Standards and Measures

Field Study Experiences Build Scientific Literacy with Young Learners

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In April 2016, Massachusetts adopted new science education guidelines based on the Next Generation Science Standards (NGSS) for students in grades Pre-K through 12. Requirements cluster around four disciplines—physical science, life science, earth and space sciences, and technology/engineering—and the incorporation of key skills, called science practices, aimed at boosting communication, collaboration, inquiry, problem-solving, and flexibility.

In science the content will always be shifting and changing, but the practices of science remain,” a fellow educator said while we discussed impending standard changes for science education in Boston Public Schools. The Children’s Education team at the Arboretum had grappled with the uncertainty of a long transition between old and new standards, awaiting a decision of how BPS would organize science education content for elementary students. Suddenly, shifting our focus to teaching the practices of science—instead of teaching specific content aligned with various topics at each grade level—would be the new lens to view our programming for Boston Public School students.

Established in the 1980s and endowed by Henry and Nod Meyer in 1995, the Field Study Experiences at the Arboretum invite Boston schoolchildren to delve deeply into nature and natural systems, helping illuminate more abstract concepts learned in the classroom. Here, in our outdoor classroom, lessons learned through books, lectures, or labs become more tangible and complex, helping children to think and work like scientists in a way that is authentic and student driven. Maintaining this formula for enriching students’ experience in nature remained paramount in our minds as we envisioned the future.

So what does children’s science education look like now, in 2018, in the field? A look at some of our programs and how they engage young minds might shed some light. Our Explorations Field Study introduces preschool, Kindergarten, and first grade kids to the flora and fauna of the Arboretum. While capturing their curiosity, the exploration also demonstrates the practice of data collection and analysis. For example, the students study pictures of interesting bark and then search for the corresponding trees, comparing and contrasting minute details, sharing and defending their ideas. Later, students make observational drawings of wood samples cut to reveal the tree rings, expanding their understanding of a tree as a living organism. Throughout the experience, these young scientists engage in argument from evidence, and obtain, evaluate, and communicate information—all vital skills identified by the NGSS standards.

In fall and spring, third and fourth graders focus on flowers and fruit as part of the Flowers Change and Plants in Autumn programs. Through a series of dissections in the field, students examine and identify the structures
that make up a flower or a fruit, learning their functions and relationships to form. Often, student questions spark impromptu investigations, like testing how maple samaras flutter to the ground or whether a seed package could travel by water. In a pollination activity, students use pipe cleaners to collect pollen from the stamens of various flowers. As they compare the pollen from similar species, they are also learning what pollination is and modeling how it occurs. Modeling continues when they mimic buzz pollination, or make sketches to show the four stages of how flowers change from bud to fruit.

Learning about the biology of ecosystems through fieldwork in a woodland forest remains the focus for fifth-grade Field Studies on Hemlock Hill, categorizing organisms as producers, consumers, and decomposers. Students first take a census of the many producers present, noticing not only the shape, size, and texture of the plants, but also their growth habits. Understanding the verticality of this ecosystem is important: there are ground covers, herbaceous plants, shrubs, saplings and mature trees all occupying the same space, each of them contributing to the richness of biodiversity within the ecosystem. Students also search for consumers and decomposers, using wooden probes and bug boxes to capture and observe spiders, centipedes, slugs, millipedes, beetles, and sometimes even salamanders! By amassing data points to their collective inventory—which may include observations from bird calls to woodpecker holes or insect cocoons—students gain an understanding of organisms visible and invisible to the eye in this ecosystem.

After an hour of fieldwork, which includes making observational drawings and taking notes, students chart all their information and discuss what they saw. By collecting and analyzing data and constructing explanations, the Hemlock Hill experience provides a powerful experience for students to truly understand the complex web of organisms and interactions at play in any ecosystem.

For over three decades and counting, the Arnold Arboretum, its Public Programs staff, a host of dedicated volunteers, and generous donors to our Children’s Programs have remained committed to meaningful, authentic, and timely science teaching and learning for students in Pre-K to fifth grade through the Field Study Experiences. The two hours that students experience in our landscape on a field trip adds value to the content they learn in the classroom through personal observation and experimentation, hands-on learning, and even fun in the outdoors. At the Arboretum, we are excited and energized by the new learning standards adopted by Boston Public Schools, which encourage student awareness and interest in careers in science, technology, engineering, and mathematics (STEM). Stewarding the next generation to appreciate, understand, and cherish our natural environment is just as important.

As part of the fifth grade Field Study Experience on ecosystem change, students convene with Manager of Children’s Education Nancy Sableski and guides to discuss, analyze, and form conclusions regarding their collected samples of producer, consumer, and decomposer organisms found on Hemlock Hill.

Learning in the Arboretum for Teachers

Summer Institute 2018:
Investigating Ecosystems through Fieldwork
August 13–16, 2018
In this four-day intensive course, teachers will learn about meadow and forest ecosystems while applying fieldwork techniques to gather data. Intended for teachers of grades 3–12. Deadline for applications is May 25, 2018.

Arboretum for Educators
Monthly workshops for teachers of Pre-K through Middle School exploring how to use the outdoors to teach science. See complete listings at arboretum.harvard.edu

- April 7: Flower Form and Function through Dissections
- May 5: Exploring Pond Ecosystems
- June 2: Pollinator Diversity