Imaginative Approaches to Science Education

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Abstract
Can an outdoor education curriculum promote environmental awareness and address the needs of children from diverse backgrounds? In what ways can a science curriculum founded in environmental awareness engender inclusivity and help students embrace the idea of life-long learning? Drawing from many different outdoor education curricula and current “best practices,” my research shows the overwhelming need for positive experiences in nature. It is through the use of natural curiosity and wonder that children can develop pro-environmental habits of mind. When a child sees snow melting into a drain on the side of the road they begin to question where that water is going and the impact the chemical residue left on the road may have on its final destination. Environmental stewardship comes from positive experiences in the natural world and a clear understanding of how each and every ecosystem is interconnected. The primary part of my project is a 5th grade curriculum, which aims to encourage exploration and student driven inquiry in order to better understand the world and its systems and to develop a love of learning and the natural world.
Introduction

The average American child only spends about seven minutes playing outside per day (Sampson). Instead, children are spending the majority of their non-school time indoors and locked into their electronic devices. This negatively affects their health, and since the health of our planet and the health of our children are deeply interconnected, it also affects how they interact with and care for the environment. It is critical that we find the time to help children reconnect with nature and connect with their curiosity and imaginations.

At any age, nature has the power to inspire. Developmentally, childhood is a time where imagination runs rampant. In order to foster children’s innate capacity for creativity and wonder, it is critical that we encourage them to explore their environment, get outside and investigate. There is a gap between the classroom and “traditional” field trips. My curriculum for any educator allows teachers and outdoor educators to bridge that gap. It also offers specific ways to encourage curiosity and develop critical and creative thinking skills. Central to my vision of finding learning experiences that offer children the joy of imagination, I believe it is also imperative that we look at nature centers and parks as classrooms that enhance a child’s ability to learn and grow.

An attitude of wonder and sense of mystery have the power to open the senses to what is around us. When we wonder, we are curious. When we wonder our curiosity awakens us to the energy of the world and encourages us to explore its mysteries.

Children are naturally curious and have an almost inexplicable interest in what makes things work. The natural world offers children a platform, a model, and an arena from which to observe, collect information, and, most importantly, learn to ask questions. I have found that the seemingly unending organic wonder of nature sparks curiosity in the children I work with, and
encourages them to understand that learning and asking how and why questions are foundational to a life of creativity and discovery.

Critical to becoming well-educated and healthy are developing lifelong positive habits of mind—critical thinking, intuitive learning, and an awareness that human beings are an integral part of the natural world.

The most beautiful experience we can have is the mysterious. It is the fundamental emotion, which stands at the cradle of true art and true science. Whoever does not know it can no longer wonder, no longer marvel, is as good as dead, and his eyes are dimmed. Albert Einstein 1931

Introduction to Curriculum

My environmental education curriculum begins with lessons that frame how to ask thoughtful questions and how to design a scientific methodology. It is in initiating and cultivating conversations about how and why it is important to ask questions that will equip students with the habits of mind and skill sets to think about what they perceive and learn from the world around them in a careful and meaningful way. The scaffolding provided in lessons 1-5 will encourage students to think creatively and take intellectual risks. The following subsections provide a brief overview and analysis of each section of my curriculum.

The lessons are divided into four parts with the intent being that the curriculum follows the progression of a typical school year in the U.S. (introductory exploration/framework, fall, winter, spring). Each season during the school year offers a unique landscape to view and interact with the natural world. With this in mind, the lessons in my curriculum are meant to provide educators inspiration for using the environment as the framework and natural materials as the tools to aid in the process of discovery and learning. It is important to note that the lesson plans and resources included in my curriculum are meant to serve as a supplement to a school’s
science curriculum and as a way to bridge the gap between outdoor educator and classroom teacher.

**Lessons 1-5**

Lessons 1-5 are designed to lay the groundwork in the classroom for a trip to an outdoor education center, they can also be condensed and consolidated to meet the needs of students at outdoor education centers. In addition, lessons 1-5 can be modified depending on the setting of a school, needs of the students, and time constraints.

Lessons 1-5 provide a cognitive framework and content background for students. It is possible that if you are an outdoor educator (as distinct from the classroom teacher) you may not have the time necessary to provide in-depth scaffolding on how to ask thoughtful questions or how to design a plan of action to think through possible solutions to those questions. If that is the case, you can take the format and questions provided in lessons 1-5 and consolidate essential information into a brief mini lesson/discussion before starting the exploration process. By asking students to think carefully about the purpose of asking questions and hypothesizing solutions, students will be more aware of how they record observations and inquire about their surroundings.

Another possible solution to the issue of potential time constraints could be a partnership with the classroom teacher(s). Contacting the classroom teacher prior to student visits can help outdoor educators better understand how to construct an effective lesson plan, including differentiating the lessons and accommodations for specific students. In the resources section, there are pre- and post- questionnaires that can assist outdoor educators with connecting with classroom teachers and collecting information about how to tailor their lesson plans to the specific needs of students visiting an outdoor education center.
Lessons 6-10: Fall
Lessons 6-10 address how changes in weather and season affect plant and animal life. Through self-guided exploration, hands-on experiments, and whole group discussions and readings, students will begin to better understand chemical and biological shifts that occur during the fall season. Building on lessons 1-5, students will be able to think carefully and build on their previously developed inquiries regarding the world around them. Students will continue to practice asking meaningful questions and problem solving possible solutions.

The world around us offers many opportunities to delve deeply into learning experiences. Inquiries into what students can physically see often can translate into questions about the unseen as well. As is apparent, throughout lessons 1-5, students are given time to think about broad questions that could turn into specific and pointed questions.

Lessons 10-14: Winter
Winter awakens the senses with the brisk, cool air and allows students to think about chemical changes in water, the water cycle, and what could lie beneath the surface. It is in the discomfort of the chilly air that a student might wonder, “how do other creatures survive this weather?” or “where does all that ice and snow go when it melts?” A student’s inquiry into snow melt might lead into an inquiry into where do the chemicals spread over the road go when the water washes it away. These types of connections are critical to the concept of becoming a steward of the environment.

Lessons 10-14 create a platform for children to explore a variety of questions. The overarching “guided” central questions are general. They are general in order to allow for specific student questions to shine through uninhibited by traditional “comprehension” type questions. More specific questions emerge from student led discussions so that they are better
able to follow their interests and inquiries, as well as to let students know that their questions and ideas are highly valued.

**Lessons 14-19: Spring**

Spring offers a vibrant background for exploration and wonder to occur naturally. With the blooming of flowers, the melting of snow, the abundance of rainfall, and the emergence of green leaves, the spring-focused lesson plans encourage dissection of plants, connections between the previous seasons and spring, and a process focused discovery of the chemical, biological, and physical changes that are both seen and unseen.

**Overview and Energizers**

Each lesson is designed to be exploratory. While students (and educators) could be accustomed to highly structured lessons, this curriculum begins by giving and then taking away structure. In the first few lessons, educators model and help student practice how to ask meaningful questions, design and implement scientific inquiries into questions, and argue for or against possible solutions based on their experiments. This free form, yet guided explorative approach allows students the opportunity to think creatively about how to problem solve and delve deeply into thinking about the world around them.

Long-term learning targets located at the top of every lesson plan are meant to provide a common framework for each lesson. This thread throughout the curriculum focuses on certain goals that are central to the learning and thinking process, as well as to develop a love (and eventually a stewardship) of the natural world.

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**Philosophy of Education**

I believe that all children learn, achieve, and grow intellectually and emotionally if they are equipped with the right cognitive tools. By helping students find internal motivation and wonder,
students can explore, interact, and delve deeply into problems and create or investigate possible solutions to those problems. Finding internal motivations for the learning and thinking process, students can grow their critical thinking skills and realize that being a life-long learner is an invaluable skill to have.

Collaboration, community, commonly understood student and teacher goals, clear expectations and developing critical and creative thinking skills are essential components of an engaging and powerful learning experience. Through the use of dynamic, meaningful and challenging work both in and outside of school, students can engage the process of self-discovery and become self-sufficient and caring members of a community.

It is not easy to prepare children for the rapidly moving and changing world they will inherit, but it is important to engender confidence and an understanding that no problem is insurmountable. Schools and educators can empower students by collaborating with them to find the knowledge and skills they need to be successful.

Co-constructing with students a learning environment that suits the needs of all learners and respects differences in a safe and secure way will help students take risks, be confident, learn in a social context, and develop social and emotional intelligence. Above all, if students learn how to manage their moods and stay mindful they will have the opportunity to be successful in our rapidly changing world.

Motivation

Since our rapidly changing world includes human imposed climate change, we need future generations to care for and about the environment. Science curricula and environmental education play a critical role in how children approach environmental issues, engage in
conservation-related social change efforts, and encourage others to engage in environmentally friendly practices.

There are many different approaches to science education in public and private schools as well as outdoor education and nature centers. Many current science teaching practices that educators use to treat the natural world and environmental efforts are abstract—often focusing on exotic animals and places far away from the child’s immediate world. In addition, the “typical” science related information presented to, and discussed with, children often pertains to current crises and impending potential “apocalyptic” events. How does the seeming current emphasis on the “gloom and doom” narrative of science curricula in schools affect children’s ability to engage in conservation and become future stewards of environment? What needs to be present in effective science curricula to promote stewardship of the environment and a love of the planet? How can the science education standards, like the Next Generation Science Standards, play a role in a free form, exploration based curriculum?

“Gloom and doom” science facts about melting ice caps, dying polar bears, and deforestation in the Amazon in the general media influence science curricula and can create a sense of anger, sadness, and fear, which then can lead to feelings of helplessness. In a study in “Children’s Environmental Concerns,” the author, Susan Strife, suggests that when asked about environmental issues, children demonstrate signs of anxiety and worry about the health of the planet. Strife cites a 2003 study done by Barratt and Hacking where they asked eleven and twelve year olds about how they felt about conservation efforts. Most of the participants felt “incapable of making positive impact even though they care” (38).

In Beyond Ecophobia, Sobel illustrates the struggle between not “shielding” children from the truth about climate change and other environmental crises and, at the same time,
wanting to maintain a sense of hope and wonder. “If we fill our classrooms with examples of environmental abuse, we may be engendering a subtle form of dissociation” (Sobel 4). In “Significance of Perceived Social Expectations to Conservation Education,” authors, Lo, Chow, and Cheung comment on how negative fear tactics influence environmental messages and how those messages were received by the public. They say, “rather than creating positive responses, messages based on impending ecological crisis and tragedy might even make people feel powerless and disengaged” (Fien et. al 2009; Moser 2007).

Students who present feelings of sadness, anger, and fear also demonstrate a sense that environmental issues are insurmountable. Children in both the Barratt and Hacking study (2003) and Strife’s study “Children’s Environmental Concerns: Expressing Ecophobia,” mention that they felt extremely frustrated with the general public and adults, in general, in regard to a lack of effective environmental action. The following quotes taken from Strife’s study on how children perceive environmental issues from four children between the ages of ten and eleven illustrate their frustrations with adults’ inaction with climate change and their feelings of helplessness.

“… you adults are always telling us you want to be here to help…and fix it for us…then do it! Now is your chance” (Anna, age 10)

“I feel sad because when I die, I am probably gonna have a grandson or great grandson by then and maybe their son or nephew is going to experience the end of the world” (Connor, age 11)

“I am scared because the ozone, and if it gets bad, then the solar system and outer space might suck all the air out…And because the sun is coming in, and if Antarctica’s ice melts, we will all drown” (Miguel, age 10)

“I feel helpless when people are talking about it (global warming) because mostly I am just at school, and I know I am a little too young to help right now” (Cliff, age 11)

Research has shown that encouraging children to voice their environmental concerns and having faculty that are willing to talk about what is important to them, will begin to create a sense of independence which informs their ability to enact change and make the planet a better
place. When children understand that their voice matters, they develop a sense of value and are more likely to pose possible solutions, problem solve, and think critically about the world around them. The results from Susan Strife’s research in “Children’s Environmental Concerns: Expressing Ecophobia” show that “Eighty-two percent of children expressed environmental concern when asked how do environmental problems make you feel” (42). More specifically, children mentioned the following areas as a cause for severe concern; “destruction of nature (56%),” “global warming (38%),” “air pollution (38%),” and “killing animals (38%)” (42).

Issues raised by children should be at the heart of how we approach creating a curriculum and how to help children with better understanding their local environment.

In addition to talking to students about their environmental concerns, Susan Strife and her team of researchers on the “Children’s Environmental Concerns” study asked children to draw representations of earth 100 years from today. Below are a few examples of children’s drawings of the earth 100 years from now.

From left to right: Miguel depicts the ozone burning the earth; Cory draws the world if we do something about climate change versus if we do not; Cliff depicts the world flooding with ice that has melted.

The tragic ways that 10 and 11 year olds perceive an apocalyptic vision of the world is indicative of the fear-causing information they hear both home and school. The emotional weight associated with fear about climate change can be too much for young children to bear and can
cause feelings of helplessness. The apocalyptic nature of their drawings reflects the apocalyptic messages that environmental education efforts tend to send.

On the United States Department of Agriculture website under “About Conservation Education” the first education theme is “Climate Change” (“Educator’s Toolbox”). While this is an important topic to discuss with children and educate young people about, it does not need to be a central focus for younger grades (Pre-K through 4th). It is not developmentally appropriate to burden children with the vast and all-encompassing nature of climate change. If exposed early on to horrifying and seemingly hopeless facts and figures on the future of the Earth, students will become apathetic to the situation. Instead of leading with the fearful drama associated with apocalyptic environmental information, we could gradually increase information about the dramatic impact of climate change.

In my 5th grade environmental science curriculum, the lessons offer students positive experiences in nature and encourage them to follow their natural curiosity. Developmentally, 5th graders have become accustomed to managing concrete information, but, at the same time, they are increasingly better able to handle abstractions. In order to adapt curricula for this age group that is rapidly changing developmentally, educators could draw from the organic joy and wonder that arises in students exploring the natural world.

Also, instead of teaching about abstract climate change halfway across the globe, educators in elementary education need to consider more concrete and meaningful local efforts to improve the environment. Sobel writes that there is a tendency in current methods in science education to promote “premature abstraction” for students in early grades (13-15). Sobel suggests that educators look at the larger framework of the relationship between the natural world and human development (14).
Educators can look at the relationship between age and developmental stages and how children perceive the world by looking at their drawings of maps so that teachers can make science education appropriate. Between ages four and seven, children will often draw their homes, backyards, and natural and human made elements that are within sight and earshot of their houses. During middle childhood, ages eight through eleven, children depict “explorable landscape” (Sobel 14-15). Their geography expands beyond their homes to the larger framework of their city, town, and neighborhood. In those drawings, their homes tend to be small and not as detailed. Later in childhood, ages twelve to fifteen, their maps become more abstract and take on a broader scope with a significant more emphasis on social gathering spaces (like the mall, restaurants and friends’ homes) (Sobel 15). This demonstrates the developmental progression from concrete to more abstract thinking. Children in 5th grade are developmentally at an age that is directly between abstract and concrete thinking. I am particularly interested in this “in between” developmental stage and have created a curriculum that bridges fact and abstraction by utilizing the outdoors.

Positive external social pressure can impact children’s feelings and attitudes towards environmental awareness. The teaching and learning process as it pertains to environmental education (and all education really) is a social experience. In my curriculum it is important that students and teachers co-construct an environment and learning space based on what students find most important in their lives. By channeling that interest and community energy into conservation efforts, a student’s social learning environment can begin to positively impact how children attempt to problem solve local environmental issues. In Lo, Chow, and Cheung’s “Significance of Perceived Social Expectation and Implications to Conservation Education: Turtle Conservation as a Case Study,” students who encourage one another to participate in
conservation efforts were more likely to contribute time and energy to the turtle conservation cause. The social pressures and expectations of groups meant people were more likely to “contribute financially, do voluntary work, and encourage others to boycott turtle products…” (904).

The way people perceive wildlife and how they interact with wild creatures and plant species has drastically changed over time. The internet, with quickly and readily available information about far away endangered species, can create a disconnected view of conservation and science knowledge. With the continual growth of urban areas and a dramatic decrease of natural spaces, humans have become more separate from the natural environment (Mbugua 60). Urban schools in particular struggle to connect children to nature. Children learn about endangered species and far away places on the Internet, but sometimes this disconnects them from their local natural world. As Sobel writes, this phenomenon creates a “strange kind of schizophrenia” (5). For this reason, a science curriculum should focus on cultivating learning experiences about local issues in the local environment.

Children cannot develop the “pro-environmental” (Strife 31) behaviors discussed in previous paragraphs without implementing intentional experiences in the natural world. For example, at Echo Hill Outdoor School on the Eastern shore of Maryland, children from inner city Baltimore schools were completely surrounded by nature and as a result developed positive experiences. Unfortunately, most students do not have access to outdoor schools like Echo Hill and funding for overnight trips in the natural world, particularly in education, have been cut. My 5th grade science curriculum is designed to create outdoor learning experience regardless of location and/or experience of the educator.
More positive representations, drawings, and reflections by children about environmental issues are often associated with a child’s ability to see solutions. Solution-based educational approaches to science education can empower children and help them feel more optimistic about the future of the natural world. Strife states children’s feelings and concerns impact “lifelong environmental concerns and behaviors” (51). Therefore, having a positive outlook on the future of our planet can translate into future stewardship of the planet. Encouraging children to problem solve and see possible solutions for climate change issues will over time have a positive effect on the health of the planet and future environmental policies.

Developing positive relationships with animals and considering animals as “allies” helps children buy into the idea of local environmental concerns. Naturally curious and imaginative, children that personally relate to the earth’s other creatures will be more likely to participate in long term environmental protection efforts (Nabhan and Trimble 77-79). Starting locally, children can examine and explore their local surroundings in order to better understand and take on the perspective of creatures living in their local habitats. Games and learning activities like “Becoming Birds,” where children create wings and take on the role of a bird, and “Tiger Dances,” where children take on the perspective of a tiger by creating dances, featured in Beyond Ecophobia cultivate animal empathy (Sobel 16-17). This kind of empathy is critical for future and current conservation efforts.

Richard Louv quotes Naturalist Robert Michael Pyle in Last Child in the Woods, “What is the extinction of a condor to a child who has never seen a Wren?” (146). This quote demonstrates a clear need for not only a connection to nature, but also a connection to the local environment. Being outdoors and experiencing what is in their own backyards helps children become stewards of their neighborhood, city, state, country, and planet. This slow outward
movement from local to global awareness and action happens over time concurrent with the development of abstract thinking.

It may be problematic that National Parks and human constructed “natural spaces” have closed children off from wild spaces and have instead created spaces where it is “acceptable” to enjoy nature in a particular way. If a child’s experience with nature is always constrained by the limitations of socially acceptable forms of recreation, like hiking or other “sport” activities, then we are hindering their ability to truly connect with their natural, wild environment. Children that are free to explore their surroundings uninfluenced by adults can let their natural curiosity and wonder develop and are able to engage in meaningful experiences in nature. These types of experiences could create future stewards of the environment (Louv 148-152).

Currently, children are spending less time outdoors and more time inside on electronic devices. According to Richard Louv’s *Last Child in the Woods* (146-148) and Sobel’s *Beyond Ecophobia* (5), because children are spending less time outside, they are actually worrying about nature more. These worries, however, do not translate into social action. Because children do not have the opportunity to regularly experience nature, they feel increasingly debilitated. Because of a lack of connection to the environment, there is a decrease in people who are growing up to become conservationists and environmentalists. (Louv 147).

According to Bert Horwood, author of “Outdoor Education and the Schools,” outdoor education is a pivotal component of effective science education. As described by Sobel, Louv, Strife, and Nabhan and Trimble in their work on children, nature, and conservation, Horwood emphasizes being in nature and experiential learning as crucial for developing a deep understanding of the natural world (9-11). By cultivating a love of the environment in
experiential, outdoor education settings, children begin the first step towards becoming agents of social and environmental change.

In the fall, 6th grade students from the Smith College Campus School go to Nature’s Classroom, an experiential education program in Freedom, NH for one week. During this time, the 6th graders not only focus on their science curriculum, but also develop social and emotional skills. Teambuilding challenges, exploration of nature, and creating relationships with their peers and the natural world are key components of this trip. I observed students who, in the classroom, were quiet and reserved, become leaders and dig through the mud when others wouldn’t. In addition to the emergence of unexpected leaders, students on the trip connected to the natural world and disconnected from the electronic world. The transformation was incredible. Students returned to the classroom with a newfound respect for the environment and one another.

Student’s ages 6-18 came to Echo Hill Outdoor School for experiential education programs that include lessons in natural history, science-related information, teambuilding initiatives, and risk-taking. Similar to the Nature’s Classroom experience, Echo Hill Outdoor School integrates whole child education and their classroom science curricula into outdoor experiences and social and emotional learning experiences. For example, children who are studying different types of bodies of water get the chance to immerse themselves (literally and figuratively) in swamps, marshes, creeks, streams, and the Chesapeake Bay. By digging through the different types of mud or sand found along the edge of these water sources, looking closely at the animals and invertebrates living there, and observing species’ behavior, students get a 360-degree view of what they have only been able to read about. The physical experiences in nature are critical components to remembering information and developing a love of the world around them.
Channeling curiosity and wonder into social action is one role of quality science education in schools. For example, at the Smith College Campus School in 3rd grade an exploration of the water cycle began after a group of children began studying snow melt and streams that formed on the playground. This conversation between peers led to a deeper inquiry into the water cycle, clean and dirty water, and where our drinking water comes from. With this in mind, the 3rd grade teachers connected with the art teacher in an effort to utilize multiple modes of self-expression to figure out “where does the water go?” It is moments of student-led inquiry that allows students autonomy and a feeling that they can find solutions to problems (i.e. wasted water). Students mapped out the school building in order to find the places where water can be turned on and off (sinks, water fountains, etc.). They created posters to remind members of the school community to conserve water and posted them in the areas that they found during the map exercise.

During their inquiry, the 3rd graders at the Smith College Campus School used their knowledge of the water cycle and the dilemma of wasted water to create an environmental change campaign. Without being prompted, they devised a plan to help educate others about water consumption and conservation. They created posters to educate other students and faculty members about water use and ways to save water (even taking into consideration the younger members of the community that were not able to read and creating picture instructions). In addition to physical materials, they asked the head of school to consider water-saving measures, like low-flow toilets and automatic faucets. This type of social action from students empowers them and makes them feel like they are making a difference at a local (and more manageable) level. Students in this classroom did not demonstrate the feelings of helplessness outlined in Strife’s case study.
Following children’s interests and inquiries about the natural world should be the first step in any science curricula. In my curriculum, I begin by allowing children to explore the environment around them and create lists of questions that arise in their field notebooks. Using student questions and observations allows students to be autonomous in their learning and explore their interests. With the rise of standards-based curricula and a more “uniform” and “equal” curricula for all public school children, this may prove to be difficult. In order to combat this, I have added certain science education standards to some of the lesson plans. Incorporating student interest and student-led lines of questioning as much as possible is one critical step towards quality environmental education.

Children need to have hands on experiences in their local environments. Going outside helps children see “things in their wholeness” (Crimmel et. al 17). Engaging children in outdoor activities immerses them in the learning and allows for investigative approaches to their surroundings. For example, children can read and discuss swamps within the classroom, but unless they go outside and touch, smell, and interact with swamps, the learning only occurs on one level of the brain (Matre 47). My science curriculum is deeply rooted in the foundation that taking children outside and showing them the power of the natural world, asking questions, and creating observation are critical components to learning science. Taking a multi-faceted approach allows for deeper meaning and understanding to emerge as well as a more concrete understanding of the swamp as a whole. In addition, new inquiries will emerge based on what they smell, feel, and examine in the field (Crimmel et. al 192).

Developmentally appropriate environmental education dictates that children begin by exploring and creating a connection with their local environment. After children have progressed to more abstract thinking, educators can begin to help students construct a more global
perspective on environmental stewardship and differing ecosystems. By creating a concrete and, therefore, developmentally appropriate conservation curriculum in pre-k through 5th grade, educators avoid the pitfalls of “gloom and doom” science education that can lead to feelings of helplessness (Strife 39).

**Explanation**

This curriculum is meant to serve as a connection between outdoor educators and classroom teachers. Each lesson is designed so that it could either be implemented at an outdoor education center or in a classroom setting. The field notebook acts as a consistent thread between lessons implemented in a classroom setting and at the outdoor education center. Depending on when students visit the outdoor school, they may arrive having just started recording observations and practicing question asking or they may be seasoned question askers. The field notebook takes this possible disparity into consideration.

The pre and post questionnaires act as a way for outdoor educators to better understand and prepare for the groups of students visiting the outdoor education center. Each question within the questionnaire serves a distinct purpose. In order to best serve a variety of student populations, outdoor educators need to have a clear understanding of who the students are, what they are interested in and their level of preparation. By asking the right questions about the setting of the school, the number of students in each classroom, classroom habits, prior knowledge and experience with written observation, and accommodations for specific students with learning needs, the outdoor educator can tailor their lesson plans for the needs of each group of students. This will not only enhance the experience of the students, but it will also strengthen the long-term impact of their trip to the center.
What if I don’t have access to natural spaces at my school?

While outdoor space is a necessity for many of these lesson plans, there are accommodations that can be made in order to serve urban schools. Bringing in natural resources to supplement a lack of natural spaces can contribute greatly to connecting children with nature. In addition, the National Wildlife Federation offers helpful solutions for creating natural spaces outside of schools to encourage local plant and animal life (“National Wildlife Federation”).

Each lesson connects to the Next Generation Science Standards (Fifth Grade Science 2009-to-2004 Standards Crosswalk). This is meant to serve as a way for outdoor educators and classroom teachers to have a shared language. A shared language forms connections between educators that not only affects the quality of the learning experience, but also can assist with budgets and funding for class trips to outdoor education centers.

Exploration of Alternate Outdoor Programs

For centuries people have written about, discussed, shared, and taught about the outdoors. Outdoor educators, come at this with two specific main goals in mind: to preserve nature and its inhabitants and to promote stewardship of the environment. These two goals are interconnected, but they are not the same. The articulated goal of preservation asks people to think carefully about how human impact can help sustain and maintain the environment; promoting stewardship requires an inquiry-based approach to learning, planning and purposeful action. For example, when we ask students to think about preservation, we are asking them to consider how human impact has required that we now act as a protector of a certain endangered species. On the other hand, when we promote stewardship, students are asked to become forward thinkers and planners to avoid the impact of humans on the planet. The first approach is reactive and the second approach is proactive.
Currently, the National Park Service, Outward Bound, National Outdoor Leadership School, and The Audubon Society are the most significant contributors to what we consider to be outdoor education. Most of these programs are known nationally for their experiential education components and wealth of programming tools for teachers. In addition to these American programs, across Switzerland, Italy, and parts of Canada, some school models promote the notion of learning outside as the best way to help children succeed and develop critical thinking and practical life skills. Forest kindergarten (stemming from Switzerland) has been adopted as a cutting edge program that takes 5 and 6 year olds outside rain or shine, and on lengthy overnight excursions. What makes these programs successful and how can the U.S. draw upon those ideas in the public education sphere?

The National Park Service (NPS), founded in 1916, promotes scientific exploration and preservation (National Park Service). Across the country, they deliver educational programs to promote wildlife conservation and inform the public about worldwide environmental issues. Looking at their lesson plans and educational materials online, I see two major benefits to their database. The first is the vastness of their reach. National Park Service has a park in every state and has the resources to create a large database of lesson plans for educators to use and draw inspiration from (“Teacher Resources”). The second benefit is the organization of their lesson plans online. Each plan is separated by subject, grade level, and common core standards (“Teacher Resources”). An educator can easily navigate the system and find lessons that suit his or her needs.

Although lesson plans found on the National Park Service website are easily accessible and easy to understand, some of them lack creativity and flexibility. Looking at student interest and inquiry can drive lessons beyond their intended goals into more meaningful conversations.
and excitement about the learning process (National Park Service). While the NPS lesson plans are a great way to find information and ideas (National Park Service), it is important to consider your students and their specific needs and interests rather than following a prescribed plan that doesn’t include open-ended and thought-provoking questions.

Another influential outdoor education organization is Outward Bound. Outward Bound is an adventure-focused program with a clear emphasis on how natural spaces can push teens and adults out of their comfort zone while recognizing the transformative power of nature on individual growth (Outdoor Education Programs). Experiencing raw, relatively wild, natural spaces and personal challenges away from industrialized areas and crowds helps both adults and teens reconnect with who they are, other people and the world around them. Some of the programs in Outward Bound are specifically designed to help struggling teens find emotional balance and self-confidence (Outdoor Education Programs).

According to their website, Outward Bound classifies itself as a “character development school” (Outdoor Education Programs). They are not focused on science curricula, but instead help groups work on communication, teamwork, and leadership skills. By facing fears and challenging oneself, Outward Bound participants develop inter and intra personal skills while also learning survival skills such as, mapping, tent and fire building, and shelter building. As well as Outward Bound, the Colorado based National Outdoor Leadership School has similar goals and values.

Two of the limitations of the Outward Bound and National Outdoor Leadership School programs are cost and availability. Despite the availability of some financial aid, the majority of the programs offered by both Outward Bound and National Outdoor Leadership School are expensive (Outdoor Education Programs). Fortunately, while almost all of their programs cost
upwards of a thousand dollars, there is an effort made in both organizations to make the program available to struggling low-income teens. Unfortunately, the cost and timing of many programs—participants are often away from work for at least 7 days and as many as 12 weeks—limit access. Programs like these become more of a luxury and perpetuate the stereotype that only the white and the wealthy can recreate and utilize the resources of forests and mountain areas.

Other forms of outdoor education can be found in other countries. Forest Kindergarten and Reggio Emilia—nature inspired play and learning experiences—are from Switzerland and Italy respectively (Scheinfeld et. al). These early childhood programs recognize the importance of self-guided learning and exploration through the use of natural spaces and materials. The methods used in these two “outdoor education” programs encourage student reflection and are student interest driven. Educators who follow these methods value children’s ideas and inquiries while simultaneously fostering a love of the natural environment. Similar to Waldorf and Montessori schools, the Reggio Emilia approach to learning cultivates stewardship of shared spaces both inside and out (Scheinfeld et. al).

One significant difference between Forest Kindergarten and Reggio Emilia, Waldorf, and Montessori is that in Forest Kindergarten settings, the children will often take overnight trips outdoors. These types of experiences, while sometimes frightening for parents, help children develop confidence and a connection with nature. Many pre-schools, early childhood centers, and independent elementary schools in the United States have begun to utilize some of the same ideologies and strategies of Reggio Emilia and Forest Kindergarten programs (Scheinfeld et. al). With an emphasis on play and exploration, these types of outdoor education programs have primarily been thought of as only for small children. If we embrace exploration, experimentation,
and play as critical to the learning process for all ages (as I hope to do with my curriculum), it could be extremely beneficial to the mental and intellectual health of the children of all ages in our country.

Conclusion

It is important that teachers establish an atmosphere of respect, appreciation, and love for the natural world. When people create positive early memories of the environment, they are more likely to work towards developing ways to solve problems (Nabhan and Trimble 157). Creating an effective environmental/science education curriculum is challenging and can be time consuming. However, if we continue to help children see the beauty of the natural world and develop an appreciation for what they can do to make a difference in nurturing the environment around them (Chiras 27), then perhaps science/outdoor education lessons can morph into real change and a better understanding of the environment. By utilizing imaginative approaches to teaching and learning and developing ideas from my proposed curriculum, outdoors educators and classroom teachers can forge a partnership to help scaffold a more meaningful science education and connection to nature. It is by understanding and learning to love what is around us, that we can foster life-long learners and stewards of the environment.
Bibliography

Primary Sources:


Secondary Sources:


Curriculum: Imaginative Approaches to Science Education
Britain Scott

“An environment-based education movement—at all levels of education—will help students realize that school isn't supposed to be a polite form of incarceration, but a portal to the wider world” (Louv 226).

*Last Child in the Woods: Saving Our Children from Nature-Deficit Disorder*
This curriculum is meant to serve a variety of educators in a child’s life, ranging from parents, classroom teachers, science teachers, and outdoor educators. For that reason, please use what you find helpful and tailor each lesson to your particular needs and the needs of your students.

Inquiry-based teaching and learning approaches allow students and teachers the opportunity to craft a learning environment that reflects independence, collaboration, and cultivation of critical thinking skills. With that in mind, it is important to recognize how student driven inquiry can elevate student interest and dedication to a certain field of study. In addition, inquiry-based teaching and learning requires a great deal of attention to intentionally crafting foundational learning experiences. Educators are responsible for helping guide student inquiry towards an understanding that is rooted in scientific “truths.” Information that scientific inquiry has proven (i.e. gravity) will help guide students in their own queries.

Following the formal lesson plans you will notice a list of reflection activities and energizers. Developmentally, elementary school age children need moments to release their energy. Utilizing these energizers is a way to help children re-focus while simultaneously enjoying the world around them. In addition, the reflection activities can be used at the conclusion of a lesson. Reflection activities allow students to consider what they learned, how they processed difficult questions, and how they worked together to solve issues (intellectually and socially/emotionally).
Introductory Lessons

Central Question: How do I ask thoughtful questions to pursue new knowledge?

| Asking Questions | 30 minutes | 5th | 1 |

Lesson Learning Objectives:
- Students will be able to think critically about how to ask questions in order to investigate the world around them.
- Students will be able to create a list of questions that further their exploration of the mystery object.

Connections: Throughout this unit, students will ask questions in order to explore personal interests in the field of environmental science and nature exploration. In order to better understand how the world works around them, students will ask questions, pose problems, hypothesize possible solutions, and develop a better understanding of the natural world through investigation and testing.

Student Long-Term Learning Targets:
- Develop and foster curiosity and a mentality of life-long learning
- Help students better understand the natural world and how to ask meaningful questions

Lesson Sequence:

Preparation: Create an anchor chart and label it “Asking Questions.” (Use student questions and input to create the chart) Put unknown object into box or bag that students cannot see through (This object will serve as an exercise to generate thoughtful questions). Gather materials.

Initiation: Draw on students’ prior knowledge from English Language Arts lessons on asking thoughtful questions. Ask students to think back on question words: Who? What? When? Where? Why? and How? Turn and talk: Students will take 1-2 minutes to practice asking questions of the person sitting next to them (about their weekend, commute to school, etc.)
Ask: What is the purpose of a question? As a whole group, create list of reasons why people ask questions on the anchor chart.

Whole Group: As a whole group, pass around the mystery object inside the bag. Allow students to touch the object and ask them not to peak inside. Ask: What kinds of questions could you ask to find out what the mystery object is? Allow 2-3 students to share their questions with the whole group.

Guided Practice: Students will return to their tables. Students may work independently, in pairs, or in groups of three to come up with and write down questions on their post-it about the mystery object.

Summation: Place post-its on the mystery box or near it on a wall to return to. At the conclusion of this unit, students will hypothesize and create a reasoning for what they believe to be in the box. After showing students the object, ask them to reflect on their reasoning and hypotheses.

Materials
- Anchor chart, “Asking Questions”
- Post-its
- Field notebooks
- Pencils
- Markers
- Box or bag (opaque)
- Mystery object

Additional Notes & Student Modifications:

Differentiation:

Next Generation Science Standards:
3-5-ETS1 Engineering Design

3-5-ETS1-1. Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost
Central Question: How can I use what I observe to construct an inquiry into the natural world?

| Initial Exploration | 45-60 minutes | 5th | 2 |

Lesson Learning Objectives:
- Students will be able to generate questions from an exploration of their natural environment.
- Students will create observations and investigate initial inquiries into the landscape around them.

Connections: This lesson will ask students to connect to the lesson on asking questions as well as creating ideas about the natural world. Drawing upon prior knowledge and experiences outside, students will be given the opportunity to simply explore the world around them.

Student Long-Term Learning Targets:
- Develop and foster curiosity and a mentality of life-long learning
- Create a sense of wonder and respect for the world around them
- Think critically about how to investigate and answer questions

Lesson Sequence:

Preparation: Create and print the field notebooks (template found in resources section) and find a space outside for students to safely explore their local environment.

Initiation: Ask students to think back to the asking questions exercise and anchor chart. How do you ask a question that leads to further exploration and investigation? Whole Group: Read aloud (see below). Explain to students that today they will be exploring their local, natural environment outside just like Darwin in What Darwin Saw. Ask students to think of ways to stay safe outside. Have students “popcorn out” their answers to the whole group. Write down answers as they come. After you have created a list, help students narrow down what is most important for being safe (Note: the facilitator can guide this if students have forgotten an important safety rule).

Whole Group: As a group, read aloud and discuss What Darwin Saw: The Journey that Changed the World by Rosalyn Schanzer.

Guided Practice: Students receive their field notebooks and pencils. Ask students to look through their field notebooks and explore the different pages. Explain to students that there are no right and wrong answers in their notebooks. These small books are for them to write down questions, make observations, create drawings of what they see, etc. Just like Darwin they will use their senses to explore and investigate the natural world. Take students outside to explore and record observations and questions in their notebooks.

Summation: Ask students to share what they noticed from their exploration outside. What questions came up for them? In the next lesson, students will begin to think about how to investigate their personal questions and how to find possible solutions.

Materials
- Field notebooks (1 per student)
- Pencils
- Colored pencils
- Clipboards
- Anchor chart, “Asking Questions”
- Markers
- Blank chart paper for safety guidelines
- What Darwin Saw: The Journey that Changed the World, Rosalyn Schanzer

Additional Notes & Student Modifications:

Next Generation Science Standards:

**3-5-ETS1 Engineering Design**

3-5-ETS1-1. Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.

3-5-ETS1-2. Generate and compare multiple possible solutions to a problem based on how well each is likely to meet criteria and constraints of the problem.
**Central Question:** How does closely observing a small section of the natural world help me better understand my surroundings?

| Another (Closer) Look | 30-45 minutes | 5th | 3 |

**Lesson Learning Objectives:**
- Students will be able to create observations based on looking closely.
- Students will be able to think about how their observations are different and the same based on a variety of perspectives (zooming in and out)

**Connections:** Drawing upon previous exploration experiences outside and the question asking activity, students will take a second, closer look at their surroundings.

**Student Long-Term Learning Targets:**
- Develop and foster curiosity and a mentality of life-long learning
- Create a sense of wonder and respect for the world around them
- Think critically about how to investigate and answer questions
- Think about how perspectives change when asked to look closely and consider the benefits of close examination

**Lesson Sequence:**

**Preparation:** Gather all materials necessary, find safe outdoor space, and create small groups for book discussion.

**Initiation:** At each table, place 3-4 leaves, a magnifying glass, and a “Looking Closely…” book. Ask students to read the book together. Once they have finished, ask students to look at the leaves together and create a list of observations. Next ask them to use to magnifying glass to look at the leaves. Ask: What is different about the leaf when you look at it under a magnifying glass vs. looking at it without?

**Whole Group:** As a group, explain that students will take their hula hoop or string circle and examine a small circle of ground. Students will use magnifying glasses and their field notebooks to create questions, observations, and drawings of what is inside their circle.

**Guided Practice:** Students take the necessary supplies (field notebooks, circle, magnifying glass, pencil, clipboard) and find a small area for close examination. Stretching out their circle, ask students to remain in their spot to record for 10 minutes. Ask them to scour every inch of their circle for observations and questions. When the time is up, return to whole group.

**Summation:** Ask students to share what they noticed from their circle. Create a list what is different and the same from their previous exploration of the environment. How and why is it different/similar? By looking closely, what did students notice about the natural world?

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**Materials**

| Field notebooks |
| Pencils |
| Colored pencils |
| Clipboards |
| Small hula hoops or string tied together in a circle (1 per student) |
| Hand lenses or magnifying glasses |
| “Looking Closely” book series, Frank Serafini |

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**Additional Notes & Student Modifications:**

**Differentiation**

**Next Generation Science Standards:**

3-5-ETS1 Engineering Design

3-5-ETS1-1. Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost

3-5-ETS1-2. Generate and compare multiple possible solutions to a problem based on how well each is likely to meet criteria and constraints of the problem.
Central Question: How do I design a plan of action and inquiry so that I can investigate my questions?

Designing an Investigation 30-45 minutes 5th 4

Lesson Learning Objectives:
- Students will be able to think about a clear process in order to investigate their questions and produce possible solutions.
- Students will be able to organize their questions and observations to find an investigative question.
- Students will be able to design a process that will help them throughout their study into an inquiry of their choosing.

Connections: Students utilize prior knowledge from their observations and question asking exercises to help them begin to design their investigation.

Student Long-Term Learning Targets:
- Develop and foster curiosity and a mentality of life-long learning
- Think critically about how to investigate and answer questions
- Organize thoughts and ideas into a process of investigation

Lesson Sequence:

Preparation: Gather all necessary materials. Create anchor chart and title it “Detective Science.” (Use student input and investigation design sheets to create helpful chart) Print and copy investigation design sheets.

Initiation: Questions stem from something we observe. Ask students to share a few observations from their field notebooks. As a class, ask students to come up with a question for each observation (1-2 examples). Ask: After we have our question, what do we need to do in order to find possible solutions?

Whole Group: Generate a list of possible steps that students need to think about and plan for in order to discover solutions to their questions. Create a sample investigation as a whole group (this could be used later in lessons about the water cycle)

Guided Practice: Students will find a place to work with their clipboard, pencil, field notebook, and design sheet.

Summation: Students will continue working on their design sheets in order to better understand how to construct a scientific inquiry into their personal questions. (Note: this will probably be something students continue to work on and modify throughout their investigation)

Materials

<table>
<thead>
<tr>
<th>Field notebooks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pencils</td>
</tr>
<tr>
<td>Colored pencils</td>
</tr>
<tr>
<td>Anchor chart, “Detective Science”</td>
</tr>
<tr>
<td>Investigation design sheets</td>
</tr>
<tr>
<td>Science folder</td>
</tr>
<tr>
<td>1 investigation design sheet enlarged (for whole group)</td>
</tr>
</tbody>
</table>

Additional Notes & Student Modifications:

Next Generation Science Standards:

3-5-ETS1 Engineering Design

3-5-ETS1-1. Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost

3-5-ETS1-2. Generate and compare multiple possible solutions to a problem based on how well each is likely to meet criteria and constraints of the problem.

3-5-ETS1-3. Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.
Central Question: How do I design a plan of action and inquiry so that I can investigate my questions?

Re-Design It 30 minutes 5th 5

Lesson Learning Objectives:
- Students will be able to think about a clear process in order to investigate their questions and produce possible solutions.
- Students will be able to organize their questions and observations to find an investigative question.
- Students will be able to design a process that will help them throughout their study into an inquiry of their choosing.

Connections: Students utilize prior knowledge from their observations and question asking exercises to help them begin to design their investigation.

Student Long-Term Learning Targets:
- Develop and foster curiosity and a mentality of life-long learning
- Think critically about how to investigate and answer questions
- Organize thoughts and ideas into a process of investigation

Lesson Sequence:

Preparation: Gather all necessary materials. Put anchor chart, “Detective Science” up on the wall. Put a blank sheet of paper at every student’s place.

Initiation: Ask a few students to briefly summarize the different parts of the investigations you created in the last science lesson. Turn and talk, tell your partner the importance of designing a plan of action for your investigation.

Whole Group: Explain to students the purpose of today’s activity, to create a work plan that is unique to them. Each student will ignore the teacher template from the last lesson and use the blank sheet of paper to design their own. Basically, make a plan that is better than the other. Ask students to think about why their plan might have a better structure so that they can defend it to anyone who asks.

Guided Practice: Students will find a place to work with their clipboard, pencil, field notebook, and blank piece of paper. Remind students that they are not allowed to use any of the template in their new plan.

Summation: Students will create a new way to investigate their questions. Wrap up this lesson by asking students to look at their new investigation plan side by side with their old one. Which one do they think would be more effective? Ask students to explain to their partner the pros and cons of each one.

Materials

Field notebooks
Pencils
Colored pencils
Anchor chart, “Detective Science” (posted)
Blank pieces of paper
Science folder

Additional Notes & Student Modifications:

Next Generation Science Standards:

3-5-ETS1 Engineering Design

3-5-ETS1-1. Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost

3-5-ETS1-2. Generate and compare multiple possible solutions to a problem based on how well each is likely to meet criteria and constraints of the problem.

3-5-ETS1-3. Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.
Central Question: How and why do leaves fall?

Lesson Learning Objectives:
- Students will be able to investigate why and how leaves fall.
- Students will be able to organize questions, observations, and prior knowledge to help them answer the central question.
- Students will be able to work collaboratively to problem solve and create an understanding of gravitational pull.

Connections: Students will use their observational skills, practiced in previous lessons, in order to create hypotheses and questions about the change in season and how and why leaves fall off of trees.

Student Long-Term Learning Targets:
- Develop and foster curiosity and a mentality of life-long learning.
- Think critically about how to explain how forces in our world work.
- Organize thoughts and ideas to develop and substantiate an argument.

Lesson Sequence:

Preparation: Gather all necessary materials. Set-up a falling leaf simulation (or alternatively, you could take students outside to observe falling leaves). If you take students outside, ask them to notice what the trees are doing and record observations in their field notebooks prior to going outside. Hand out field notebooks, pencils, and clipboards.

Initiation: Activate prior knowledge by asking students: “What happens outside in the fall?” Create a list of student answers—writing down specific phrases or terms that students use.

Whole Group: If you choose to remain inside, either stand on top of a chair and drop a leaf or ask a student to drop a leaf standing on tiptoes. Ask students to utilize the power of observation and write down 2-3 observations in their field notebooks. Students may draw pictures and label what is happening, write down the process, or simply create a description. (Students will have practiced observing and writing observations in different ways prior to this)

Ask students to share their observations with a partner. Next, use thumbs up/thumbs down to take a poll; is the action you just observed something we wrote down on our “list of things happening in Fall?”

Guided Practice: Prepare students for “Guided Practice.” Students will receive two pieces of paper. One sheet will have lines, the other will be blank. Ask students to create a picture diagram of the process that they observed on the blank sheet. On the second sheet, students will begin to think about possible answers to the question, “How and why do leaves fall?” Challenge students to think beyond the answer of “because of gravity” and ask them to think about the question as if they did not know the term gravity existed. (A fun way to challenge students to describe gravitational pull is by asking them to explain it as if they were teaching the concept to an alien)

Summation: Bring students back together as a whole group. Share out ideas and hypotheses.

**Possible follow-up: Collect 3-5 different types/shapes of leaves. In pairs, students can create leaf falling simulation to investigate how different surface areas, textures, or age of leaf affects how the leaf falls. This is also a great way to have students practice creating a written scientific investigation.

Materials

- Field notebooks
- Pencils
- Colored pencils
- Clipboards
- Chair or step stool
- Leaves

Additional Notes & Student Modifications:
Central Question: How and why do leaves change color?

**Lesson Learning Objectives:**
- Students will be able to investigate changing colors in leaves.
- Students will be able to organize questions, observations, and prior knowledge to help them answer the central question.
- Students will be able to problem solve to identify reasons that leaves change colors.
- Students will be able to follow step-by-step directions in order to observe chemical changes.

**Connections:** Students will use scientific inquiry methods (outlined in previous section), to run a series of tests in order to better understand the chemical process that leaves undergo as trees prepare for winter (i.e. loss of chlorophyll in preparation for “hibernation”).

**Student Long-Term Learning Targets:**
- Develop and foster curiosity and a mentality of life-long learning.
- Think critically about how to explain how change in season affect plant life.
- Organize thoughts and ideas to develop and substantiate an argument.
- Formulate ideas about naturally occurring chemical processes.

**Lesson Sequence:**

**Preparation:** Collect all necessary materials. Create small groups for students to work in. In each group, give students one of each of the materials.

**Initiation:** Take students outside. Allow each student to sit near trees and come up with 3 adjectives to describe the leaves. Share with a partner. Prior to going back inside, ask students in groups to take 3 green leaves from the same tree. (Each group can get leaves from a different tree, but within the group, it should be the same tree).

**Whole Group:** Brainstorm ideas regarding central question. Ask students, “Why do leaves change color?” Create brainstorm web as a whole group. Without comments from peers or educator, leave list of ideas up on the wall.

**Guided Practice:** In small groups, ask students to perform the scientific experiment. Ask students to read the instructions carefully and follow along together.

**Summation:** Ask students to leave their jars and coffee filters on their table. Ask students to travel around the room and make notes in field notebooks about what is similar and different about each group’s results. As a whole group, follow up on the brainstorm map created at the start of class. Ask students: What do the colors on the coffee filters tell us about those particular leaves?

**Materials**
- Field notebooks
- Pencils
- Colored pencils
- Water
- Rubbing alcohol
- Clear cups/jars
- Collected leaves from outside (still green)
- Clear plastic wrap
- Rubber bands
- Coffee filters cut into strips
- Bowls or small pans
- Step-by-step instructions (resource section)

**Additional Notes & Student Modifications:**

Source: http://www.education.com/activity/article/Leaves_Change_fifth/
Fall

Central Question: What do you notice?

Ecosystems and Interactions | 30-40 minutes | 5th | Fall

Lesson Learning Objectives:
- Students will be able to investigate their inquiries about the world around them.
- Students will be able to organize questions, observations, and prior knowledge to help them formulate a clearer understanding of chemical and biological shifts in ecosystems.
- Students will be able to problem solve in order to identify changes that occur and why they happen.

Connections: Students will use prior knowledge to carefully consider how the change in season impacts their surroundings and the organisms that live there. Through the power of observation and asking questions, students will formulate inquiries into the chemical reactions and biological shifts that occur during the fall.

Student Long-Term Learning Targets:
- Develop and foster curiosity and a mentality of life-long learning.
- Think critically about how to explain how change in season affect plant life.
- Organize thoughts and ideas to develop and substantiate an argument.

Lesson Sequence:

Preparation: No preparation is required for this activity. You can prepare students for this outdoor exploration by making sure everyone is properly dressed for the weather (jackets, rain boots, sweaters, etc.)

Initiation: Begin by asking students to find a quiet place away from distractions. Ask students to turn to a blank page in their field notebooks. Ask them to answer, “What do you notice?” Students can draw, describe, create lists, word maps, etc.

Guided Practice: Students will find a space to observe. They may move around and explore the space as needed. Ask them to think about the variety of ways students can record observations. Ask students to create a list of questions they have while observing. **If you are in an urban setting, try placing boundaries using cones or natural marker, i.e. trees/bushes.

Summation: Ask students to reflect on a question they had while they recorded observation. Is there anything from your observations that offer answers to your questions. Share with a partner or write a few notes for yourself.

Materials
- Field notebooks
- Pencils
- Clipboard

Additional Notes & Student Modifications:

Differentiation-
Central Question: What’s in your ecosystem?

Lesson Learning Objectives:
- Students will be able to investigate how organisms and plant life interact within an ecosystem
- Students will be able to organize questions, observations, and prior knowledge to help them answer the central question.
- Students will be able to identify and list components of their ecosystem

Connections: Utilizing prior experiences with observation and inquiry, students will create a list (illustrated or not) that helps them begin to think about how each component in an ecosystem interacts with another.

Student Long-Term Learning Targets:
- Develop and foster curiosity and a mentality of life-long learning
- Think critically about how to explain how change in an ecosystem impact a variety of components within that same ecosystem
- Organize thoughts and ideas to develop and substantiate an argument
- Formulate ideas about naturally occurring connections/interactions within an ecosystem

Lesson Sequence:

Preparation: Check out Butternut Hollow Pond by: Brian Heinz from your local library.

Initiation: Read aloud Butternut Hollow Pond. Stop mid-way through and ask students to call out components of the ecosystem in the book. Write down the ideas that they share on a piece of chart paper.

Whole Group: As a whole group, ask students to share their ideas about each aspect of the ecosystem in the book. Ask them to think about the illustrations to help them formulate a list. After you have read the whole book, ask students to look at the list. Ask them to think about connections between organisms and plant life on the list. When a student comes up with a connection have them draw a line with a different color marker to connect them.

Guided Practice: Students will use the world around them to observe and create their own list of components in the ecosystem around them in their field notebooks.

Summation: Ask students to put a star next to components that were also included in the book. Using a different color pencil, ask them to draw connecting lines between components of the ecosystem that rely on one another.

Materials
- Field notebooks
- Pencils
- Colored pencils
- Markers
- Chart paper
- Butternut Hollow Pond, by: Brian Heinz

Additional Notes & Student Modifications:

Note to educators: After implementing this observation-based lesson, you may want to have students create replicas of their ecosystem. You can do this by splitting students into small groups and asking them to collect materials that represent components of the ecosystem. Ask them to creatively think of ways to represent connections between the different components.
Central Question: Who lives there? Who lives where?

Ecosystems and Interactions | 60-75 minutes | 5th | Fall

Lesson Learning Objectives:
- Students will be able to continue to investigate how organisms rely on different parts of their ecosystem in order to survive.
- Students will be able to organize questions, observations, and prior knowledge to help them answer the central question.
- Students will be able to identify and describe animal habitats.

Connections: Students utilize observation skills to determine habitats and survival skills of animals/organisms in their ecosystem.

Student Long-Term Learning Targets:
- Develop and foster curiosity and a mentality of life-long learning
- Think critically about how to explain how changes in season impact the creatures that live there
- Organize thoughts and ideas to develop and substantiate an argument

Lesson Sequence:

Preparation: Post the chart paper and divide it into three sections. Label the bottom section ground, the middle section water, and the top section tree tops.

Initiation: Ask students to think about animals that they have seen in their neighborhoods, parks, etc. Sort the animals into ground, water, or tree dwellers. List the animals that students say and sort them as a group.

Whole Group: What makes a good habitat? Thinking about the list created, what would be a good habitat for ground, water, or tree top dwellers? Ask students to share 2-3 ideas with their partner. As a whole group, have students share out.

Guided Practice: Outside, ask students to observe the animals they see and look around (without disturbing them) for natural habitats. In groups of 2 or 3, have students explore natural materials and creating a sustainable habitat for a local creature.

Summation: Have a “house tour.” Ask students to present their habitats and explain how the habitat suits the animals needs and why they used the materials they did.

Materials
- Field notebooks
- Pencils
- Colored pencils
- Chart paper split into three sections
- Markers (at least three colors)
- Natural/found materials

Additional Notes & Student Modifications:

Differentiation

Note to educators: To connect this lesson to English Language Arts, ask students to take on the perspective of the organism they studied. Thinking about the habitat of that particular organism, ask students to write a story about that animal or from the perspective of that creature. Questions to get them started: How might that animal talk? What does the voice sound like? What are some behaviors that organism demonstrates? How does their habitat shift what they do or say?
Winter

Central Question: What do you notice?

Ecosystems and Interactions | 30 minutes | 5th | Winter

Lesson Learning Objectives:
- Students will be able to investigate their inquiries about the world around them.
- Students will be able to organize questions, observations, and prior knowledge to help them formulate a clearer understanding of chemical and biological shifts in ecosystems.
- Students will be able to problem solve in order to identify changes that occur and why they happen.

Connections: Students will use prior knowledge to carefully consider how the change in season impacts their surroundings and the organisms that live there. Through the power of observation and asking questions, students will formulate inquiries into the chemical reactions and biological shifts that occur during the winter.

Student Long-Term Learning Targets:
- Develop and foster curiosity and a mentality of life-long learning
- Think critically about how to explain how change in season affect plant life
- Organize thoughts and ideas to develop and substantiate an argument

Lesson Sequence:

Preparation: No preparation is required for this activity. You can prepare students for this outdoor exploration by making sure everyone is properly dressed for the weather (jackets, rain boots, sweaters, etc.)

Initiation: Begin by asking students to find a quiet place away from distractions. Ask students to turn to a blank page in their field notebooks. Ask them to answer, “What do you notice?” Students can draw, describe, create lists, word maps, etc.

Guided Practice: Students will find a space to observe. They may move around and explore the space as needed. Ask them to think about the variety of ways students can record observations. Ask students to create a list of questions they have while observing. **If you are in an urban setting, try placing boundaries using cones or natural marker, i.e. trees/bushes

Summation: Ask students to reflect on a question they had while they recorded observation. Is there anything from your observations that offer answers to your questions. Share with a partner or write a few notes for yourself.

Materials

| Field notebooks |
| Pencils |
| Clipboards |

Additional Notes & Student Modifications:

Differentiation:
**Winter**

**Central Question:** *Wait, is anything out there?*

<table>
<thead>
<tr>
<th>Animal and plant life</th>
<th>20-25 minutes</th>
<th>5th</th>
<th>Winter</th>
</tr>
</thead>
</table>

**Lesson Learning Objectives:**
- Students will be able to reflect on what remains during winter months
- Students will be able to organize questions, observations, and prior knowledge to help them answer the central question
- Students will be able to create a coherent set of arguments for why and how organisms are able to withstand colder temperatures

**Connections:** Utilizing their observation and question asking skills, students will think deeply about how the landscape has changed over time and what remains during winter. From previous recorded observations in their field notebooks, students can think critically about the process of changing seasons.

**Student Long-Term Learning Targets:**
- Develop and foster curiosity and a mentality of life-long learning
- Think critically about how to explain how change in season affect life
- Organize thoughts and ideas to develop and substantiate an argument

**Lesson Sequence:**

- **Preparation:** Create square frames with students. These should be sturdy—use cardboard or paper reinforced with popsicle sticks. You can also use the popsicle stick to act as a handle.

- **Initiation:** Ask students to think back to the hula hoop exercise about “Looking Closely.” Read *Zoom* by Istvan Banyai. Ask students how focusing in on one spot on the ground changed their recorded observations? Share out ideas as a whole group.

- **Whole Group:** Introduce the idea that they will be zooming in, but to the world around them. Students will use their frames to focus in on sky, tree-line, or ground. Send students out to record observations.

- **Guided Practice:** Using their frames, students will record their close observations. Ask students to think about their “snapshot.”

- **Summation:** In small groups, ask students to share their “snapshots.” How did perceptions of the outdoors change from student to student?

---

**Materials**

<table>
<thead>
<tr>
<th>Field notebooks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pencils</td>
</tr>
<tr>
<td>Square or rectangular frames (can be cut from cardboard or reinforced paper with popsicle sticks)</td>
</tr>
<tr>
<td><em>Zoom</em> by Istvan Banyai</td>
</tr>
</tbody>
</table>

**Additional Notes & Student Modifications:**

**Differentiation**
Winter

Central Question: Where do ice and snow go when they melt?

| Change in matter/Water cycle | Three 30 minute lessons | 5th | Winter |

Lesson Learning Objectives:
- Students will be able to investigate snow melt and how that affects natural landscapes and regrowth.
- Students will be able to organize questions, observations, and prior knowledge to help them answer the central question.
- Students will be able to work on their problem solving skills to identify where the water goes when it melts.

Connections: Students will utilize prior knowledge about properties of water to better understand the water cycle. This lesson will draw upon collaboration with peers, meaningful question asking, and innovative engineering and problem solving.

Student Long-Term Learning Targets:
- Develop and foster curiosity and a mentality of life-long learning
- Think critically about how to explain how change in season affect water cycles
- Organize thoughts and ideas to develop and substantiate an argument
- Formulate ideas about naturally occurring processes

Lesson Sequence:

Preparation: These lessons are best implemented after snowfall or when snow has been plowed into piles (either way will work). Collect necessary materials for each lesson.

Lesson 1/3
Initiation: Walk around outside. Ask students to find a patch of snow or where water might be draining. Record observations in their field notebooks.

Whole Group: In small groups, ask students to share what they notice and to record any questions that come up about their observations.

Guided Practice: Ask students to reflect on their observations and record follow-up questions. At the end of this lesson, ask students to consider the central question: Where do ice and snow go when they melt?

Lesson 2/3
Initiation: Ask students to consider, how and why does snow fall? In a drawing ask students to draw what is happening when snow falls. Where does the snow come from? Where does it go?

Whole Group: Discuss ideas and ask students to explain their drawings (rationale, etc.) Work through ideas as a group and come up with a collaborative explanation. Guide students using prior knowledge and experiences with snowfall.

Guided Practice: In their field notebooks, ask students to go back to their drawings. Is there anything specific they left out and need to add? Ask them to make their adjustments as needed.

Lesson 3/3
Initiation: Ask students when a drop of water melts and begins its journey, where does it go?

Whole Group: Lay out maps of the local area with the water shed clearly defined. Talk with students about the concept of a water shed and why the water shed is defined the way it is. Considering their knowledge of gravity, ask students where a drop of snow melt water would go if it dropped within the water shed? Outside the water shed?

Note: This will work best if students have had some experiences with maps.

Guided Practice: In their field notebooks, ask students to write a story titled “Snow Melt: The Journey of the Water Droplet” (Note: you can tie this in with a writing lesson about perspective and voice)

If there is time, you can ask students if anyone would like to read their stories aloud to the class.

Materials

<table>
<thead>
<tr>
<th>Field notebooks</th>
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</thead>
<tbody>
<tr>
<td>Pencils</td>
</tr>
<tr>
<td>Colored pencils</td>
</tr>
<tr>
<td>Snow/ice</td>
</tr>
<tr>
<td>Map of local water shed (different kinds: topographical, geological, etc.)</td>
</tr>
</tbody>
</table>

Additional Notes & Student Modifications:

Differentiation-
Spring

Central Question: What do you notice?

Ecosystems and Interactions | 75-90 minutes | 5th | Spring

Lesson Learning Objectives:
- Students will be able to investigate their inquiries about the world around them.
- Students will be able to organize questions, observations, and prior knowledge to help them formulate a clearer understanding of chemical and biological shifts in ecosystems.
- Students will be able to problem solve in order to identify changes that occur and why they happen.

Connections: Students will use prior knowledge to carefully consider how the change in season impacts their surroundings and the organisms that live there. Through the power of observation and asking questions, students will formulate inquiries into the chemical reactions and biological shifts that occur during the spring.

Student Long-Term Learning Targets:
- Develop and foster curiosity and a mentality of life-long learning
- Think critically about how to explain how change in season affect plant life
- Organize thoughts and ideas to develop and substantiate an argument

Lesson Sequence:

Preparation: No preparation is required for this activity. You can prepare students for this outdoor exploration by making sure everyone is properly dressed for the weather (jackets, rain boots, sweaters, etc.)

Initiation: Begin by asking students to find a quiet place away from distractions. Ask students to turn to a blank page in their field notebooks. Ask them to answer, “What do you notice?” Students can draw, describe, create lists, word maps, etc.

Guided Practice: Students will find a space to observe. They may move around and explore the space as needed. Ask them to think about the variety of ways students can record observations. Ask students to create a list of questions they have while observing. **If you are in an urban setting, try placing boundaries using cones or natural marker, i.e. trees/bushes

Summation: Ask students to reflect on a question they had while they recorded observation. Is there anything from your observations that offer answers to your questions. Share with a partner or write a few notes for yourself.

Materials

<table>
<thead>
<tr>
<th>Field notebooks</th>
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</thead>
<tbody>
<tr>
<td>Pencils</td>
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</tbody>
</table>

Additional Notes & Student Modifications:

Differentiation-
Spring

**Central Question:** How do different parts of an ecosystem fit together?

| Ecosystems and Interactions | 20-25 minutes | 5th | Spring |

NOTES: Look at the middle, bottom, top—tree line challenge and moments of mindfulness

**Lesson Learning Objectives:**
- Students will be able to better understand how an ecosystem is interconnected
- Students will be able to organize questions, observations, and prior knowledge to help them begin to answer the central question.

**Connections:** Utilizing student interest and prior lessons pertaining to observation, students will be able to gain more experience with written observation.

**Student Long-Term Learning Targets:**
- Develop and foster curiosity and a mentality of life-long learning
- Think critically about how to explain how ecosystems are interconnected
- Organize thoughts and ideas to develop and substantiate an argument

**Lesson Sequence:**

- **Preparation:** No preparation necessary.
- **Initiation:** Ask students to find a quiet spot where they can sit comfortably for 15 minutes.
- **Whole Group:** Begin by asking students to look closely at the tops of the trees. Ask students to observe and record observations (draw, narrate, list, etc.) for 5 minutes. Give students a signal when time is up. Next ask students to closely observe the middle of the trees and plants. Ask them to record observations. Give students a signal when 5 minutes have passed. Lastly, ask students to take a look at the ground level. What do they notice about the earth around them? Ask them to record observations for 5 minutes. Give signal for the final time.
- **Guided Practice:** On their own or with a partner ask them to make notes about the differences between each of these locations. How were they different and how were they similar?
- **Summation:** In pairs, ask students to make connections between them. Have them make a note next to two that seem to be connected. What do they notice about those connections? Divide the class into 3 groups. Roll out a sheet of large paper (butcher paper works best)—so that everyone can work comfortably around the same piece of paper. Have 1 group of students take the top, one take the middle, and one take the bottom layer. Ask them to recreate the environment in a drawing. Working together ask students to connect their drawings.

**Materials**
- Field notebooks
- Pencils
**Spring**

**Central Question:** What do we notice about form and function when we take a closer look?

**Ecosystems and Interactions | 45-60 minutes | 5th | Spring**

Lesson Learning Objectives:
- Students will be able to investigate the structure of leaves.
- Students will be able to organize questions, observations, and prior knowledge to help them answer the central question.
- Students will be able to look closely and make hypotheses in order to figure out possible solutions to the central question.

Connections: Using the observational skills from the previous lesson, students with zoom in to take a look at how even at a micro level form impacts function.

Student Long-Term Learning Targets:
- Develop and foster curiosity and a mentality of life-long learning
- Think critically about how to explain how form and function are connected
- Organize thoughts and ideas to develop and substantiate an argument

Lesson Sequence:

**Preparation:** Collect all necessary materials. If possible, go on a nature walk and collect leaves with the students. Ask students to collect 3-4 big leaves that are not dried out.

**Initiation:** Ask students to think about what has happened when they take a closer look? What do they notice when looking closely that they might not have noticed before?

**Whole Group:** As a whole group, explain to students that they will be using the leaves they collected to see what they can investigate about form and function. Explain all directions before allowing students to begin the exercise.

**Guided Practice:** First, students will use the magnifying glass to examine their leaves. Using their field notebooks they will create a list of adjectives describing their leaves. Next, students will take the crayons and the plain paper to create leaf rubbings. Ask students to compare their leaf rubbings and the actual leaves. What can they see from the leaf rubbings that isn’t clearly defined on the leaf itself? Lastly, students will use the transparency paper to trace the “veins” in the leaves. (Suggestion: taping the leaf onto the table and taping the transparency paper over the leaf will help to hold them still).

**Summation:** As a whole group, use the projector to display the transparency paper leaves and the leaf rubbings. Ask students to think about how the form serves the function. Students will draw upon their prior knowledge of the anatomy of leaves, to come up with solutions to the connection between form and function.

<table>
<thead>
<tr>
<th>Materials</th>
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</thead>
<tbody>
<tr>
<td>Field notebooks</td>
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<tr>
<td>Pencils</td>
</tr>
<tr>
<td>Colored pencils</td>
</tr>
<tr>
<td>Leaves</td>
</tr>
<tr>
<td>Transparency paper</td>
</tr>
<tr>
<td>Transparency markers</td>
</tr>
<tr>
<td>Crayons (unwrapped)</td>
</tr>
<tr>
<td>Plain Paper</td>
</tr>
<tr>
<td>Magnifying glass</td>
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</tbody>
</table>

Additional Notes & Student Modifications:
Spring

Central Question: What do you hear?

| Animals and Adaptations | 20-30 minutes | 5th | Spring |

Lesson Learning Objectives:
- Students will be able to begin to investigate how animals have mechanisms for survival
- Students will be able to organize questions, observations, and prior knowledge to help them answer questions about adaptations
- Students will be able to work on their problem solving skills to identify possible beneficial characteristics and why certain animals might possess them

Connections: Students will use their senses and keen observational skills to explore animal survival skills.

Student Long-Term Learning Targets:
- Develop and foster curiosity and a mentality of life-long learning
- Think critically about how to explain how change in season affect plant life
- Organize thoughts and ideas to develop and substantiate an argument

Lesson Sequence:

Preparation: Collect necessary materials.

Initiation: Ask students to think back to the lesson on habitat. How do animals utilize natural materials to create habitats? What are habitats used for?

Whole Group: Discuss with students how animals have physical characteristics that help them to survive. Ask students to share examples of how certain animals use their bodies for different things. (i.e. a fish uses its gills to breathe under water)

Guided Practice: Explain to students that they will be using one of their senses to test how animals use their ears. Ask students to first stand still and close their eyes. Allow them 1 minute to listen and hear as many sounds as they can. When the minute is up, ask them to share all the sounds with a partner. Next ask students to cup their hands behind their ears so that their palm is facing forward. Ask them to close their eyes for one minute and make a mental note of all the sounds they hear now. Ask them to turn and talk with a partner to list the sounds they heard. Walking through their environment, ask students to put one hand behind one ear and leave the second ear alone.

Summation: Come back together as a whole group. Ask students: what was the difference between their hearing the first time compared to the second time? Were they able to hear more? Why or why not? Ask students to think about animals with extremely good hearing. Does the shape of their ears reflect the exercise? How does the form match the function? Ask students to think back to the leaf lesson; how is it similar and how is it different?

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<tbody>
<tr>
<td>Field notebooks</td>
</tr>
<tr>
<td>Pencils</td>
</tr>
<tr>
<td>Plain pieces of paper</td>
</tr>
</tbody>
</table>

Additional Notes & Student Modifications:

Differentiation:
Energizers/Brain Breaks: Encouraging Outside Play

1. Run and Scream- This game is exactly as it sounds. Begin in a line. Students take a deep breath and run for as long as they can scream with one breath. Once they run out of air, they stop. (You need space for this activity—best for outdoor educators)

2. Oh Deer!- This activity promotes an understanding of food chains and fluctuations in population. Choose two students to be the deer and the rest will be resources (water, shelter, and food—create a quick and easy hand symbol for each). Resources line up on one side, the deer on the opposite side (with their backs facing one another). Ask the resources to choose which one they will be. Ask the deer to choose which resource they need. (Both should show which resource they chose with the hand motions). On the count of three, both turn around. The deer go and select the resource they chose (only one). Those resources are now deer. Play a few rounds. When there are more deer than resources, some deer may not get what they need. When this happens, they “decompose” and become resources once more.

3. Thai Tree- Ask students to spend a minute observing the trees around them. Ask them to notice the movement at the top, middle, and bottom. Share out a few observations. Ask students to firmly plant their feet about shoulder width distance apart. This is their root system. Then ask them to lengthen their spine and reach their arms towards the sky. Students emulate the trees around them. Swaying in the wind and taking deep cleansing breaths. (This is a great activity for taking a break for mindfulness)

4. Match it up (play dough prints)- Students pair up and receive a small chunk of play dough. In partners, one student goes and makes an imprint with the play dough. When the student brings the print back, the other student must try to match up the print with the object.

5. Nature paintbrushes- Using clothespins and natural materials (pine needles, leaves, grasses, etc.) Clip the natural materials into the clothespin and use them as paintbrushes.

6. Sensory Walks- Take a few minutes to focus on each sense. Using their sense of sound, ask students to cup their hands behind their ears to enhance their hearing. What do they notice? For touch, ask students to find different textures on the walk. Share some descriptive words or phrases with a partner. For sight, ask students to look closely at bark, leaves, etc.

7. I hear, you see (one child is the ears, one is the eyes)- In pairs, one student is blindfolded and the other one leads them on the walk. Ask the blindfolded student to pay close attention to what they hear or smell. Then switch.

8. Helium hoop- Have students stand in a small circle around a hula hoop. Each student must place two flat fingers under the edge of the hoop. Give them the task of raising and lowering it evenly to certain points (ex: shoulder height, knee height, etc.)

9. Color match (paint chips)- Give each student three paint chips, ask them to find that color in the natural world.

10. Look up, look down (observing the upper, middle, and lower parts of the earth)- Take a walk and ask students to keep their eyes on the sky. How does that change their perspective of the world around them? On the walk back, ask them to look down at the ground. What is different? How did this
way of looking at the world change what they noticed?

11. Sky walk (a “closer” look at clouds)- Ask students to lie on their backs and take 10 minutes to observe the clouds.

Active Learning Techniques for Reflection (any of these can be turned into outdoor activities)

While working in classrooms and at an outdoor education center, I have come across and learned from many master teachers. These teachers have taught me easy to use techniques for reflection. Reflection is a critical part of the learning process because it cements what children are learning and helps students create and draw connections between the learned material and their lives.

1. Think, Pair, Share
Ask students a thought-provoking question or make a statement to comment on (i.e. Climate change is caused by humans or How does a drop of water get to the ocean?) Give students think time. Allow them to share their thoughts with a partner. Each pair will share their ideas to the whole group.

2. Marker Talk
Write questions, comments, quotes, or thoughts on chart paper or large pieces of paper. Each student will use a different color marker to silently walk around the room and add their thoughts to each question. You can also use chalk and the black top to create a marker talk outside.

3. Gallery Walk
Post pictures. Ask students to go around and put a post-it note with a comment on the part of the picture they find interesting, worrisome, thought-provoking, frightening, beautiful, insightful, etc. (You can use photos of neighborhoods, forests, raindrops, etc. to promote different themes or topics)

4. Turn and Talk
Ask students to discuss their questions, thoughts, comments, etc. with the person next to them. This can be extremely beneficial in larger groups with quieter students.

5. Back to Back, Face to Face
Ask students to stand and find a partner. Students stand with their back facing their partner. Pose a question or series of questions to the students. Allow students some think time. When the teacher says “face to face,” students turn around to face their partner and discuss the question.

6. Fish Bowl
Use a large bowl to collect questions or ideas from students (observations or queries from their observations). Once you have collected a few (or made up your own) have a small group of students create a circle around the bowl. The remaining students will create a larger circle around the small group. Have the inner circle pick a topic and discuss (without interference from the larger group), then open the conversation up to the whole group.

7. Pine Cone Discussions
Give each student 3-4 pine cones (or other small objects that can be tossed). Ask each student to throw a pine cone into the middle every time they make a comment or ask a question. When their pine cones are gone, ask them to wait until everyone else’s pine cones are gone before speaking again.

8. Pick a Picture (Body part, dance move, ice cream flavor, etc.)
Print out many different pictures to put in the center of the circle. Ask the students to pick a picture that reflects their experiences in nature that day. You can also have students express their experience with a body part, dance move, ice cream flavor, etc.
9. Post-it Partners
Ask every student to write one word on a post it that describes their area of interest from that day’s observations. Shuffle the post-its and redistribute them to the group. Without looking, have each student place the post-it on their forehead. Students try to guess the word on their forehead by asking other students yes or no questions.

10. Gratitude Knots
Take a large rope and tie a knot in it to form a circle. Ask each member of the group to put one hand on the rope circle. Move the rope knot around the circle saying “Stop” occasionally. When the rope stops moving, ask the student with the knot closest to them to compliment the group as whole or say something that they are grateful for that day.

11. Compliment Web
Students sit in a circle. Take a ball of string, holding one end of it. Roll the ball of string to someone in the circle and give them a compliment. Continue the compliment web until each person is holding onto a piece of the string (and each person has been given a compliment). Another component to realizing interconnectedness.

12. One-minute Words
In 60 seconds, have students write down as many words to describe their surroundings.

13. Concentric Circles
Have students form an inner and an outer circle facing one another (equal number in each circle). Pose a question and ask students to discuss with the person they are facing. Every time you switch questions, have the inner and outer circles rotate to their right.

14. Parking Lot
Keep a large piece of paper or chart paper up at every whole group class discussion. When students have questions that they want to pose to the group, ask them to write them down. Keep a running list of questions to discuss and problem solve.

15. Skittles Conversation Starter
Give students a small handful (4-5) skittles each. Each color represents a different question. Have students work in small groups, randomly choosing a skittle from their pile.
Resource Guide

Pre and Post Visit Questionnaires
Investigation Planning Sheet
Fall, Lesson 2 Instructions and Materials
Field Notebook Template
Pre-Visit Questionnaire

School: ____________________________________________
Grade(s): ________
Date(s) of visit: ____________
Number of Teachers: ________
Lead Teacher(s): _________________
Contained classroom? Y/N
If no, explain:

_______________________________

What setting is your school in?
Urban    Rural    Suburban
Other: ____________

Do students have access to natural play spaces?

What science curriculum do you use?

What unit in your science curriculum are you currently working on?

What are the learning needs in the classroom? Useful/pertinent information for differentiation?
(ESL, struggling readers or writers, learning differences, etc.)

Do you have a specific way of getting students’ attention?

<table>
<thead>
<tr>
<th>Have students had experiences with:</th>
<th>Y/N</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recording observations?</td>
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<tr>
<td>Designing tests or experiments?</td>
<td></td>
<td></td>
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<tr>
<td>Asking questions about what they observe?</td>
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</tr>
<tr>
<td>Reading maps?</td>
<td></td>
<td></td>
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<tr>
<td>Exploration of natural world?</td>
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</tr>
<tr>
<td>Spending nights away from home as a class?</td>
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</table>

Please describe any experiences your students have had outside the classroom:

Anything else we should know?
**Post-Visit Questionnaire**

School: ____________________________________________
Grade(s): __________
Date(s) of visit: ______________
Number of students visited: __________
Number of teachers visited: __________
Names of outdoor educators on this program:
________________________________
Lessons taught:
________________________________
________________________________
________________________________
________________________________

Did the students who needed special accommodations receive the support needed?

Types of differentiation techniques used:

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What are some ways that we can improve our delivery or material to better suit the needs of your students?

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<table>
<thead>
<tr>
<th>Did your students experience:</th>
<th>Y/N</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recording observations?</td>
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<td>Writing and asking questions about what they observe?</td>
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Anything else we should know about your experience?

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How do you think the experiential learning trip enhanced the science curriculum?

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What are the ways in which you plan on connecting this trip with classroom material?

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Investigation Design Planning Sheet

Name: _________________________
Date: _________________________

Ask a question:

Imagine possible solutions:

Design a plan to investigate:

Record observations:

Reconsider solutions and ask follow-up questions:
Fall—Lesson 2 Instructions

**Materials:**
3 leaves (from the same tree)  
Rubbing Alcohol  
Measuring cup  
Clear jar  
Spoon  
Plastic baggie (or plastic wrap)  
Rubber band  
Paper Coffee Filter strip  
Small bowl or pan

**Directions:**

1. Check table to make sure you have all the necessary materials.  
2. Break up the green leaves into small pieces and put them in the bottom of the jar.  
3. Add ¼ cup rubbing alcohol to the jar.  
4. Stir and mash the rubbing alcohol and the leaves together in the jar until the rubbing alcohol turns green.  
5. Cover the jar with plastic wrap and put the rubber band around the top of the jar.  
6. Put the jar into a pan with hot water. Leave for 30-45 minutes, gently swishing every so often.  
7. Place one end of the coffee filter strip into the water and drape the other end over the edge.  
8. Leave for 1 hour.  
9. Pull the filter out of the jar and let dry. Observe and record observations
Field Notebook Template

Field Notes

Belongs to: __________

Take a snapshot! What do you notice?
Questions I have are...
A question I have is...

One thing I notice is...
A question I have is...

One thing I notice is...
First this happened:
___________________________

Then:
___________________________
___________________________

Lastly, I noticed:
___________________________