



Seeds in the Window, Soil in the Sensory Table

Science Education through Gardening and Nature-Based Play

Alyse C. Hachey and Deanna L. Butler

Early in the school year, I realized that the 3-year-olds in my class had little exposure to nature and even less knowledge of things in nature. As a child, I spent a lot of time outdoors playing, hiking, and working in the garden with my family. These experiences gave me a continuing appreciation for nature of all kinds, and I wanted to offer my class similar opportunities. I wanted the children to listen to birds and to look at trees and really notice details about them. I wanted the children to be curious about insects, not frightened of them. I wanted them to experience planting a seed and watching it grow. I wanted them to help care for plants and notice the growth, the smells, and the textures of leaves. I wanted the children to first notice, then observe, then appreciate and question and wonder about these things . . .

A growing body of evidence indicates that contact with nature is as important to children as good nutrition and adequate sleep, and therefore, educators need to address children’s access to nature (see Louv 2008 for a review). This is particularly important in urban areas, where children have few opportunities to interact with nature. Gardening and nature-based curriculum support children’s development and learning in academic, social, and health-related domains (Ozer 2007). The National Research Council states, “Because plants are especially easy to grow and care for, students at every grade level should be involved with gardening projects, using outside space, window boxes, or potted plants” (NRC 1990, 14).

Gardening and nature-based play in preschool classrooms integrate motivating and meaningful activity with the three elements of science education—attitude, process skills, and content (NRC 1996; Charlesworth & Lind 2007).

Alyse C. Hachey, PhD, is an associate professor in the Teacher Education Department at the Borough of Manhattan Community College, City University of New York. She is an educational psychologist whose teaching and research interests focus on early childhood cognition and curriculum development. ahachey@bmcc.cuny.edu

Deanna L. Butler, MS, is a head teacher at the Borough of Manhattan Community College Early Childhood Center. She is an educator of 3- to 6-year-olds with 10 years of experience teaching in the boroughs of Brooklyn and Manhattan in New York City. dbutler@bmcc.cuny.edu

Photos courtesy of the authors except where noted. Cluster illustration © Melanie Hope Greenberg. This article is available in an online archive at www.naeyc.org/yc.



Scientific attitude, process skills, and content

Building *scientific attitude* involves encouraging children's natural desire to question and seek answers. Gardening supports children's curiosity about and exploration of the natural world and provides opportunities to build self-confidence through successful nurturing of plants over time.

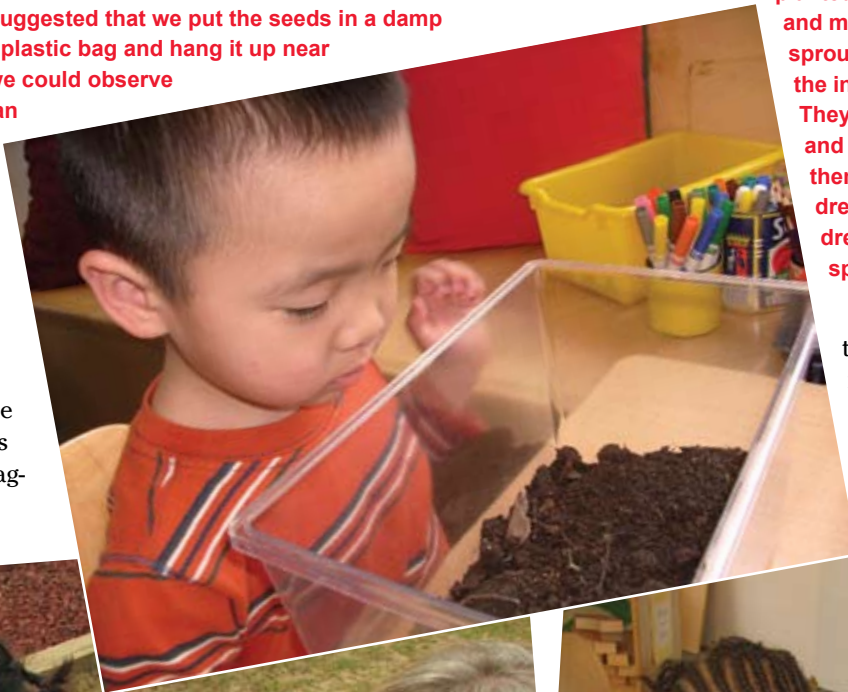
One day, Jack walked across the classroom with his hand full of something that was dripping water. When I asked him what he had, he opened his hand to reveal wet bean seeds that I had brought in for sorting. I asked what he was doing with them. "I want to make them grow. They need water, don't they?" he replied. Jack showed that he had ideas about what plants need and he was willing to try out his ideas. I suggested that we put the seeds in a damp paper towel in a plastic bag and hang it up near the window so we could observe what the wet bean seeds would do over the next few days.

Science process skills relate to how children find the answers they are seeking. Such skills include using simple tools like rulers and mag-

nifiers to observe scientific phenomena and documenting findings through graphs and drawings. Children learn these skills through concrete problem solving and discovery that focus on inquiry. Gardens provide a work space for children to raise questions about the natural world, take hands-on action, and seek answers through observation, exploration, and data collection.

I brought in samples from my fall garden and added them to the items we had collected in the neighborhood—leaves, dried bean pods, and other natural materials. The children observed the materials with magnifying glasses, sorted them, touched and smelled them, and played with them. Capitalizing on Jack's desire to make some seeds grow, we planted his beans, then observed and measured the growing sprouts. Jack's interest sparked the interest of the other children. They too wanted to put beans and seeds in plastic bags and then plant the sprouts. The children took measurements and drew pictures to compare their sprouted beans' growth.

Science content includes the facts, concepts, and models that we want children to know, understand, and use. The study of plants and nature allows



© Karen Phillips

Hang plants from the ceiling; place them on shelves and window ledges; use them to fill empty spaces on tables and furniture.

water them and sometimes commented on new leaves or a plant getting bigger. While watering a particularly colorful plant, one child looked at the sweater he was wearing, then looked at the leaves he was watering. He laughed and said, "Look. I look like the plant. Look, stripes [pointing to his sweater] and stripes [pointing to the plant]!" Both had stripes of the same colors. When I asked the children what plants needed to grow, collectively they knew quite a lot. They said that plants needed sun, warmth, water, soil, and time to grow!

This type of curriculum does not have to be complicated or use extensive outside space to succeed. Urban schools or schools that have very limited green space outside can still offer gardening and nature in the classroom, as seen in the tips that follow. Successful gardening and nature-based activities depend on being thoughtful about the space in and outside of your classroom and seeking out readily available natural materials.

Gardening basics

Include a variety of plants to make the classroom warm and homelike and to spark children's interest in nature. Hang plants from the ceiling; place them on shelves and window ledges; use them to fill empty spaces on tables and furniture. Just about anything can be used to hold plants, but be sure to use containers (with holes for drainage) that are big enough to hold plenty of soil *and* water.

Child-friendly classroom plants include grape ivy, Christmas cactus, aloe, cast iron plant, spider plant, bamboo, and pothos—the last two can even grow in water! An

children to explore the cycle of life and the concepts and terms that apply to nature. Gardens offer children "perfect laboratories where scientific concepts literally come to life" (Mohrmann 1999, 25).

I also brought in plants for the classroom.

The children helped

Internet search of "easy-care indoor plants" will lead to detailed photos of plants and descriptions of their needs to help you select what will work best for your space. Aim for a variety of leaf shapes and textures throughout your classroom. Most important, do your homework. Make sure that all classroom plants are nontoxic and nonpoisonous to children. (For a comprehensive list of Web sites and books on this topic, see <http://research.calacademy.org/research/library/biodiv/biblio/poison.htm>).

A few pots on a shelf by a window can support yearlong gardening investigations. Focus on plants that do well in small spaces, have a short growing season, and are low maintenance. Several good seed choices for producing food are radishes, lettuce, spinach, carrots, bush beans, and sunflowers. Consider sprouting a pot of grocery store produce, such as garlic, potatoes, onions, and yams. In a container of damp soil, simply bury each item so that 1/3 is below the soil and 2/3 is above the soil. They will sprout quickly, have interesting stems and leaves, and can grow quite large!

For a wintertime planting project, look at local flower shops or grocery stores for paperwhite bulbs that are prepared specifically for growing indoors. Paperwhites grow very quickly once they begin to sprout, and they produce long-lasting, fragrant flowers. A wonderful accompaniment to the growth and study of paperwhites is the picture book *Paperwhites*, by Nancy Elizabeth Wallace. Important note: Paperwhite bulbs can be mildly toxic to humans if eaten, so use care when planting them with children, and for extra safety, have children wash their hands if they handle the bulbs.

Place gardening containers in areas of the classroom that get lots of bright light yet are not too close to heating or air-

conditioning sources. Use a high-quality container soil mix to ensure the best chance of success. Provide child-size gardening tools so the children can do as much as possible. Be sure to account for growth rates and how long a "growing season" you have, in terms of school days and vacation time, so the children get to care for and observe their plants' growth as much as possible. To promote science process skills and content knowledge, set up data collection stations with calendars, charts, graph paper, tracing paper, plenty of writing and art materials, and a variety of

Gardening and Nature Play— Everything We Look for in Early Childhood Education

Learner-centered—intrinsically motivating and rewarding

Hands-on—promotes sensory exploration

Inclusive—connects children of all cultures, all ages, and all skill levels

Socially bonding—provides interesting things to talk about and work on together

Emotionally uplifting—builds self-efficacy and self-esteem

Physically stimulating—promotes fine and gross motor skills

Integrative—allows for seamlessly incorporating science, math, reading, social studies, and the arts

Aesthetically appealing—offers opportunities to create and appreciate beauty

measurement tools so children can document their observations of the planting and growth process.

Tips to take gardening further

Once the class has the basics down, consider some of these further explorations.

Seek out natural treasures. Even in urban areas, children can find many natural objects during neighborhood walks. Take advantage of the natural settings near your school, such as parks or public gardens. Take walks to find and document the first signs of a new season; to search for insects, rocks, and leaves; or to look for birds. Let the children bring their found natural items inside, when possible. A great alternative is for children to take photographs. Try to get as close as possible to capture details, take pictures from multiple angles, and get some shots of the surroundings.

Nature photos can become


Nature photos can become the focus of class-made posters, stories, scrapbooks, and other nature-based projects.

the focus of class-made posters, stories, scrapbooks, and other nature-based projects.

Add items from nature walks and from the grocery store to the science and other classroom areas. Include herbs, fruit peels, leaves, sticks and branches, pinecones, tree seed pods, acorns, rocks, and shells. Ask a florist for cuttings and trimmings from flowers or for flowers that are past their prime, so children can take them apart—touching and smelling the petals and stems, and measuring, sorting, and graphing the parts. A construction


site may be willing to donate a tree stump or large stones to incorporate in classroom construction and dramatic play activities.

Consider adding live treasures to the science area too! Simple habitats for small garden creatures such as snails, worms, beetles, and crickets let children gain firsthand knowledge and develop appreciation of these animals.



Happy CHILDREN.
Connected PARENTS.
Musical COMMUNITY.

Music Together goes beyond the once-a-week music model, making music an essential and engaging part of your core curriculum for teachers, parents, and students. Call us to discover how you can bring the power of music to your early childhood learning community.



Bringing the Music Home!®

(800) 728-2692 X353 • musicTOGETHER.com/NaEYC

Snail Trails and Tadpole Tails: Nature Education for Young Children, by Richard Cohen and Betty Phillips Tunick, has tips on adding small critters to your classroom.

Diversify. Use a variety of seeds for sprouting activities so children can compare and contrast growth rates and discuss concepts like *diversity*. Bean soup mixes and bird seed mixes are inexpensive ways to get a variety of seeds for sorting and sprouting. Also consider other grocery store “seeds,” such as corn and wheat kernels, sunflower seeds, and lentils. Use the seeds you have on hand, like those from the classroom pumpkin or from a lemon juiced for a cooking project.

Sprout seeds by putting them in a plastic baggie with a damp paper towel and taping it to the window. This quick project will show results in a week or less. Beans are often used for sprouting because they are almost foolproof. They sprout quickly and grow fast, which helps hold the children’s interest; and they produce relatively large leaves, which make the plant easy to observe. Seed sorting and sprouting activities let children use many science process skills (measurement, comparing and contrasting, charting, and so on), and the children can pot all the ones that sprout later in a container in the classroom or a window box outside for continued exploration and enjoyment.

Focus on the five senses. Herbs such as sage, oregano, rosemary, and a variety of mints are easy to grow in a sunny place in the classroom and have smells that are both strong and appealing. In addition, children can taste these herbs and use them to season snacks. Strawflower, hens and chicks, and lamb’s ear are all hardy plants that have interesting textures and can take touching by small hands. Flowers such as marigolds, pansies, and violas do well in small window containers and add eye-catching color to your classroom in the spring. Also, consider dwarf nasturtiums. These plants have bright, cheerful blooms and edible leaves and flowers with a pungent, watercress-like flavor and scent.



For these sensory explorations, it’s best to purchase young plants rather than trying to grow them from seeds. Although fairly easy to care for when mature, most of these plants can be difficult and time-consuming to start from seed.

Note: Take some time to discuss how some natural items and plants are good for people to eat and some are not and can make people very sick. Strongly discourage children from tasting things unless directed to by a teacher. Be sure that any natural objects available for exploration and free play in the classroom are nontoxic.

Play in the dirt. Put high-quality potting soil in the classroom sensory table and add child-size gardening hand tools, as well as containers and plastic flower pots of many sizes to fill. Later, add a variety of rocks, high-quality plastic insect models, and a handful of seeds (separately or together) for continued interest. Keep

the soil just a little damp to prevent it from becoming dusty.

Extend this play outside by designating an area in the playground where children can dig holes. And the only thing better than just playing in the dirt is to add some water. Mud play allows for the scientific exploration of soil composition, erosion, and evaporation—plus, it is fun!

Provide realistic representations. Display pictures and posters of the natural objects children are investigating to offer visual interest and content knowledge resources. Children can use posters and guides to compare and contrast characteristics of similar plants, small garden creatures, or birds. Nonfiction books provide facts about objects’ properties and animals’ life cycles. Choose resources with high-quality artwork and age-appropriate explanations.

Realistic and durable models of small garden creatures or plants allow children to explore the features of natural objects when handling the real thing could cause harm. They are fantastic props for dramatic play. Posters, guides, and models can be found in gift shops of museums, zoos,

and botanic gardens, as well as from teacher stores and Internet distributors.

Make connections. Gardening projects are not about science alone. Nonfiction and fiction books about plants, gardening, and nature can link literature and stories with hands-on knowledge. Also explore related social studies concepts like responsibility and care of nature, farmers and their role in the community, and environmental advocacy.

Tie in edible plants you grow and seed explorations with nutrition concepts. Children love making a seed trail mix for snack and discovering what parts of plants they eat every day (broccoli is a flower!?!). Provide for role-play and movement activities by acting out plant growth and engaging in gardening finger plays and songs. Find nature-based songs and chants online.

Children can combine nature with art by making natural material collages, photographing nature, and drawing or building models. Display natural objects collected by teachers and children on trays and shelves so children can sort and classify them. Have children spend time touching, smelling, sorting, and observing with magnifying glasses.

Allow the natural treasures to travel to other areas of the classroom to be incorporated into dramatic and construction play. Also, use gardening and nature-based play as a fun way to learn meaningful social skills, such as turn taking, cooperation, and responsibility for other living creatures.

Live and learn. Talk to local gardeners and invite them to speak to the children about plants and garden critters in your area. Read some basic gardening books and visit related Web sites (some favorites are provided on p. 48). Botanical gardens often have workshops for teachers. Most important, give yourself the time to learn through experience. Don't get discouraged when you or the children make mistakes.

As in the rest of life, you live and learn. Try turning things that don't work into opportunities for discussion and exploration. Remember, the focus is on process rather than product—and sometimes, mistakes can provide better learning experiences than when everything goes right!

Conclusion

As I reviewed my classroom journal, my observations of the children, and all the pictures I had taken, I was amazed at how much we had actually done related to nature and life science over the course of the school year. I knew from the beginning that I wanted to bring nature into our learning experiences, but it wasn't really the main focus of our classroom. We had done so many, many other things. But looking back, I was able to see that throughout the months, natural materials and nature play had been a subtle yet important constant in our classroom.

PreschoolFirst.com - NAEYC Booth 2323

Play to Learn · Show They Grow

- Play-based curriculum...children learn naturally
- Integrated assessment...ongoing accomplishments
- Variety...3,200 DAP activities
- Learning experiences...theme-based, developmentally appropriate
- Research-based...promotes best practices, high quality
- Supports development...infant, toddler, preschooler
- 300+ family activities...involve parents
- Progress reports...simplify conferences

From  **the source for Learning** For teachers. For families. For excellence.



FREE Web Tour and Trial! Call 1-866-584-2900 or visit www.preschoolfirst.com

Remember, the focus is on process rather than product—and sometimes, mistakes can provide better learning experiences than when everything goes right!

And all of this happened while other important curriculum was going on.

Nature-based experiences became part of the fabric of what we did in our classroom, and because of this, I think the children always responded with interest and

excitement when new natural materials showed up in the classroom.

It was a year of discovery and learning for me, the assistant teacher, and for the children. It was a rewarding exploration and introduction for us all to some of the natural world we live in.

Gardening and nature-based play curriculum do not require a teacher to be an expert botanist or biologist. These activities are all about the elements of science education rather than expertise on the part of the children

and the teacher. It is about tapping into everyone's inner scientist and encouraging the attitudes, process skills, and content knowledge that are central to scientific thinking.

References

- Charlesworth, R., & K.K. Lind. 2007. *Math and science for young children*. Clifton Park, NY: Thomson Delmar Learning.
- Louv, R. 2008. *Last child in the woods: Saving our children from nature-deficit disorder*. New York: Workman Publishing.
- Mohrmann, P. 1999. Planting the seeds of science: The school garden—A perfect laboratory for teaching science. *Instructor* 108 (i6): 25–29.
- NRC (National Research Council). 1990. *Fulfilling the promise: Biology education in the nation's schools*. Washington, DC: National Academies Press.
- NRC (National Research Council). 1996. *National Science Education Standards: Observe, interact, change, learn*. Washington, DC: National Academies Press. www.nap.edu/catalog.php?record_id=4962
- Ozer, E.J. 2007. The effects of school gardens on students and schools: Conceptualization and considerations for maximizing healthy development. *Health Education & Behavior* 34 (6): 846–63.

Copyright © 2009 by the National Association for the Education of Young Children. See Permissions and Reprints online at www.naeyc.org/yc/permissions.

Interested in Exploring More?

Check out these resource books on nature-based education:

Last Child in the Woods: Saving Our Children from Nature-Deficit Disorder, by Richard Louv. 2008.

The Sense of Wonder, by Rachel Carson. [1965] 1998.

I Love Dirt! 52 Activities to Help You and Your Kids Discover the Wonders of Nature, by Jennifer Ward. 2008.

Gardening with Children: Brooklyn Botanic Garden All-Region Guide, by the experts at the Brooklyn Botanic Garden. 2008.

Ready to get started?

Check out these Web sites for information and ideas

Growing a Green Generation—<http://horticulture.unh.edu/ggg.html>

Growing Minds, Farm to School—www.growing-minds.org/lessons.php

Junior Master Gardener—www.jmgkids.us/index.k2?did=11777

Kid's Gardening—www.kidsgardening.com/themes/preschool.asp

The Kid's Garden UK—www.thekidsgarden.co.uk

My First Garden—<http://urbanext.illinois.edu/firstgarden>

National Gardening Association—<http://assoc.garden.org>

