responded, “Sunflowers have seeds in them” (Appendix D). Thinking about these questions, curious students also asked their own follow up questions: is food a kind of plant; or where do deer sleep at night?

It is not surprising to me that this standard was scored the highest, because both with Inquiry and Montessori teaching methods you really follow the students’ interests as the environment presents them. Toddlers and preschoolers are developmentally engaged in naming the things in their environment and placing them in their roles. Anyone that has interacted with a toddler that can name all the Pokémon or My Little Ponies, knows that their brains are ready and willing to process this type of information. So why not encourage them to be young naturalists, calling birds, insects, and flowers by their proper names?

The qualitative data from the lowest-scoring standard K-ESS3 (Earth and Human Activity) gave some interesting insights into misconceptions and learning gaps that I could have easily addressed either through a more focused inquiry or traditional classroom lessons. You can tell from the parent commentary that they were able to identify the learning gaps as well. In response to the question: “Why is it good for us to walk to the library instead of drive,” one parent quoted her son as saying, “We walk on the sidewalk street because there are no signs to park there” (Appendix D). But then the parent added, “Good description of the Walking Mall, but no connection to walking lowering our carbon foot-print.” When I asked: “Why do we pick up trash on our walk,” one student said, “We don’t throw garbage on the ground and we pick it up if we see it”

(Appendix D). Another student did not answer this question, but the mother wrote, "I am surprised she didn't answer this question because she frequently wants to pick up trash on our walks" (Appendix D). This response makes me hopeful that some of our lessons on this subject have been internalized even if students are not able to articulate them yet.

Most of the rubrics showed an above-average understanding of the NSGS Kindergarten Science standards, though in a small subgroup of three preschool students. Most of their answers showed curiosity, understanding, and a surprisingly mature vocabulary, even if not total mastery. In one humorous example, standard K-2-ETS1 (Engineering and Design) and K-PS-1(Energy) both ask questions about how you can cool yourself down if your environment is hot and warm yourself up if your environment is cool. One of the preschoolers was not having it, and told her mother the question had been asked earlier (Appendix D).

Aside from traditional "nature school" curriculum, many other science goals were also met. For example, standard K-PS2-1 (Motion and Stability) approached physics questions of force, mass, and motion through pushing and pulling a wagon on our inquiry walks. Each of the three students was clearly able to demonstrate how they would handle the force and movement of a wagon differently going uphill or downhill (Appendix D).

Across several instruments, looking at all of the qualitative, quantitative, and thematic data, it appears that preschoolers would benefit and respond to a more challenging and hand-on inquiry approach to science than many teachers believe. Please remember that the standards used in the study were written for kindergarteners, and the preschoolers showed mastery of these concepts. Once again, our students teach us, even

in this small sample when their work was interrupted by a global pandemic, that their hungry minds are ready to reach through inquiry into the big world around them. As Maria Montessori (1949) famously said, "The child has a mind able to absorb knowledge. He has the power to teach himself."

Inquiry-Focused Nature Walks Increase Students' Engagement in Nature

Several of the parent survey items were designed to gather data for my second research question: how do inquiry-focused nature walks influence preschools students' engagement in nature? The first survey item I asked was "The daily outside emphasis of Green Earth is important to my family," and received a score 1.63 (Table 4). Parent responses were enthusiastic. One family shared that their daughter "often asks to go on a walk in the evening after dinner. If we run out of time she will get upset. We love how much she loves being outside" (Appendix C). Other helpful responses included: "I love getting outside. Good for everyone!" and "I notice with my kids how much more enjoyable they are if they are physical" (Appendix C). I think that many teachers and parents, including myself, can relate to these responses.

Next, I asked whether they believed "that it is important to encourage toddlers and preschoolers to take developmentally appropriate risks. (for example: climbing, running, exploring, etc.)" (Appendix C). I included this statement under this research question because I felt both that this is a crucial skill, and also one of the more innovative things we intentionally did at Green Earth. This statement received a score 1.72, tying with question 11 for the highest score, which felt really validating (Table 4). One parent responded: "She has a lot of confidence walking around her neighborhood and

understands safety rules. She explores her world with enthusiasm and does so safely at age two. We've been so impressed to see this at such a young age" (Appendix C). This question ties in directly with students' abilities to self-rescue and focus, which will be further discussed under my last research question.

Another value that separated Green Earth from the standard practices of comparable programs in the Helena community was Green Earth's commitment to being screen free. Parents responded that this was important to their family, giving this statement a score of 1.64 (Table 4). I agree with the parent that wrote, "Yes, as a school with kids that young, there is no need for screens" (Appendix C). This echoes the opinion of Mayo Clinic Staff (2019), which suggest less than one hour of high-quality screen time a day for children 2-5 years old.

However, I also agree with the parent that stated, "There are fun educational programs that are good too" (Appendix C). Our school philosophy about screen time is not about judgment of good programming, which has a time and place, but simply that screens can supplant many other things in the school day. So much of teaching and parenting is just sorting through and prioritizing what is the best use of your available time.

From the beginning we have wondered if it would be possible for us to meet our goals in a modest, transitional classroom environment. Parents responded supportively, affirming that they believe Green Earth successfully taught nature school without an expensive travel or facility budget. This statement received a score of 1.54 (Table 4), and large amount of feedback, such as: "You guys do an awesome job of seeing nature

everywhere", and "I think Green Earth excels at helping children observe and understand the outdoors" (Appendix C). One very specific response I found helpful was, "Yes! We love the urban outdoors approach. Our daughter has learned so much about plants, birds, animals, tracks, directions etc… from all of the work at school. She loves to share!" (Appendix C). I found this list very gratifying because it basically includes most of my nature inquiry walk objectives!

This question is important, because nature school and science activities are often things put off for when programs have "more." You will hear other teachers wistfully say, "I wish I could teach science. Maybe when we have better equipment, or more time." I have also heard, "I would love to do the nature school thing, but how could we afford an adequate facility." I think one lesson that can be drawn from these results, is that teachers can be more creative, and students are often more ready and receptive than we think. Much more can be done with so much less than we think we need.

One parent expressed a wish for an affordable option saying, "Compared to other schools, it was quite expensive. The last school was not Montessori, but it was $250 dollars less" (Appendix C). This is a sentiment that I can relate to and empathize with. The question of how to provide quality childcare, with professional staff, and a healthy environment, in an affordable manner is a very important question for another day! Which brings us to our final research question.

Inquiry-Focused Nature Walks Positively Influence Students' Emotional Regulation

We are now moving into some very important soft skills that are even more difficult to evaluate objectively. First let's look at the response to: "I notice a difference

in my child's ability to focus when they spend time outdoors." This question received at response of 1.6 (Table 4). A parent of one of the youngest toddlers said, "He is still young, but he seems happier when he spends time outdoors" (Appendix C). The family of one of our older students wrote, "She already has a pretty high ability to focus, and the time outdoors does increase it" (Appendix C). These responses echo my experience that outdoor time not only increases student focus, but teacher focus as well.

Continuing with exploring the development of softer skills, I asked parents if they noticed, "a difference in my child's ability to regulate their own emotions (self soothe) when they spend more time outdoors." Some very grateful parents wrote things like, "We definitely have fewer meltdowns when she is spending time outside, even if it is brief" (Appendix C). Other responses were "Tantrums are shorter and less frequent," and, "They are definitely less grouchy" (Appendix C). If our practices support restful naps, that may be related to many of the other positive benefits we see.

In addition, my co-workers all agreed that they felt more passion for their work the more time we spent outside. This is particularly interesting because reluctant teachers are often one of the roadblocks stopping many programs from spending more time outdoors. Teacher concerns range from not having enough time, to taking too long to get ready, it's not safe, etc., may fade in light of positive results for the whole community. This would be an interesting question to follow up with future research.

The next topic is one of the most important for both toddler/preschoolers and school-aged children. I asked parents if their child "shows a difference in their ability to self-rescue and try again when they spend more time outside." As I learned during this

project, the literature is full of different instruments and scales to measure grit and resiliency in older students and adults. But in self-reflection and discussion with my teaching partners, we decided to use this statement as a goal in helping our students develop these skills.

For this age group, self-rescue is a lofty developmental goal. Interestingly, parents gave this statement an average score of 1.27 (Table 4). While being the lowest score in our study, it is still a positive result between agree and strongly agree. One parent remarked, "I have noticed a change in my child's confidence, comfort, and enjoyment of the natural world. Yes! Also her stamina has increased. We can happily walk for several blocks and chat about what we see and she can always find something interesting to play with!" (Appendix C). Any parent or teacher of toddlers or preschoolers will tell you that the development of self-rescue and independence in frustration is a crucial factor in the speed and ease at which they develop all other skills. The average response suggests that our outdoor emphasis not only increased students' appreciation for nature, but also helped them develop grit and resiliency in other areas of their life.

In a similar line, we also asked the parents if they noticed "a difference in my child's age-appropriate independence." They affirmed that they did with a score of 1.53 (Table 4). Many of the parents' examples not featured walking as an activity that encouraged and demonstrated independence. For example: "She is now highly inclined to walk independently on a family outing and to figure challenges out for herself;" and, "Our daughter impresses us with how far she can walk on her own already. She usually

prefers to walk (even longer distances) now rather than ride in the stroller or be carried" (Appendix C).

The last survey question turned out to be very important. When asked if they noticed "a difference in my child's sleep when they spend more time outdoors", scores jumped up to 1.62 (Table 4). Enthusiastic responses included, "Yes! The nap benefit is huge" (Appendix C). One of our youngest students, "transitioned from 25-minute naps to 1-hour naps after joining Green Earth at 10 months old" (Appendix C). One parent described how they know their daughter will, "sleep best on Monday nights (her first days back to school each work)" (Appendix C).

The qualitative responses from the parent surveys suggested that the nature walks lead to better naps, and I was curious whether quantitative data would support this. The effects of sleep on learning and emotional regulation are well documented, so we became very interested in whether or not nap time and walk time could really be quantitatively correlated. So I included it in the Nature Inquiry Walk Data Sheet.

As explained above, the Winter and Summer Inquiry Walk Data Sheets were filled out by three different teachers, and two different classes of students (Appendix F). When you compare the winter and summer data, we walked 7.41 minutes longer and the students slept 15.35 minutes longer on average in the winter than in the summer (Table 5).

This comparison is striking, particularly because I expect that the summer students spent more total time outside. Please note that there are dramatic seasonal differences in the weather in Montana. The students had both a morning and afternoon

recess throughout the year. But in the summer, these recess periods are augmented by instructional and work time, as well as outdoor meals. So, summer students almost certainly spent more time outdoors, in total. However, I did not keep track of the total outdoor time in the winter, so this cannot be verified.

The data shows that students in the summer program spent on average 222 minutes outside each day, but took shorter walks than during the winter (Table 5). This suggests that the inquiry walk time potentially had a greater impact on nap time than just time spent outdoors. I think that the correlation does not reflect this as strong as it might, due to a few outlier walks in the winter which pulled the averages down.

In the winter there was a strong positive correlation (greater than 0.5) between walk time and nap time (Table 6). A longer walk was correlated with a longer nap. There was also a strong negative correlation (less than -0.5) between walk time and emotional regulation (table 6), meaning that longer walks correlated with fewer tantrums and behavioral challenges that required adult intervention. This was true even though our class in the winter had more emotional regulation problems overall than our summer class. The average number of emotional regulation incidents in the winter was 0.86 and in the summer was 0.31 (Table 5). There was also a moderate positive correlation between walk time and nap quality.

The data collected in the summer after Green Earth reopened, and I was unable to return, did not follow this trend. There was a weak negative correlation of –0.36 between walk time and nap time, and no demonstrable correlation (0.6) between walk time and emotional regulation (Table 6). It is not surprising that two classes, with different

students and taught by different teachers, would have such different results. Also, I think that any data collected following a three-month disruption in a school year would be far from the expected norm. I am very curious what a longer-term study would have shown, especially with a larger group of children. This is an interesting question for further research.

This data suggests that the inquiry walks positively impacted students' healthy sleep and emotional regulation. Frankly, I was surprised that the walks more strongly correlated in this way than total outdoor time. I added that piece of data collection to the study in the summer because I thought that walks would be less important when the weather was better. However, the data suggests that more recess or outdoor instructional time did not have the same impact as the inquiry walks. An interesting question for further research might be why this occurred. Regardless, this is an encouraging thought for teachers that would like to see some of these results, but don't have room in their schedule for large chunks of outdoor time.

Although my sample size is small and my data collection was interrupted and nonuniform, I believe some helpful trends may be observed in the data. Quantitative, qualitative, and thematic data streams suggest that inquiry-focused nature walks did positively influence preschool students understanding of their environment. Some families even self-reported a precocious mastery of the Kindergarten NGSS science standards. Further, inquiry-focused nature walks appear to positively influence pre-school students' engagement in nature. While many communities view this as a lofty educational goal, requiring great resources of time, money, and equipment, we

accomplished this in an urban environment with between 30 to 45 minutes a day walking, on average. Total time outside, while perhaps aspirational, did not seem to influence the results. This suggests this educational tool is within the reach of many more schools.

Finally, on the important question of whether inquiry-focused nature walks influenced preschool students' emotional regulation, thematic analysis of qualitative data showed a positive and enthusiastic response. Separately, the quantitative data exhibited a strong positive correlation between walk time and nap time, meaning that a longer walk can equal a longer nap. In addition, a strong negative correlation between nap time and emotional regulation events, showed that taking inquiry nature walk everyday reduced the number tantrums requiring adults support, freeing up valuable teacher time and increasing class moral. While I know these results are not definitive, I believe they are encouraging enough to hopefully inspire changes to parenting and classroom practices, as well as inspire future study.

Value of the Study and Consideration for Future Research

Tomorrow, teachers all over the world will wake up and go to work with restrictive budgets, burdensome noninstructional duties, and less-than-ideal environments. That is the reality of our chosen vocation. So, we return to the purpose of this study: can adding elements of outdoor education increase knowledge of early science concepts, contribute to a love of nature, and encourage the development of grit, by building resiliency and independence? And what if it is in an imperfect, transitional environment?

The results of my project encouraged me to ask other questions as well. What does an outdoor class really look like? What are the essential elements? If you don't have access to a trail in the woods, are there benefits to taking a 20-minute walk on tree-lined streets? What indoor parts of the school day can you take outside, and what parts of nature can you bring in? Can you create a nature school on a limited budget and in an urban environment, if you have a creative, dedicated staff and a supportive community? Do inquiry walks support restful naps and if so, did the walks have a great impact on sleep than total outdoor time? Would teacher show some of the same positive benefits we saw in the students?

I am still very curious about the extreme between the summer and winter results. Will future researchers examine my data to look at how the global pandemic impacted education? It is possible that my results have been more similar without the interruption and staff and location changes, but maybe a seasonal factor was also at play. My science advisor suggested that one research direction to follow, might be to investigate the effects of seasonal affective disorder in very young children. One of my co-workers remarked antidotally that children seem to be more cheerful and need less sleep in the summer. Finally, would this project show stronger results over more time and a larger population?

Impact of Action Research on the Author

What is next for me and Green Earth? As I mentioned earlier, I was unable to return to Green Earth when they reopened, as the Helena School District remained partially digital. My own children spent their 3rd and 5th-grade years as part of a neighborhood digital learning pod school. My teaching partner and I—another displaced

working mother—taught 10 elementary students ranging from 2nd to 5th grade for the entire 2020/2021 school year. Our classroom was an insulated garage, heated by a woodstove, with a guinea pig, two rescue dogs, and 10 chrome books. To supplement the digital instruction, we spent a third of our day outside riding bikes and building forts. We also made nature journals, started a band, and read 100's of books.

Two lessons I took from my work on this capstone included daily outside walking time and a weekly field trip. We routinely completed five days of schoolwork in four days, so that we could spend every single Wednesday outside, in nature. We hiked, biked, explored, climbed, sledded, and skied our way through the pandemic school year. Interestingly, the only time we know that our school was directly exposed to Covid-19, none of our students contracted the virus. This lead many of us to speculate that our emphasis on outdoor time might have acted protectively during the pandemic.

What long term effects this year will have on my own children and the other "students of the pandemic" remains to be seen. Inspired by my experiences this year, I have taken a job as the upper elementary teacher in the two-room historic schoolhouse in Basin, Montana. I hope to continue to use what I have learned in Basin, as I serve this new community.

In some ways we were not able to meet our initial goals for Green Earth at the beginning of the study. They still do not have the idealized nature school location we dreamed of two years ago. However, the program managed to survive and thrive in an extremely challenging climate for both small businesses and schools. This was very much in part due to the dedication of the teachers, the support of the families, and several

grants directed at supporting small businesses, particularly for childcare. The results of this capstone teach us that perhaps the facility is not the important part of a school. Instead, the choices we make with the time and resources we have can have a greater impact for our students than we might have dared to imagine.



Figure 3. A friend walking with his baby.

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APPENDICES

APPENDIX A

PHOTO RELEASE



INSTITUTIONAL REVIEW BOARD

For the Protection of Human Subjects

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Photo Release Form

Event: _____ Date _____

I hereby grant _____ (*name of Principal Investigator*) permission to interview me and/or to use my likeness in photograph(s)/video in any and all of its publications and in any and all other media, whether now known or hereafter existing, controlled by Montana State University, in perpetuity, and for other use by the Investigator and/or University. I hereby release the Investigator and/or Montana State University and any photographer chosen by the Investigator and or Montana State University to photograph me from any and all claims for damages for libel, slander, invasion of privacy or any other claim based upon the use of my photograph and information about me for this purpose.

Subject's Name (*print full name*)_____

Signature _____

Address _____

City, State, Zip Code _____ Telephone _____

Requested by _____

Guardian's Release for Minors under 18 years of age

I warrant that I am of full legal age and have every right to contract for the minor in the above regard. I have read, understand and agree with the conditions listed above.

Guardian's Name (*print full name*) _____

Signature _____

Relation to Subject_____

Address _____

City, State, Zip Code _____ Telephone_____

Requested by _____

APPENDIX B

PARENT LETTER AND PERMISSION FORM

Dear Green Earth Parents,

As many of you know, I have been hard at work these last few years earning my master's degree in science education through the MSSE program at Montana State University. As much as I have enjoyed my classes, this program is not all fun and dinosaurs and now I am in the final stages of thesis writing. I would like to ask your permission to collect data and take pictures at school in my capstone project and possible further writings. All data (both qualitative and quantitative) will be collected as part of our normal school assessments. Students will never be identified by name.

Data collection will center around students' understanding of their environment, engagement in nature, and emotional regulation. Parent surveys will be sent home asking our families what they observe about their children's growth in these areas. Class wide data will be collected pertaining to outdoor time and possibly effects on academics, behavior, and sleep. Individual students in our "Bears" class be working with a Nature Inquiry Checklist based on the NGSS kindergarten science standards.

Thank you so much for allowing us to share in this special time of your child's life. This project is just one example of our commitment to using the best possible teaching practices here in our school. I appreciate your help and support on my educational journey.

Thank You,
Camas Sturm Kakuk

I give permission for my child to participate in this study, for data to be collected, and for photos of him/her to be used in this project and further writings.

Signature: _____ Date: _____

AUTHORIZATION: I have read the above and understand the discomforts, inconvenience and risk of this study. I, _____ *(name of parent or guardian),* related to the subject as _____ (*relationship*), agree to the participation of _____ (*name of subject*) in this research. I understand that the subject or I may later refuse participation in this research and that the subject, through his/her own action or mine, may withdraw from the research study at any time. I have received a copy of this consent form for my own records.

Parent or Guardian Signature: _____

Child's Assent Signature: _____ (if applicable)

Signed: _____

Date: _____

APPENDIX C

PARENT SURVEY AND RESULTS

Dear Green Earth Parents,

The following are some survey questions related to Camas's capstone project for her Master in Science Education. **Participation is voluntary and confidential. You can choose not to answer any question you do not want to and you can stop at any time.** Circling the survey numbers will provide us with helpful quantitative data, but if you have story, anecdote, or example you would comfortable sharing, please include it in the space provided. One challenge for isolating the effects of any teaching philosophy is that much of your child's growth is based on their rapid development and your tremendous efforts as their parent. So be sure to pat yourself on the back. And thank you so much for helping us in our quest to always improve our teaching practices.

SECTION A: BACKGROUND

1. The daily outside emphasis of Green Earth is important to my family.

Strongly Disagree	Disagree	No Opinion	Agree	Strongly Agree
-2	-1	0	1	2

_____

_____

_____

2. I believe that it is important to encourage toddlers and preschoolers to take developmentally appropriate risks. (for example: climbing, running, exploring, etc.)

Strongly Disagree	Disagree	No Opinion	Agree	Strongly Agree
-2	-1	0	1	2

_____

_____

_____

3. Green Earth's commitment to being screen free is important to my family.

Strongly Disagree	Disagree	No Opinion	Agree	Strongly Agree
-2	-1	0	1	2

4. I believe Green Earth has been successfully teaching nature school without an expensive travel or facility budget.

Strongly Disagree	Disagree	No Opinion	Agree	Strongly Agree
-2	-1	0	1	2

SECTION B: CHILD OBSERVATIONS

5. I notice a difference in my child's ability to focus when they spend more time outdoors.

Large Negative Change	Small Negative Change	No Change	Small Positive Change	Large Positive Change
-2	-1	0	1	2

6. I notice a difference in my child's ability to regulate their own emotions (self soothe) when they spend more time outdoors.

Large Negative Change	Small Negative Change	No Change	Small Positive Change	Large Positive Change
-2	-1	0	1	2

7. I notice a difference in my child's sleep when they spend more time outdoors.

Large Negative Change	Small Negative Change	No Change	Small Positive Change	Large Positive Change
-2	-1	0	1	2

8. I notice a difference in my child's age appropriate independence.

Large Negative Change	Small Negative Change	No Change	Small Positive Change	Large Positive Change
-2	-1	0	1	2

9. My child exhibits a difference in knowledge about the natural world and early science concepts.

Large Negative Change	Small Negative Change	No Change	Small Positive Change	Large Positive Change
-2	-1	0	1	2

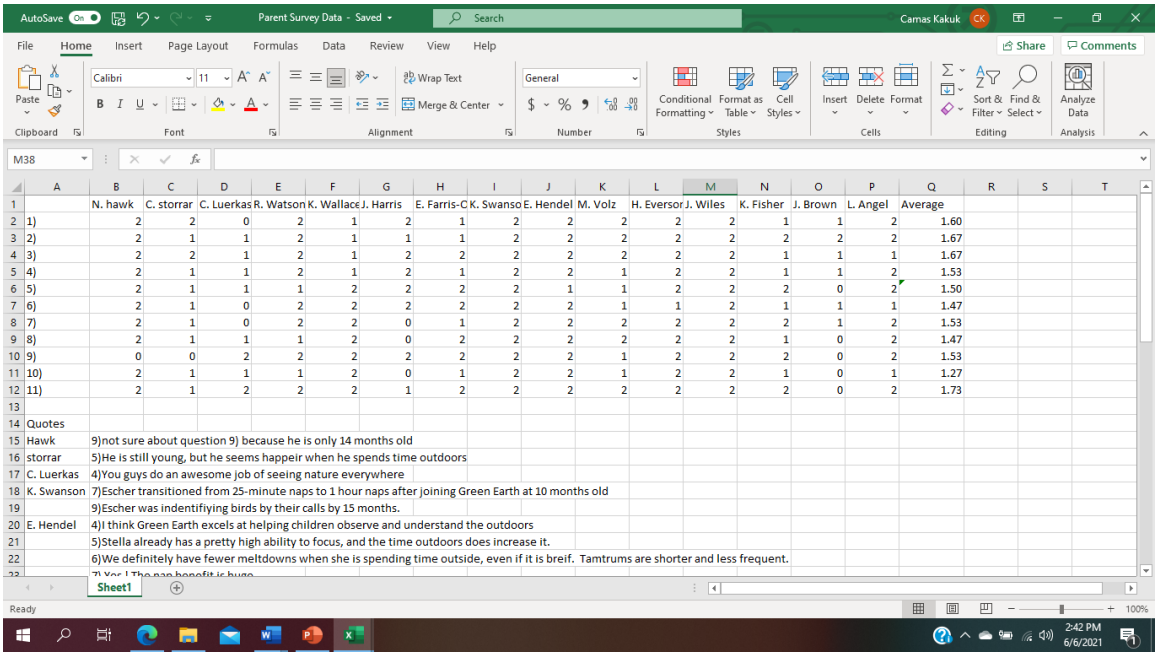
10. My child shows a difference in their ability to self-rescue and try again when they spend more time outside.

Large Negative Change	Small Negative Change	No Change	Small Positive Change	Large Positive Change
-2	-1	0	1	2

11. I have noticed a change in my child's confidence, comfort, and enjoyment when exploring the natural world.

Large Negative Change	Small Negative Change	No Change	Small Positive Change	Large Positive Change
-2	-1	0	1	2

Parent Survey Results



	N. hawk	C. storrar	C. Luerkas	R. Watson	K. Wallace	J. Harris	E. Farris-C	K. Swanso	E. Hendel	M. Volz	H. Eversor	J. Wiles	K. Fisher	J. Brown	L. Angel	Average
1)	2	2	0	2	1	2	1	2	2	2	2	2	1	1	2	1.60
2)	2	1	1	2	1	1	1	2	2	2	2	2	2	2	2	1.67
3)	2	2	1	2	1	2	2	2	2	2	2	2	1	1	1	1.67
4)	2	1	1	2	1	2	1	2	2	1	2	2	1	1	2	1.53
5)	2	1	1	1	2	2	2	2	1	1	2	2	2	0	2	1.50
6)	2	1	0	2	2	2	2	2	2	1	1	2	1	1	1	1.47
7)	2	1	0	2	2	0	1	2	2	2	2	2	2	1	2	1.53
8)	2	1	1	1	2	0	2	2	2	2	2	2	1	0	2	1.47
9)	0	0	2	2	2	2	2	2	2	1	2	2	2	0	2	1.53
10)	2	1	1	1	2	0	1	2	2	1	2	2	1	0	1	1.27
11)	2	1	2	2	2	1	2	2	2	2	2	2	2	0	2	1.73

Quotes	
Hawk	9)not sure about question 9) because he is only 14 months old
storrar	5)He is still young, but he seems happeir when he spends time outdoors
C. Luerkas	4)You guys do an awesome job of seeing nature everywhere
K. Swanson	7)Escher transitioned from 25-minute naps to 1 hour naps after joining Green Earth at 10 months old
	9)Escher was indentifiying birds by their calls by 15 months.
E. Hendel	4)I think Green Earth excels at helping children observe and understand the outdoors
	5)Stella already has a pretty high ability to focus, and the time outdoors does increase it.
	6)We definitely have fewer meltdowns when she is spending time outside, even if it is breif. Tamtrums are shorter and less frequent.
	7) Yes ! The nap benefit is huge.
	8) Stells is now highly inclined to walk independtly on a family outings and to figure challenges out for herself.
	11) Yes! Also her stamina has increased. We can happily walk for several blocks and chat about what we see, and she can always find soemthing intersting to play with or expore wehen we go hiking or camping.
E. Angel	1) Esme' often asks to go on awalk in the evening after dinner. If we run out of time she will get upset. We love how much she loves being outside.
	2) Esme' has a lot of confidence walking arround her neighborhood and understads safety rules. She explores her world with enthusian and does so pretty safely at age two. We've been so impressed to see this at such a young age.
	4)Yes!We love the urban outdoors approach. Esme' has learned so much about plants, birds, animals, tracks, directions,e tc... from all of the work at school. She loves to share what she has learned.
	7) Yes, we know that Esme' will sleep best on Monday nights (her first days back to school each work). She gets lots of exercise and outdoor time at schol and we orice a difference in her willingness to go to bed on school nights.
	8) Esme' impresses us with how far she can walk on her own already. She usually prefers to walk (even longer distances) now reather than ride in the stroller or be carries.
	9) WE love that she can teacher us about the brids and plants. She also takse a lot of interset in the moon and seasonal changes etc... Which seems to come from the good work at school.
	11) Just yesterday, Esme' happily spent 45 minutes playing and running in the snow when it was just 15 degrees out. She never said she was cold and said she was sad she had to go in for dinner!
O. Linden 1)	I love getting outside. Good for everyone! I notice with my kids how much more enjoyable they are if they are physical.
	3) Yes, as a school with kids that young, there is no need for screens, but there are also fun educational programs that are good too. At that age their attention span is super short anyway.
	4) Compared to other schools Scarlet was at it's quite expensive. It was not montessori, but it was $250 dollars less.
	6) They are definatley less grouchy.
	11) Yes, She loves to be outside, always. She doesn't want to come in. She loves to play, explore, run, and splash.

APPENDIX D

NATURE INQUIRY CHECKLIST AND RESULTS

Student Name:
Evaluator:
Date:

Nature Inquiry Concepts Checklist
Aligned with NGSS for Kindergarten

Scoring Rubric

Score	Checklist Response
0	No answer
1	Minimal engagement with questions, struggled with concepts or vocabulary
2	Correct use of some concepts, some struggles or misconceptions
3	Mastery, answers correct, detailed, and enthusiastic

K-PS2-1 Motions and Stability: Forces and Interactions: Plan and investigate to compare the effects of different strengths or different directions of pushes and pulls on the motion of an object.

1) Is it harder to push the wagon up or down the hill? How do you stand when you push? How do stand when you pull? Can you pull or push the wagon by yourself?

   Rubric Score: _____

   Notes:

K-PS-1 Energy: Make observations to determine the effect of sunlight on the Earth's surface

1) When you go outside, why do you feel cold sometimes? Why do you feel hot? What can you do to warm up if you are cold? What can you do to cool down if you feel hot?

   Rubric Score: _____

   Notes:

K-LS1 Molecules to Organisms: Structures and Processes: Use observations to describe patterns of what plants and animals (including humans) need to survive.
K-ESS3-1: Use a model to represent the relationship between the needs of different plants or animals (including humans) and the places they live.

1) What kind of animals do we see in our neighborhood? What can you tell me about them? Where do they live? What sounds do they make? What do they need to live? Where do they sleep? What do they eat? Can you tell me about their tracks and signs? Can you give me some examples? What do we do to stay safe around animals?

2) What kinds of plants do we see in our neighborhood? Can you tell me some of their names? What do you know about them? How do you take care of plant in our garden? Can you give me some examples?

Rubric Score: _____

Notes:

K-ESS2 Earth's Systems: Use and share observations of local weather conditions to describe patterns over time. Construct argument supported by evidence for how plants and animals (including humans) can change the environment to meet their needs.

1) What kind of weather did we have today? What kind of weather do you like to walk in? What kind of weather do you not like to walk in? What season is it?
2) How did you dress for the weather today?
3) People change the earth in lots of ways, how do we change the earth? Do plants change the earth? Do animals change the earth?

Rubric Score: _____

Notes:

K-ESS3 Earth and Human Activity: Communicate solutions that will reduce the impact of humans on the land, water, air, and/or other living things in the local environment.

1) What are some good things we do for the earth here at school? What are some good things you do for the earth at home?
2) Why is it good for the earth for us to walk to the library instead of drive? What should we do when we see trash on our walks? Why do we try to use less paper?

Rubric Score: _____

Notes:

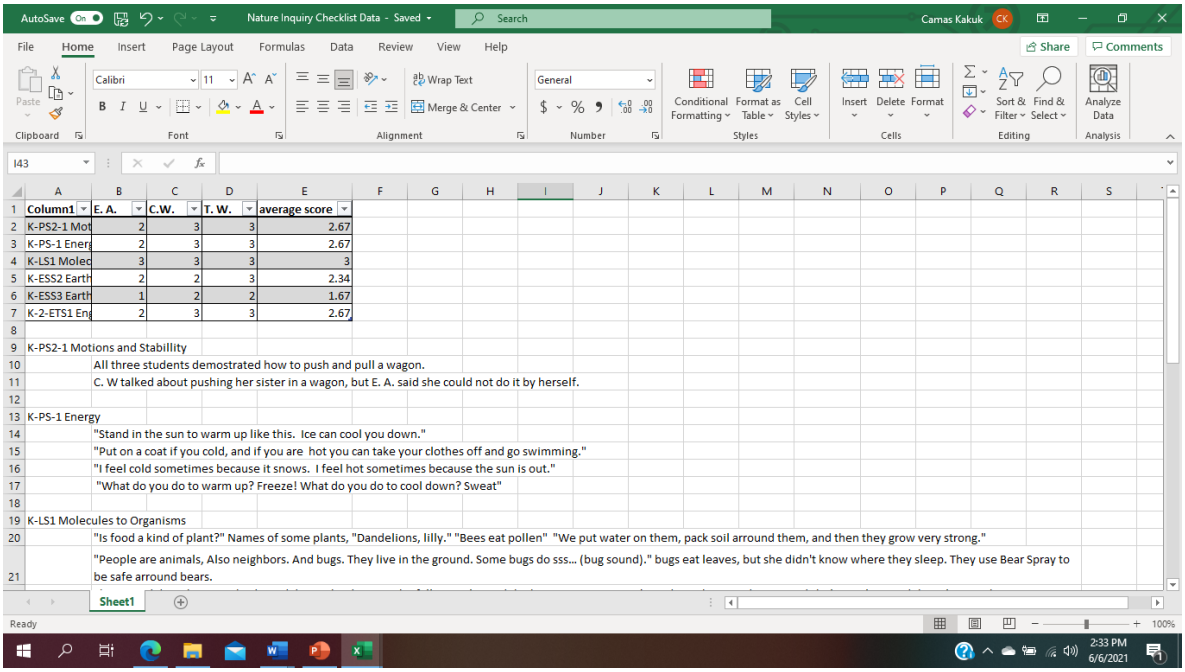
K-2-ETS1 Engineering and Design: Ask a simple question, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool?
(Nature school uses this standard all the time in our free outside free time, but does not really apply to our inquiry walks?)

1) How can you get in the shade if you are hot? How can you warm up if you are cold outside? What things can you do to help keep your hands warm? How do you climb a tree, or a wall, or a rock?
2) What can you build from materials in our yard? Hay? Tires? Sticks? Rocks?

Rubric Score: _____

Notes:

RESULTS



Column1	E. A.	C.W.	T. W.	average score
K-PS2-1 Mot	2	3	3	2.67
K-PS-1 Ener	2	3	3	2.67
K-LS1 Molec	3	3	3	3
K-ESS2 Earth	2	2	3	2.34
K-ESS3 Earth	1	2	2	1.67
K-2-ETS1 Eng	2	3	3	2.67

K-PS2-1 Motions and Stability

All three students demostrated how to push and pull a wagon.

C. W talked about pushing her sister in a wagon, but E. A. said she could not do it by herself.

K-PS-1 Energy

"Stand in the sun to warm up like this. Ice can cool you down."

"Put on a coat if you cold, and if you are hot you can take your clothes off and go swimming."

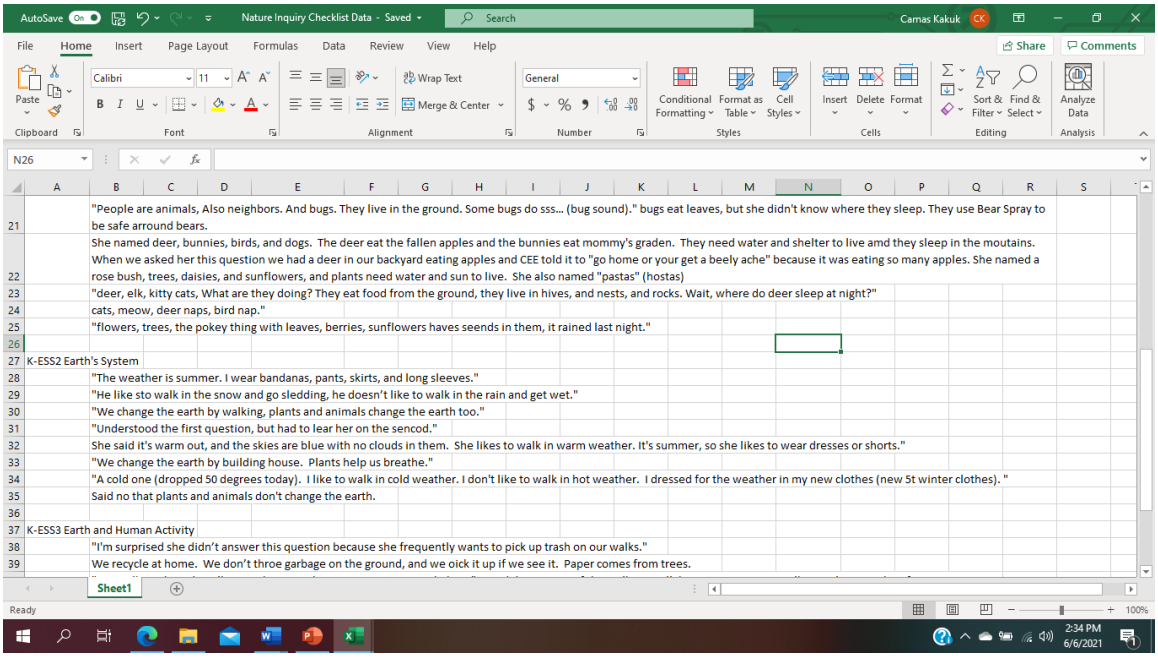
"I feel cold sometimes because it snows. I feel hot sometimes because the sun is out."

"What do you do to warm up? Freeze! What do you do to cool down? Sweat"

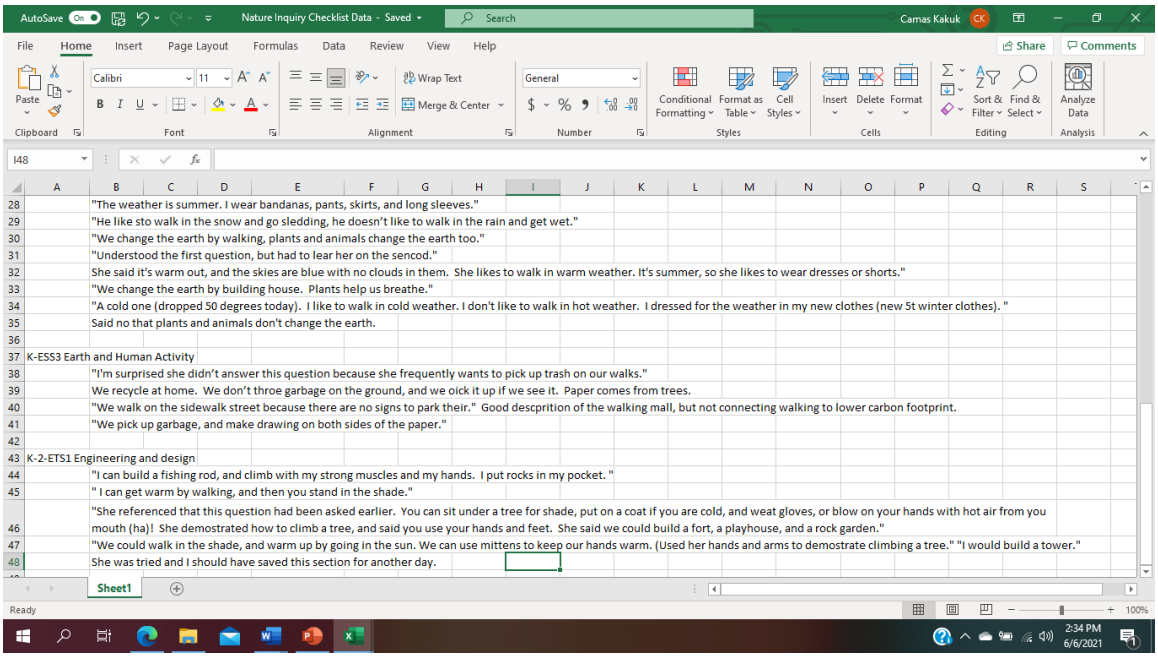
K-LS1 Molecules to Organisms

"Is food a kind of plant?" Names of some plants, "Dandelions, lilly." "Bees eat pollen" "We put water on them, pack soil arround them, and then they grow very strong."

"People are animals, Also neighbors. And bugs. They live in the ground. Some bugs do sss... (bug sound)." bugs eat leaves, but she didn't know where they sleep. They use Bear Spray to be safe arround bears.



21	"People are animals, Also neighbors. And bugs. They live in the ground. Some bugs do sss... (bug sound)." bugs eat leaves, but she didn't know where they sleep. They use Bear Spray to be safe arround bears.
22	She named deer, bunnies, birds, and dogs. The deer eat the fallen apples and the bunnies eat mommy's graden. They need water and shelter to live amd they sleep in the moutains. When we asked her this question we had a deer in our backyard eating apples and CEE told it to "go home or your get a beely ache" because it was eating so many apples. She named a rose bush, trees, daisies, and sunflowers, and plants need water and sun to live. She also named "pastas" (hostas)
23	"deer, elk, kitty cats, What are they doing? They eat food from the ground, they live in hives, and nests, and rocks. Wait, where do deer sleep at night?"
24	cats, meow, deer naps, bird nap."
25	"flowers, trees, the pokey thing with leaves, berries, sunflowers haves seends in them, it rained last night."
26	
27	K-ESS2 Earth's System
28	"The weather is summer. I wear bandanas, pants, skirts, and long sleeves."
29	"He like sto walk in the snow and go sledding, he doesn't like to walk in the rain and get wet."
30	"We change the earth by walking, plants and animals change the earth too."
31	"Understood the first question, but had to lear her on the sencod."
32	She said it's warm out, and the skies are blue with no clouds in them. She likes to walk in warm weather. It's summer, so she likes to wear dresses or shorts."
33	"We change the earth by building house. Plants help us breathe."
34	"A cold one (dropped 50 degrees today). I like to walk in cold weather. I don't like to walk in hot weather. I dressed for the weather in my new clothes (new 5t winter clothes). "
35	Said no that plants and animals don't change the earth.
36	
37	K-ESS3 Earth and Human Activity
38	"I'm surprised she didn't answer this question because she frequently wants to pick up trash on our walks."
39	We recycle at home. We don't throe garbage on the ground, and we oick it up if we see it. Paper comes from trees.



28	"The weather is summer. I wear bandanas, pants, skirts, and long sleeves."
29	"He like sto walk in the snow and go sledding, he doesn't like to walk in the rain and get wet."
30	"We change the earth by walking, plants and animals change the earth too."
31	"Understood the first question, but had to lear her on the sencod."
32	She said it's warm out, and the skies are blue with no clouds in them. She likes to walk in warm weather. It's summer, so she likes to wear dresses or shorts."
33	"We change the earth by building house. Plants help us breathe."
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37	K-ESS3 Earth and Human Activity
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39	We recycle at home. We don't throe garbage on the ground, and we oick it up if we see it. Paper comes from trees.
40	"We walk on the sidewalk street because there are no signs to park their." Good descprition of the walking mall, but not connecting walking to lower carbon footprint.
41	"We pick up garbage, and make drawing on both sides of the paper."
42	
43	K-2-ETS1 Engineering and design
44	"I can build a fishing rod, and climb with my strong muscles and my hands. I put rocks in my pocket. "
45	" I can get warm by walking, and then you stand in the shade."
46	"She referenced that this question had been asked earlier. You can sit under a tree for shade, put on a coat if you are cold, and weat gloves, or blow on your hands with hot air from you mouth (ha)! She demostrated how to climb a tree, and said you use your hands and feet. She said we could build a fort, a playhouse, and a rock garden."
47	"We could walk in the shade, and warm up by going in the sun. We can use mittens to keep our hands warm. (Used her hands and arms to demostrate climbing a tree." "I would build a tower."
48	She was tried and I should have saved this section for another day.

APPENDIX E

ENGAGEMENT RUBRIC

Student Name:
Evaluator:
Date:

Student Nature Engagement Rubric

Score	Engagement	Independence	Resiliency /Grit
0	Is unable or refuses to participate	No Independence, teacher must dress, and carry, etc…	Cannot self-regulate or redirect independently
1	Low engagement, is fussy, may be distracting other students	Learning to dress for themselves and move independently	Still requires some assistance to self-regulate and redirect in most situations.
2	Engaged, mostly positive attitude. but may require some redirection or assistance	Can dress and move independently but may still request teacher assistance.	Demonstrates that they can self-regulate and redirect in all but challenging situations.
3	Engaged, positive attitude. Mindful, drawing teachers and student's attention to surroundings.	Dress and play independently, leading, initiating, and experimenting.	Rarely needs help to self-regulate or redirect, responds positively to setbacks, and self-initiates challenging situations.

APPENDIX F

INQUIRY WALK DATA RECORD, WINTER DATA, AND SUMMER DATA

Inquiry Walk Data Record

Date	Mon	Tues	Wed	Thurs	Friday
# ER Before					
#ER After					
Walk Time					
Walk Quality					
Nap Time					
Nap Quality					
Notes					

Inquiry Walk Data Record

Date	Mon	Tues	Wed	Thurs	Friday
# ER Before					
#ER After					
Walk Time					
Walk Quality					
Nap Time					
Nap Quality					
Notes					

Winter Inquiry Walk Data

Date	#ER	w time	w qual	n time	n qaul
1.31.20	2	30	2	90	3
2.3.20	1	60	3	100	3
2.4.20	1	30	2	90	3
2.5.20	1	45	3	90	3
2.6.20	2	30	2	90	3
2.7.20	2	30	2	90	3
2.10.20	1	45	3	90	3
2.11.20	1	30	3	60	3
2.12.20	0	40	3	120	4
2.13.20	1	30	2	90	3
2.14.20	1	45	3	120	4
2.18.20	1	45	3	120	4
2.19.20	0	60	4	105	4
2.20.20	0	45	3	120	4
2.24.20	1	30	4	105	4
2.25.20	2	30	3	90	2
2.26.20	1	30	3	75	2
2.27.20	0	45	3	120	4
2.28.20	1	45	4	90	3
3.2.20	0	60	3	120	4
3.3.30	0	45	3	90	3
3.4.20	0	60	4	120	3
3.5.20	2	30	4	75	2
3.6.20	1	45	3	120	4
3.9.20	0	45	4	90	3
3.10.20	0	45	3	90	3
3.11.20	2	30	3	90	4
3.12.20	0	45	4	120	4
3.13.20	1	60	3	120	4
Average	0.86	41.72	3.07	99.66	3.31

Summer Inquiry Walk Data

date	temp	#ER	w time	w qual	n time	n qaul	total time
8-Jun	45	0	10	2	45	2	90
9-Jun	55	0	60	3	105	4	150
10-Jun	55	1	0	1	105	4	120
11-Jun	80	2	60	3	60	2	210
12-Jun	85	0	30	3	90	3	270
15-Jun	60	0	90	3	0	0	240
16-Jun	55	1	0	1	60	3	60
17-Jun	50	1	0	1	105	5	30
18-Jun	55	0	40	3	120	4	90
19-Jun	70	0	30	3	90	3	240
22-Jun	75	1	90	3	60	2	300
23-Jun	75	1	60	3	90	5	300
24-Jun	90	0	0	1	105	5	300
25-Jun	70	0	60	3	90	3	300
26-Jun	75	0	60	4	105	4	300
29-Jun	50	0	30	3	90	3	60
30-Jun	55	0	30	3	75	3	240
Jun-31	55	0	15	3	90	5	240
1-Jul	65	0	60	4	90	3	300
6-Jul	65	0	15	3	90	3	300
7-Jul	65	0	45	3	90	3	240
8-Jul	70	0	0	1	90	3	300
9-Jul	65	1	30	4	75	2	300
10-Jul	65	0	30	3	90	3	270
13-Jul	65	0	30	4	75	2	240
14-Jul	65	0	30	3	90	3	240
15-Jul	75	0	30	3	90	4	240
16-Jul	75	0	30	4	90	3	240
17-Jul	75	1	30	3	90	4	240
Average	65.69	0.31	34.31	2.79	84.31	3.21	222.41

APPENDIX G

WALK / NAP RUBRIC

Number Ranking	Walk	Nap
1	No Walk	No Nap
2	Unsuccessful walk, students were fussy or uncomfortable, challenging weather, or challenging behavior. Everyone feels stressed.	Unsuccessful nap many students do not go down easily or wake early. Fussing wakes sleeping students, everyone gets up either early or doesn't go down.
3	Average walk, good exercise, nature experiences, student and teacher engagement average.	Average nap, easily nappers rest well, and some students rest with extra support
4	Above average walk, beautiful weather, high teacher and student engagement, exciting nature experiences, a special day.	Above average nap, students rest easily and awake refreshed with minimal teacher support.
5	Perfect or Idealized Walk, a Unicorn	Perfect or Idealized Nap, a "Unicorn"