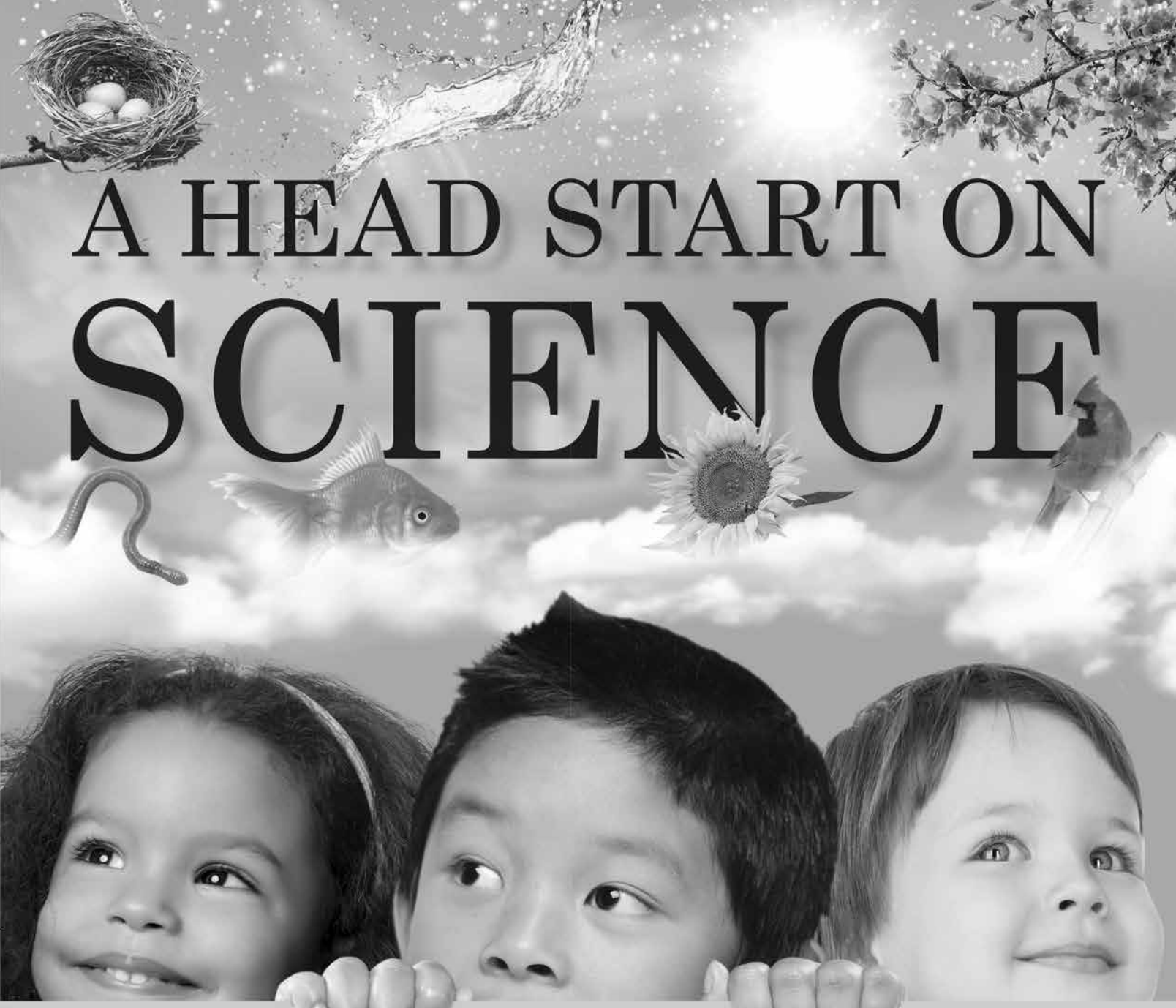
A HEAD START ON SCIENCE

Encouraging a Sense of Wonder

2nd Edition

Edited by
William C. Ritz
William Straits

NSTA press
National Science Teachers Association



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Preface

In 1996, *A Head Start on Science* began with the goal of increasing the quantity and quality of science learning in early childhood educational settings by supporting preschool and primary grade teachers in their efforts to bring engaging and meaningful science experiences to their children. The creation of the project, a collaboration between the Department of Science Education of California State University Long Beach and the Head Start program of the Long Beach Unified School District, was supported by funding from the U.S. Department of Health and Human Services. As part of this work, we compiled activities that had been used successfully by thousands of teachers in Head Start programs across the nation. We modified the activities to be useful to a greater variety of early childhood educators—including those who teach in programs such as day care, preschool, transitional kindergarten, home school, and grades K–2—and created *A Head Start on Science: Encouraging a Sense of Wonder*. This book, like all of our work, strives to foster a life-long interest in science among children in early childhood and to help adults become enthusiastic science explorers working alongside their young children. Twenty-three years, thousands of copies, and countless hours of professional development later, the program is still going strong. But much has changed in early childhood science education since 1996.

We have grown to understand that children are amazingly capable observers and thinkers and that facilitated early childhood experiences are central to children's development of these skills. We now know that the benefits of an intentional, well-conceived, developmentally appropriate, child-centered preK/K education can be long lasting and key indicators of future school success. As the importance of preK and Kindergarten education has become well documented, and its importance has grown in acceptance, the education of our youngest learners has

received increased support. Subsequently, our early childhood educators are more qualified, and have more resources available to them, than ever. Standards, assessments, evaluation tools, curricula, and other resources have all found an increased presence in early childhood education. And when used appropriately, each of these developments has led to improved classroom practice. Throughout all of these changes, one thing has remained constant in early childhood education—children's curiosity about and awe of the natural world around them.

At the start of our project, we took inspiration from the beautiful book *The Sense of Wonder*, written by marine biologist and conservationist Rachel Carson. "A child's world is fresh and new and beautiful, full of wonder and excitement. It is our misfortune that for most of us that clear-eyed vision that true instinct for what is beautiful and awe-inspiring, is dimmed and even lost before we reach adulthood.... [I wish that] each child in the world be [given] a sense of wonder so indestructible that it would last throughout life."[1] *A Head Start on Science* activities are written to help adults facilitate young children's learning as they work together as partners in exploring the natural world. We hope your "sense of wonder" will be heightened as you interact with children, watching as their curiosity leads them to explore and find answers to their own questions about all that they experience in the natural world.

In this new edition of *A Head Start on Science: Encouraging a Sense of Wonder*, you'll find updated activities that reflect current standards and learning frameworks that help shape our practice as educators and additional, more up-to-date, resources. We hope this edition serves you well in your noble and indispensable work—providing children with opportunities to follow and expand their own curiosity as they joyfully explore the natural world.

With great hope and admiration,
William Ritz and William Straits
Project Directors, *A Head Start on Science*

1 Carson, R. 1956. *The Sense of Wonder* (p. 42). New York: Harper and Row.

About the Editors

William C. Ritz, professor emeritus of science education at California State University Long Beach (CSULB), has been involved in science teaching and science teacher education all his professional life. Bill's career began in the public schools of western New York state, where he taught junior high science and biology for many years. Then, four years as an elementary science consultant with the Eastern Regional Institute for Education took him into classrooms throughout New York and Pennsylvania; during this time he completed doctoral studies in science education at The State University of New York at Buffalo. In 1970, Bill joined the science education faculty of Syracuse University, where he also directed the university's Environmental Studies Institute.

Since moving to California in 1977, he has taught both elementary and secondary science education courses at CSULB. Bill was elected to the Board of Directors of the National Science Teachers Association (NSTA) as its teacher education director in 1983. He returned to the NSTA Board in 1988–1989 as president of the Association for the Education of Teachers in Science (AETS) and again in 1996–1998, as director for District XVI. Author of more than 20 publications in science education, he has directed a number of funded projects at CSULB. Perhaps most important, in 1996 Bill developed the *A Head Start on Science* project that strives to provide quality science resources and professional development for early childhood educators. (Additional information can be found at the *A Head Start on Science* website: *www.sci4kids.org*.)

William Straits, professor of science education at California State University Long Beach, has taught science at the elementary, middle school, and college levels. After studies and work focused on biology, Bill tried his hand at teaching. These K–8 teaching experiences inspired a career focused on improving science teaching and learning and led Bill to the

University of Texas at Austin where he studied education, earning an M.Ed. in curriculum and instruction (1997) and a Ph.D. in science education (2001). After his doctoral studies were completed he worked as an elementary science teacher before joining the Curriculum & Instruction faculty at Appalachian State University.

In 2005, Bill returned home to Southern California. At CSULB he teaches science and science pedagogy to preservice and inservice elementary teachers. As Dr. Ritz began to embrace retirement, Bill stepped in as acting director of the National Center for Science in Early Childhood and the *A Head Start on Science* project. After emphasizing the natural and important connections between science and language literacies early in his career as a science teacher and teacher educator, he now focuses much of his scholarly work on early childhood science education. He is author of several *Science and Children* articles as well as *A Head Start on Life Science: Encouraging a Sense of Wonder* (NSTA Press, 2018).

Introduction

Our Theme

In 1956, Rachel Carson wrote a book, *The Sense of Wonder*, about the time she spent along the Maine coastline with her nephew Roger. From the time Roger was just a baby until he was more than four years old, he and Rachel shared in explorations of the world of nature. She never set out to "teach" him anything, but rather to have fun and marvel at all the plants and animals, the sounds and smells encountered on walks through the woods and near the ocean. Roger, of course, learned a great deal as Rachel called his attention to various things and as they made discoveries together. In *The Sense of Wonder* she wrote, "If a child is to keep alive his inborn sense of wonder … he needs the companionship of at least one adult who can share it, rediscovering with him the joy, excitement and mystery of the world we live in."[1] *A Head Start on Science* was written to help young children, and the adults that care for and work with them, develop an increased *sense of wonder* about the natural world.

Our Beliefs About Science Education and Young Children

- Doing science comes naturally for young children.
- Young children learn about science through play.
- Early childhood teachers should build on the *sense of wonder* present in all children.
- The science practices that young children engage in are more important than learning science facts.

1 Carson, R. 1956. *The Sense of Wonder* (p. 45). New York: Harper and Row.

- Early childhood science teachers must serve as "facilitators" of learning rather than "instructors."
- As children engage in science experiences, adults should observe their actions and listen to their conversations so that they can follow children's leads.
- Science thinking and learning occur in all parts of the classroom and outdoors, not just at the science table.
- Children are intrinsically motivated when they have hands-on materials to manipulate, have some control over their learning, and enjoy success when involved in doing science.
- Children and adults should feel free to engage in science learning experiences, understanding that exploration is more important than right or wrong answers.
- A primary role of the early childhood science teacher is to provide an appropriate learning environment and opportunities for children to make, share, and compare discoveries.
- Children learn best when they have their own science materials to explore.
- Trial and error and cause and effect are natural parts of the scientific learning experience.
- Science activities and materials need to be culturally relevant and part of a child's everyday world.
- Every child needs to have equal access to science experiences.
- Young children with disabilities are best served in classrooms where they are involved in science experiences along with typically developing peers.
- Adults need to model excitement and enthusiasm when involved in science learning experiences and when planning and anticipating discoveries.
- Children who engage in active learning in early childhood programs are more likely to succeed in school and in life than children who attend more teacher-directed programs.
- Peer modeling, lively interaction, and conversation are essential parts of the early childhood science curriculum.
- When talking with children about science, it is important to honor their ideas and choice of words.
- In early childhood classrooms there should be a balance between child-initiated and teacher-initiated science activities.
- Effective early childhood teachers must be effective parent educators who involve families in their children's science learning experiences.

The Role of Questioning in Science

Listen to Children and Follow Their Leads

You will notice that we have included a recommendation in the "Getting Started" section of many of the activities in this curriculum: "Listen to what children say and observe what they do before asking questions." Another frequent suggestion is: "Follow children's leads when deciding which questions to ask." If you observe children in their explorations and really listen to

what they say, your questions and comments will follow their interests. If you see Kayla pick up a snail and study the bottom of the snail, your asking, "What do you see on the bottom of the snail?" or "What does the bottom feel like?" makes sense. However, asking, "What do you think the snail eats?" (although a perfectly good question) does not make sense at this particular time. Instead, it interrupts the child's concentration and pulls her attention away from something that she is interested in.

Don't Answer Too Quickly

Give children time to think and explore before asking questions. Children will often answer their own questions. Sometimes they are just thinking out loud. If Tyler asks, "What do snails eat?" wait a bit. Then, if he doesn't offer additional explanation, turn his question back to the group by asking, "Tyler is wondering what snails eat; How can we find out?" This gives children a chance to think and explain on their own, and also keeps a group of children engaged as they begin to think about how to find out what snails eat. You may have planned to discuss the snail's hard shell today, but if the children are interested in finding out what snails eat, follow their lead! Ask children what they think snails might like to eat and spend the rest of the activity time testing various foods to see which becomes "snail food."

Ask Genuine Questions

The questions you ask should always be genuine. They should often be questions to which you don't know the answer. If you ask a child, "How does that smell to you?" you really don't know the answer. On the other hand, if you ask, "How many rocks are in front of you?" you know there are four and the child probably knows there are four. This type of question does nothing to further children's understanding. It can also interrupt the child's explorations and even dampen a child's enthusiasm. Genuine questions lead to conversations that allow adults and children to share thoughts and ideas and create an environment in which both share control of the learning.

What Kinds of Questions Are Best?

The most appropriate and effective questions are questions that follow children's interests or leads, questions for which you may not know the answer, questions for which each person has his or her own correct answers, and questions that are genuine and lead to conversations. The following are examples of best questions:

- "What do you notice?"
- "What does it look/feel/smell/taste/sound like?"
- "How can we find out?"
- "Can you think of another way?"

Encourage Children to Engage in Doing Science

To promote children's interest in science and understanding of science as an activity and not just a set of information, ask questions that prompt children to engage in science practices and processes (see The Importance of Science Practices and Skills, page xvii), such as the following:

- "How could you make the sound last longer?"
- "What do all the ones that rolled have in common?"
- "How does it feel? Do other materials feel similar?"
- "How is the object different from its shadow?"

- "Is a larger magnet always stronger than a smaller one?"
- "How could you make your marble go farther?"
- "Are all the crickets the same?"

Questions like these encourage children to explore, compare, and communicate their findings. They are not used to find out if children know the "correct" information, but instead encourage children to consider different ways to discover information and develop understandings on their own. Also, general questions such as "How do you know?" "What could you do to find out?" and "Why do you think that?" can be used in many activities and will prompt children to think and explain, and promote science learning.

Encourage Children to Use Science Tools

Encouraging children to make regular use of science tools is important for helping them to become more independent in their explorations of the natural world. Use questions that prompt children to consider the use of science tools:

- "What can you find out with the magnifier?"
- "How could we measure how far it went?"
- "Which one is the heaviest? How would you use the balance to find out?"

These questions encourage children to make observations and to collect data—practices that are central to scientific endeavors.

Give Children Time to Answer

Once you ask a question, be sure to give children a chance to answer it! Science education innovator Mary Budd Rowe studied teachers' responses to children's questions. She advised waiting for at least three seconds after asking a question (longer for younger children). She called this "wait time." After the child answers a question, pause again for another three seconds. If you provide time, the child will often add to his or her initial response or even change his or her answer.

Comments and Questions That Facilitate Learning

The following is a list of comments and questions that can facilitate learning. Post them in your classroom where you can refer to them. Put some of your favorites on tag board and post them up high to remind you to use them when talking to children about science.

- "I'm not sure I understand what you mean. Try telling me again."
- "What makes you think so?"
- "Wow! Look at that!"
- "What would happen if…?"
- "Tell me more…"
- "I don't know. What could we do to find out?"
- "What do you think those (things) might be?"
- "I wonder what that (animal) might like to eat?"
- "Paul, you did a nice job of being gentle to that mealworm!"
- "Let's try that again."
- "How does the top of that rock feel to you?"
- "How many pennies would it take to balance that rock?"

- "What could you do to make the marble roll farther?"
- "Tell me what you did from beginning to end."
- "How could we find out which magnet is strongest?"
- "Does that (odor/sound/texture) remind you of anything else?"
- "How are the two objects alike? Different?"
- "Which of the two objects feels heavier?"
- "Which of these things belong together?"
- "Let's put all the things that go together into one group."
- "What can we call that group?"
- "How can you make your shadow longer?"
- "Draw a picture that shows how the snail eats."

The final payoff in using these questions on a regular basis is that you will begin to hear the children ask them. When children can ask themselves questions that lead them to further explorations, then they are truly on their way to becoming effective and engaged science learners.

The Importance of Science Practices and Skills

A Head Start on Science emphasizes children's active participation in *doing* science. It is through participating in science that our most important early childhood science outcome is achieved—an emotional connection to the natural world that fosters curiosity and a lasting sense of wonder. "I sincerely believe that for the child, and for the parents seeking to guide him, it is not half so important to *know* as to *feel*," wrote Rachel Carson. "If facts are the seeds that later produce knowledge and wisdom, then the emotions and the impressions of the senses are the fertile soil in which the seeds must grow. The years of early childhood are the time to prepare the soil."[2] To "prepare the soil" we must help children engage in joyful explorations of science. This participation requires, as well as fosters, the use of science practices and skills. In Head Start and other preschool classrooms these are the skills required for scientific inquiry; in most kindergartens and elementary classrooms they are the practices of science and engineering. Across all of our early childhood settings, we aspire to offer science learning experiences that engage our children in actively doing science—where children do not merely learn science information, but discover science concepts by observing, measuring, comparing, predicting, and more. We know that active and joyful exploration will best inspire and prepare our children for future science success in school and beyond.

The *Next Generation Science Standards* (*NGSS*) calls for children in elementary school to develop an understanding of and competency in eight practices: (1) Asking Questions and Defining Problems; (2) Developing and Using Models; (3) Planning and Carrying Out Investigations; (4) Analyzing and Interpreting Data; (5) Using Mathematics and Computational Thinking; (6) Constructing Explanations and Designing Solutions; (7) Engaging in Argument from Evidence; and (8) Obtaining, Evaluating, and Communicating Information. Although these practices grow in complexity through the grade levels, all eight are included in the primary grades. Considering the central place these practices have in the *NGSS*, they are clearly important for all elementary teachers. However, given the prominence of these practices in K–12 science standards and their central place in the pursuit of scientific understanding, it is also important

2 Carson, R. 1956. *The Sense of Wonder*. New York: Harper and Row.

for preschool educators to be aware of these learning objectives and to consider the demands awaiting children as they grow.

For children to be successful in their learning and use of the practices of the *NGSS*, they must, in the early years (ages 3–8), develop important foundation skills. While it is important for young learners to develop their abilities to perform a number of science-related tasks, perhaps most important are the abilities to observe and compare. While there are several science practices and skills included in *A Head Start on Science* activities, observe and compare are intentionally the most frequently used. Observing is the use of our senses to notice and make sense of specific components of the world around us. Children make observations as they feel the texture of a rock or smell a flower. The ability to make and describe these observations is vitally important, as it is the foundation for nearly all other science tasks (e.g., measuring, comparing, gathering data). Comparing is the ability to observe two different objects or phenomena and analyze them to determine similarities or differences. Children compare as they observe the shapes of different objects or distinguish between two or more sounds. The ability to compare is foundational for other science practices and skills such as analyzing data, classifying or sorting, and identifying patterns. In addition to observing and comparing, *A Head Start on Science* activities provide opportunities for children to engage in analyzing data, communicating, classifying, graphing, identifying patterns, measuring, predicting, and using tools. By engaging children in joyful explorations that use science practices and skills, we can best "prepare the soil"—setting our children on course for a lifetime of appreciating and learning science.

Using the Activities

The activities in *A Head Start on Science* are developmentally appropriate for children in nearly all early childhood education settings. Children as young as two or three years old will enjoy observing and exploring new and familiar materials. At the same time, primary-grade children will enjoy the challenges of investigating and finding out more while they organize information and try out new ways to communicate results. Each activity calls for active involvement of children and adults. Adults should not focus on teaching children science "facts," but rather should encourage children to make discoveries on their own and to frame new questions.

Each activity begins by providing introductory information. This Introduction includes the following components:

- *Investigation:* A simple description of the activity that includes the main point of the investigation.
- *Science practices and skills:* A list of the science practices and skills that children will use during the activity and follow-up activity. The practices and skills listed here relate directly to the Science and Engineering Practices domain of the *NGSS* and the Scientific Reasoning domain of the *Head Start Early Learning Outcomes Framewor*k (*HSELOF*).
- *Materials:* A list of all materials needed to complete the activity.
- *Safety:* A brief description of possible safety considerations, provided for nearly all activities.

The procedure of the activity is then explained. The Procedure section consists of four components:

- *Getting started:* Suggestions for beginning the investigation. Most include a reminder for the adult to observe children and listen to what they say before asking questions.
- *Questions and comments to guide children:* Ideas for how you can interact with children to deepen their interest in and attention on the investigation. Listening to children is equally important to forming questions and making comments. As you listen and follow children's leads, decide which questions to ask, or which comments to make. Choose only a few; child talk should dominate as the investigation proceeds.
- *What children and adults will do:* A description of what children and adults will probably do as they engage in the activity. It is quite possible, however, that children's interests may move the activity in a different direction. Adults should take advantage of these "teachable moments" even if the activity does not go exactly as planned. For example, children may be fascinated by looking through a magnifier and may begin looking through a variety of transparent objects instead of just looking at their hands as the teacher had planned.
- *Closure:* A description of how you might conclude the investigation. This often includes suggestions for various ways children might communicate their findings, such as participating in discussion, drawing, or graphing. It sometimes includes ideas for continuing the activity or discussion or extending it into a new direction, often as a bridge to the *follow-up activity*.

After the activity is explained, opportunities for extending the science learning are offered. The Extending the Activity section has three components:

- *Follow-up activity:* All of the investigations include suggestions for a follow-up activity using similar materials or investigating similar topics that will help children make additional discoveries. Of course, many young children love repetition, so you may want to repeat a popular activity exactly the way it was originally presented before introducing variations.
- *Center connection:* Center connections remind you to have materials available so children can continue to make discoveries and to explore "science" ideas well beyond the science activity. These connections relate the activity to multiple times and centers within the school day, including outdoor time and science, art, math, reading, dramatic play, music, blocks/building, listening, and writing centers.
- *Literature connection:* It is important that books, both fiction and non-fiction, with science themes be an everyday part of the classroom environment. The books listed in each activity include titles recommended by *A Head Start on Science* curriculum developers and by teachers who have used the activities in this book in their classrooms. We included books from the NSTA "Outstanding Science Trade Books for Students K–12" lists of the past decade. Additionally, a special effort was made to include newer titles as well as some "classics" for each section and to include books that have Spanish editions available.

Next, for each activity, we provide the most relevant standards from two important standards documents, the *HSELOF* and the *NGSS*, in a section called *NGSS* Connections and *HSELOF* Indicators.

The *HSELO*F is designed to have an important role in informing program planning and classroom practice. It describes what young children should know and be able to do as they progress through a Head Start program, from birth to age five. As such, it provides information useful to the development of effective, intentional, and responsive teaching. For preschool, the framework is composed of seven domains, and although the science activities in *A Head Start on Science* include elements from all domains, we have focused our connections on mathematics development and scientific reasoning. For each activity, we give the most prominent science and math goals and related indicators from *HSELOF*. (Please note that *HSELOF* goal P-SCI 2, "Child engages in scientific talk," is part of every activity. However, it is only explicitly listed in the activities that most directly incorporate the standard.)

The *NGSS* are science standards for students, grades K–12; have been adopted, in some form, by several states across the United States; and are composed of three foundational "dimensions." These dimensions—Science and Engineering Practices, Disciplinary Core Ideas, and Crosscutting Concepts—are designed to interact synergistically, helping teachers to design authentic student experiences that more accurately represent the discipline of science. With the *NGSS*, teaching content is integrated with teaching the practices of scientists and engineers. In alignment with the *NGSS*, the activities in *A Head Start on Science* include connections to the Disciplinary Core Ideas dimension and the Science and Engineering Practices dimension for grades K–2, helping children to participate in the doing of science while developing foundational experiences with science content. (Please note that although not explicitly stated in the activities, each is readily connected to a Crosscutting Concept, such as structure and function, cause and effect, or stability and change.)

In the What to Look For section, we present a four-level rubric to help teachers to better understand children's participation in the activities. In the first edition of *A Head Start on Science*, we used the terms "Not yet," "Emerging," "Almost Mastered," and "Fully Mastered" to represent these levels. We have changed these terms and their descriptions to better characterize what is achieved at each level and to more readily align with the assessment tools you use. We hope that the rubric can easily be adapted to the measures, and related terminology, used at your site. As you use this rubric, keep in mind that minor changes will be needed for preverbal children. The four levels are as follows:

I. *Preparing:* This level is typified by a lack of interest or curiosity about the subject. However, as the term "preparing" implies, although children may not (yet) be interested in a certain topic or activity (and should be free to choose an alternative), presenting the topic or activity to them as a possibility is important. These initial exposures can expand understanding and, more importantly, spark children's curiosity.

II. *Attempting:* At this level, children are somewhat reluctant to participate in the activity, and instead—and importantly—choose to watch others. This alternative, indirect participation can be a safe and valuable way for children to figure out how they might negotiate this experience before participating at a more involved level. Although children may not appear to be actively

engaged or may only hesitantly participate, they are attentive and are sharing in the experience.

III. *Exploring:* Children at the exploring level are willing to observe and experience the materials, either in a group or independently. They participate in discussions about the topic or activity and may begin to ask questions as their curiosity and interest in the topic grows. Often they require some adult assistance to fully participate in the experience.

IV. *Connecting:* At this level, children are actively involved in the activity, making observations and comparisons and sharing these with peers or adults. Their thinking extends beyond the immediate task as they attempt to make connections between the current topic or activity and others they have experienced. Children at this level will exhibit a great deal of autonomy and curiosity, asking several questions.

Finally, a Family Science Connection concludes almost every activity. These connections, which are intended to be photocopied and sent home with children, extend the learning that has taken place at school and involve the whole family in a pleasurable science learning activity. The suggested materials can easily be found in the home or in the nearby outside environment. Directions are simple and open-ended, allowing family members to make choices depending on their particular interests and the availability of materials. Family members are also offered suggestions for comments or questions to use to stimulate children's curiosity. These connections are provided in English and Spanish.

Teaching Respect for Living Things

Young children are often interested in and attracted to animals—especially those that can fit in the palms of their hands. These creatures bring squeals of joy and excitement from most children, their faces filled with wonder as they marvel at the animals. Bringing animals into your early childhood setting can be a wonderful decision; as you do so, consider the following.

Selection and Care of Animals

A sound first step is to select smaller, low-maintenance animals such as many invertebrates. (Invertebrates are animals that lack a backbone and include roly-polies, insects, earthworms, and many more.) Small reptiles and fish are also popular choices; however, reptiles and sometimes fish require a constant heat source, which calls for the use of electrical components in the classroom that can pose electrical dangers. It is also wise to steer clear of "hairy" animals with dander that can cause allergic reactions or asthmatic flare-ups. Using the internet, your local pet store, or biological supply companies as resources, learn about the habitat and food needed for the animal of your choice. And remember that many states, agencies, and school districts have regulations regarding the use of animals. Be sure to consult these as you find the most appropriate animals for your classroom.

Involving Children

Animals provide wonderful opportunities for children to question, wonder, and observe as they move, eat, drink, and more. As you investigate animals, keep in mind that your children have been fascinated by and thinking about animals long before they came to your classroom. In all of your lessons, make time for children to share what they know about animals and what they wonder

about animals. Listen to the children and follow their leads, allowing them to safely explore what it is they wonder about the animals in their care. Be aware that some children may show some fear of certain animals. Never try to force children to handle animals that frighten them. Instead, begin by asking children to observe interesting features of the animal from outside the animal's enclosed area. As children's familiarity with the animal grows, their fears may subside and most children will eventually want to handle the animal. Provide alternative tasks for children who are not comfortable handing the animal. As children are ready, encourage them to help with creating and maintaining an appropriate habitat for the animal to live in. Talk about proper feeding and care and ask the children to help you with the responsibilities of caring for your classroom animals.

Building Stewardship and Care

When incorporating the use of animals into your science teaching, be sure to continue to remind children that living creatures have similar needs to humans. Like us, they need food, shelter from harm, care, and respect from others. Encourage children to observe living creatures, handle them with gentleness and care, and be responsible for taking good care of them. Throughout your explorations, consider the safety of the animals children are observing. Also consider inviting local park naturalists, veterinarians, or 4-H members to bring animals into the classroom to demonstrate proper handling. Familiarize yourself with NSTA's guidelines for the responsible use of animals in the classroom (see below). During lessons, engage children in conversations about the appropriate handling and treatment of animals and encourage children to be kind to animals. Remember that, throughout these lessons, your gentle and respectful treatment of animals will serve as an important model for your young learners.

Animals After Your Lesson(s)

In some of the activities in *A Head Start on Science*, you and your children are encouraged to find some sort of animal in your own schoolyard or neighborhood. When you do, make certain that children understand the importance of returning the animal to its own "home" after the activity ends. Also, if you purchased animals from a pet store, keep them as class pets or return them to the pet store. Animals obtained from stores should never be released outside; in many cases, these non-native species can harm native species and existing natural systems, as well as crops and gardens.

Not Just Animals

Of course, we want our children to respect *all* living things, including plants. As you and your children investigate living plants, keep in mind and discuss the considerations described above. Involve children in the care of plants and make caring for them an important part of your classroom routine. Build stewardship and respect for plants by discussing with children the needs of plants and modeling gentle and considerate care for the plants in and around your classroom.

Resources

National Science Teachers Association. NSTA position statement: Responsible use of live animals and dissection in the science classroom. *www.nsta.org/about/positions/animals.aspx.*

Uttley, C. M. 2013. Animal attraction: Including animals in early childhood classrooms. *Young Children* 68 (4): 16–21.

American Association for Laboratory Animal Science. Position statement: Use of animals in precollege education. *www.aalas.org/about-aalas/position-papers/use-of-animals-in-precollege-education.*

All Children Can Do Science

All children in your care can and should participate in science activities. Science activities can often be door-openers for children coping with learning challenges. The open-ended, inquiry-based, child-centered environment that is at the heart of rich science learning offers children opportunities to be themselves while exploring and learning science concepts. Teachers who include science as a regular part of their school day celebrate what children think and wonder. These same attributes will make you a wonderful facilitator of all children's learning, especially those with physical, cognitive, or social-emotional challenges. As you engage in science with special needs children, enjoy the differences they bring to the classroom. Create an atmosphere of kindness where children accept and embrace one another's differences and demonstrate compassion. Teach children to care for and respect one another. Allow children to help one another. Keep in mind that including special needs children presents opportunities to enhance the learning experience for all children. The ideas offered in the specific descriptions that follow and the resource list at the bottom of this section will help you as you adapt activities for special needs children.

Children Who Are Hearing or Sight Challenged

The world of science must not be closed to children who are either hearing or sight challenged. Children with these special needs should be offered ample opportunity to explore based on their curiosities, talents, and abilities. Caregivers and teachers will have to modify activities to support exploration based on children's individual strengths. This may mean enlarging printed text and pictures; using adaptive technologies in the classroom; making sure all activities take advantage of multiple ways of learning; increasing the number of ways directions are given—verbal, written, images, sign language, Braille; modifying the ways children are asked to interact with one another; adding sign language to skills offered to learners in your setting; and discussing how all people are able to learn and contribute to our society in unique ways.

Children Who Have Physical Challenges With Their Limbs

Due to birth defects, disease, or accidents, some young children struggle to use their arms or legs without the aid of adaptive devices such as prostheses, crutches, walkers, or wheelchairs. To assist these children you should first concentrate on modifying the classroom environment to enlarge aisles and traffic pathways to accommodate children who need to use ambulatory devices. Similarly, learning centers, eating areas, and play areas where science activities take place should have tables and areas easily accessible to all children. You may also need to adapt lesson materials or science tools to make activities possible for those with fine-motor challenges or those with prosthetic or missing limbs. After you have modified the classroom environment and science tools, you can focus on thinking about doing science outdoors. Once again, choose learning environments that are accessible to all—the terrain, natural barriers, and availability of accessible pathways and vehicles must be taken into consideration when planning outdoor science activities and field trips.

Children Who Have Allergies or Asthma

Children with allergies and asthma are present in virtually all childhood settings. Like the other children discussed here, these children cannot be grouped together under one heading, nor can they be instructionally adjusted for in a single manner. For some, your instructional changes may simply mean eliminating certain foods from activities. For others, the impact may be greater. Allergies to foods, plants, manufactured products, and natural environmental stimuli all need to be considered carefully as you plan for instruction. In general, plan "healthy" science activities that are aimed at all the children, but be ready to offer alternatives to children who cannot participate in the activity as planned. Choosing alternative foods, working with latex-free gloves, eliminating cleaning products and their odors from the classroom environment, selecting classroom pets with little to no dander—these are some, but not all, of the changes you may need to make to offer a healthy science learning environment. In addition, keep in mind that children with environmental allergies and asthma are often affected by seasonal changes in the outdoor environment. For example, a science nature hunt or activity in the winter months may work well for all your children, but may need to be adjusted in the fall or spring for any children who are affected by various pollens or molds. Try to be aware of each child's needs and plan alternatives accordingly. If you are aware ahead of time, adjustments are often fairly easy to make.

Children Who Have Cognitive and Emotional Needs

Some of your children may have developmental or cognitive impairments, learning disabilities, or sociological or emotional challenges. All of these challenges may affect their attention, engagement, and achievement. Each challenge also brings its own unique set of triggers, trials, and learning implications. When "inappropriate" behaviors occur, keep in mind that often these are children's attempts at communicating—focus on finding out the causes and purpose of the behaviors. Understanding why a behavior is occurring will allow you to better meet the needs of the child and help him or her to be successful. As you come to understand the needs of your children, help others in your classroom to understand and value the uniqueness of their classmates. Explicitly describe and model to children how to appropriately interact with and support classmates with cognitive or emotional needs. Allow children to help one another. Also, as teacher or caregiver, you need to be aware of your children's diagnosed needs and how each child's family is supporting and coping with these needs and issues. Ultimately, you and your colleagues will need to partner with the family to meet the needs of each child.

Resources

Head Start Early Childhood Learning & Knowledge Center. Children with disabilities. *http://eclkc.ohs.acf.hhs.gov/children-disabilities.*

National Science Teachers Association. NSTA position statement: Students with exceptionalities. *www.nsta.org/about/positions/exceptionalities.aspx.*

Learning Disabilities Association of America. Support and resources for educators. *http://ldaamerica.org/educators.*

Science With English Language Learners

In far too many schools and districts, English language learners are denied full access to science

lessons as additional class time for these children is devoted to English language development (ELD). However, there is a growing consensus that science experiences can actually promote language learning. A substantial body of scholarly work details the important link between science and literacy and suggests that ELD and science instruction are complementary. Classroom experiences with a combined science and ELD focus can lead to increased language and science learning and achievement in the early childhood classroom. These benefits have been attributed, among other factors, to (1) the high-interest nature of science, which motivates children to use new language; (2) manipulatives and hands-on experiences, which allow all children to communicate via demonstration/manipulation of materials; (3) the collaborative nature of science, which includes discussion and peer-to-peer talk; and (4) the concrete, rich, and authentic contexts of science experiences, which make language (and science) learning meaningful. Children do not need to wait to first achieve a given level of English proficiency to participate in science; all children can and should engage in scientific explorations that focus on observing, comparing, analyzing, and sharing understandings of different aspects of the natural world.

To support your English language learners, begin to learn and incorporate into your classroom each child's home language and culture, use real materials or pictures to support conceptual understanding, and support the ways children communicate and interact through language, drawing, and the use of manipulatives. Science should not be thought of as vocabulary-laden and text-centered, but rather as a field of study that is curiosity-based, question-driven, and open-ended. Doing science is more important than learning science ideas (see The Importance of Science Practices and Skills, page xvii). Thinking of science in this way will make your classroom science experiences wonderful common ground for children of all languages and cultures to come together as a learning community.

Resources

National Association for the Education of Young Children. Where we stand: On responding to linguistic and cultural diversity. *www.naeyc.org/sites/default/files/globally-shared/downloads/PDFs/resources/position-statements/diversity.pdf.*

National Science Teachers Association. NSTA position statement: Science for English language learners. *www.nsta.org/about/positions/ell.aspx.*

Head Start Early Childhood Learning & Knowledge Center. Planning for linguistic and cultural diversity. *http://eclkc.ohs.acf.hhs.gov/human-resources/article/planning-linguistic-cultural-diversity.*

Safely Doing Science With Young Children

Wonderful science learning happens when young children enthusiastically explore the natural world around them. As teachers and caregivers of children, we have the responsibility to provide safe environments for their explorations. Here are some of the safety issues that early childhood educators are likely to encounter and some suggestions for establishing and maintaining safe indoor and outdoor learning environments.

The Senses

When "doing science," early childhood teachers often encourage activities involving the senses. It is important to think about setting up the

classroom and outdoor environment so that children can use their senses to explore safely.

Seeing: You will already be aware of the need for safety with respect to children's eyes. In particular, children need to be reminded to use caution when using sticks or sharp objects to probe an object of interest. If available, safety glasses or goggles are appropriate for children to wear at those times. However, because goggles are not always available to teachers of young children, consider using blunt objects for probing. Some teachers use craft sticks, cotton swabs, and unsharpened pencils because they are not sharp and are easy for small hands to use to move or lift objects while exploring. However, children should be directly supervised if using these probes because young children are apt to stick the probes in their ears and noses (even eyes). A safer probe might be a spatula. Start with a large spatula and work down to a smaller size as you determine your children's dexterity.

Touching: Most of what children will be touching while engaging in science learning will not be dangerous. We often use the sense of touch to discover and discuss concepts such as smooth, rough, bumpy, and cold. At times, however, touching objects can be unsafe. For example, it is important to help young children learn to avoid hot and sharp objects that might be safety hazards. It is never too early for children to learn the signs and signals that something may be hot. Sensing heat or warmth, seeing a red, white, or blue glow, observing sparks or fire—these are all signs that an object may be hot and should *not* be touched. You will need to teach children these signs and tell them that they should always be with an adult if hot objects are present in their home, classroom, or outdoor areas. Teachers and caregivers also need to help children learn about the potential dangers of touching sharp objects. Pins, needles, knives, thorns, saws, and animals' spikes and teeth are all sharp and can cut or puncture children's skin. Help children to recognize sharp objects and their potential dangers; limit the number of sharp objects in your learning environment, including sharp corners on furniture, playground equipment, and toys; and help the children understand how to carry sharp objects with their points or sharp edges pointed away from their bodies and that they should alert an adult immediately if anyone is injured by a sharp object.

Smelling and tasting: From birth, children put their hands in their mouths and near their noses as primary ways of experiencing the world. As you know, this doesn't stop when they become involved in day care, preschool, or even kindergarten. Much of the excitement of experiencing the everyday world comes through tasting new foods and smelling new smells. Without becoming overcautious, teachers and caregivers can help children learn some safety tips regarding tasting and smelling in the learning environment. Obviously, young children should learn that they should *never* put anything in their mouths except food or things identified by trusted adults as foods that are safe to eat. Furthermore, children need to understand the dangers of putting objects into their noses. When smelling, you should help children learn how to detect odors from a distance of several inches—not by burying their noses into the chosen element to be smelled. In addition, it is extremely important to check for allergies (peanuts, pollen, etc.) among all children in your care before including any food or other materials to be smelled or tasted in your classroom activities.

Hearing: One way to experience the details and nuances of the world around us is to use our ears—to sit quietly and listen. It is important to remind children to take care of their ears in the classroom and throughout their lives. Loud noises or music can hurt a child's ears. Precautions

should be taken to avoid unsafe noise levels and to protect children' ears from being harmed. If possible, turning down the volume of the noise or music should be the first step. If this is not possible, giving children earplugs to dampen the noise level is a good second choice. Closely monitor the volume on all headphones used by children. It is important to educate children and the adults who care for them about the irreparable harm loud music or noise can cause the human ear. Finally, always remind young children not to put anything into their ears. Cotton swabs and other probe-like objects should not be used in the ears as they can easily damage eardrums.

General Caution for All Activities

Outside: Extended time outside exposes children to damaging ultraviolet radiation; be mindful of children's exposure to the sun. Offer parents the option of providing children sunscreen and protective clothing to reduce exposure on a regular basis. Remember that some children have allergies to pollen, bees, and so forth. Parents should be consulted about these possible allergies. Familiarize yourself with the symptoms of allergic reactions in children and monitor your children closely. Before taking children outdoors, scout out the area to make sure it is safe and free of poisonous plants, tripping hazards, obstructions, trash, and other hazards. Recruit additional adults to help supervise children when outdoors and make sure that children wash their hands after outdoor science activities.

Electricity: When planning science activities, remember the need to plan for the safe use of electricity. Make sure all unused electrical outlets are covered, all loose cords are handled appropriately, all electrical tools or appliances are unplugged after use, and all electrical appliances are kept away from water and water sources. Ensure that the electrical outlets in your classroom are GFI (ground fault interrupter) or GFCI (ground fault circuit interrupter) outlets to protect children from possible electrical shock while using water.

Safety Summary

Being aware of safety hazards and having the resources to plan safe science learning activities are necessary for all those who manage or teach in early childhood settings. The reminders and suggestions in the paragraphs above, together with the information found in the Safety section of each activity and the resources listed below, will serve as a fine foundation for planning and implementing safe science activities. In addition, all teachers and caregivers should be aware of the safety procedures, crisis or natural disaster procedures, and parent notification plans in place at their school or caregiver sites. Knowing and following these procedures are vital to the safety of all children.

Resources

National Science Teachers Association. Safety in the science classroom. *www.nsta.org/safety.*

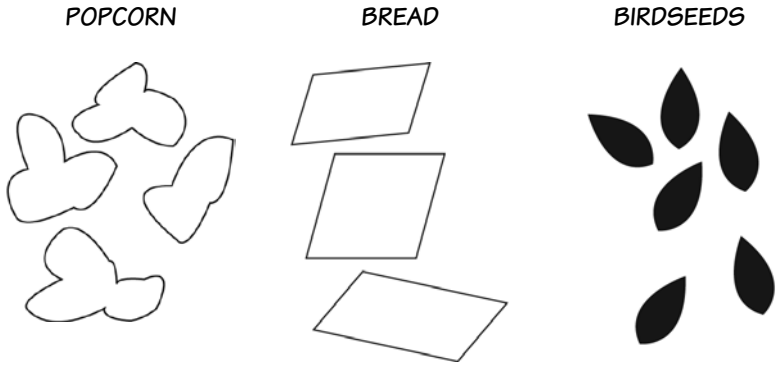
Head Start Early Childhood Learning & Knowledge Center. Safety practices. *http://eclkc.ohs.acf.hhs.gov/safety-practices.*

Safe Kids Worldwide. Safety tips: Little kids. *www.safekids.org/safetytips/field_age/little-kids-1%E2%80%934-years.*

Simple Graphing for Young Children

Graphing is an important way to document children's investigations. Graphs can help children make sense of their discoveries by giving them a visual representation of their findings. Graphs develop and reinforce the science practices and skills of observing, comparing, classifying, and recording information. There are many different ways to make graphs with children. A general rule of thumb is, the younger the child, the more concrete the graph should be.

1. The most concrete graphs use real objects. For example, if children were investigating which food is most popular with birds, and there were three choices—popcorn, stale bread, and birdseed—the children could glue a real piece of food on a graph each time they saw a bird visit a feeder and chose to eat one of the three foods. The graph would look something like this:



2. A variation of the "concrete graphs" described above uses photographs of children to record their choices. For example, if children were choosing their favorite pie from among several (e.g., apple,

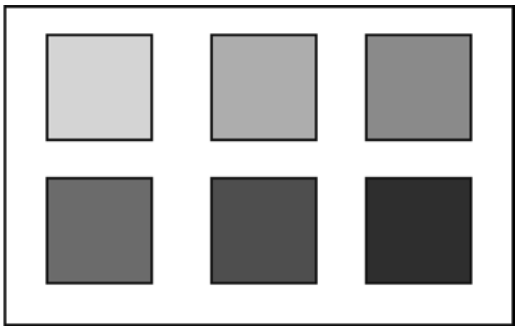
cherry, pumpkin, and lemon), you could place pictures of the pies along the horizontal axis and then have children "vote" for their favorite by placing their photo above the one they like best. The resulting graph, in which each child's photo makes up part of a particular bar, depicts how your class has voted on the favorite-pie choices.

3. A similar but more abstract graph could use children's names. For example, if children made three different kinds of bubble makers, you could make a chart with pictures of the three types. Children who used strawberry baskets to make bubbles would put their names under the picture of the basket; those who used pipe cleaners would put their names under the picture of the pipe cleaner; and so forth.

4. A graph can also help children to see changes in living, growing things (plants, caterpillars, etc.). For example, when measuring plant growth, give the children long strips of paper. Tell children the strips will help them keep track of how much their plant has grown. Give children one strip each day and ask them to make their strips the same size as their plant. Each time children measure, they can cut a strip to the same size of the object being measured. Children can glue the strips to a piece of construction paper, with the newest strip alongside the one from the last time they measured. This collection of strips will serve as a graph, showing growth over time. Ask questions such as "Which strip shows how small your plant was after it was first planted?" or "Which shows how big your plant is now?"

Science Teaching Boards and Boxes

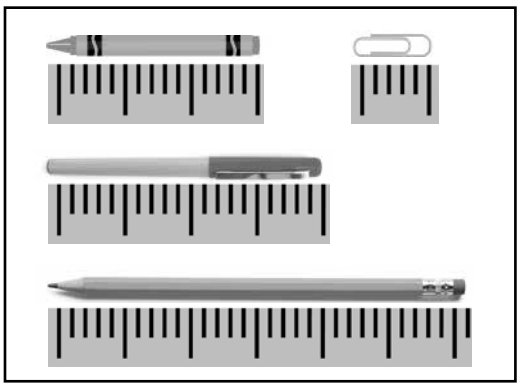
These teaching aids may be used while doing science activities and can be kept at the science center for children's use year-round.



Color Board

How to make: Cut out squares of different colors and glue them on a poster board. Label each color.

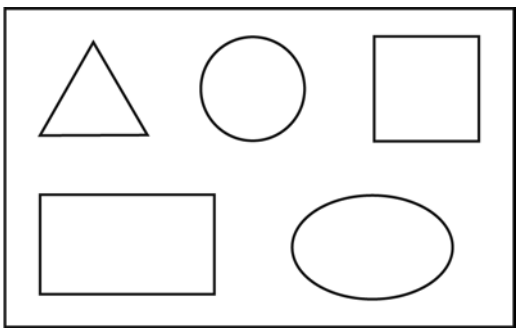
How to use: (1) Refer to the color board to match and recognize the colors of different objects. (2) Have children sort different objects on top of the board based on color.



Length Board

How to make: Glue common classroom items (e.g., paper clip, crayon, spoon, straw) or life-size pictures of animals (e.g., meal worm, caterpillar, earthworm) on a poster board. Include with each item a scale (i.e., ruler) that shows the item's length in standard units.

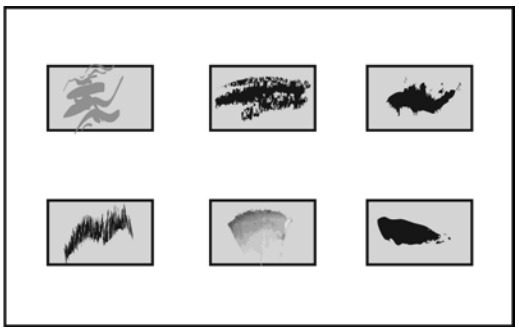
How to use: (1) Refer to the length board to match and recognize the lengths of different objects. (2) Have children sort different objects on top of the board based on length.



Shape Board

How to make: Cut out different shapes from construction paper and glue them on a poster board. Label each shape.

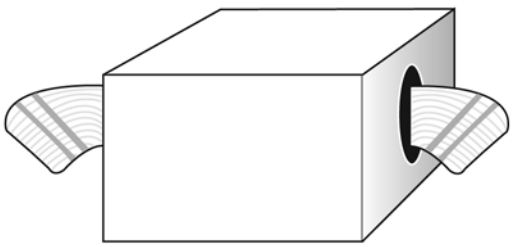
How to use: (1) Refer to the board whenever you want to help the children recognize and match the shape of different objects. (2) Have children sort objects on top of the board based on shape.



Texture Board

How to make: Glue different textured objects on a poster board (e.g., cotton = soft; sandpaper = rough; bubble wrap = bumpy; waxed paper = smooth; masking tape = sticky [sticky side up]). Label the texture of each object.

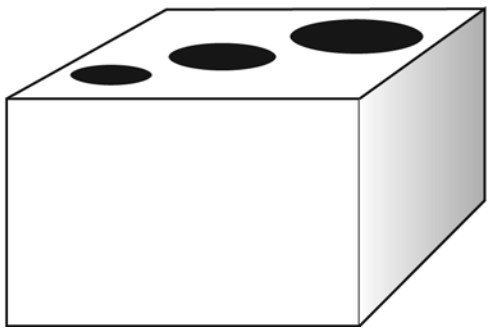
How to use: (1) Refer to the board to recognize and match objects to various textures. (2) Have children sort different objects on top of the board based on texture.



Feely Box

How to make: Cut a 3½"–4" hole in both ends of a shoebox. Cut off the top part of two socks and tape them hanging out of each hole.

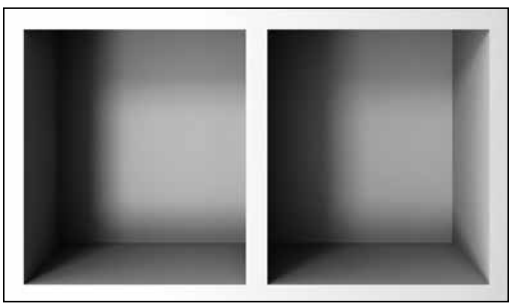
How to use: Children should put their hand through the sock top and into the box to feel any objects you have placed inside. Two children can use the box at the same time and communicate what each one is touching.



Size Box

How to make: Cut three different-size holes on the lid of a shoebox. Place cardboard "walls" to separate sections inside the shoebox for each size hole. Label holes small, medium, and large.

How to use: To help children compare and estimate the size of objects to a given standard, have children predict the smallest hole that a given object will fit into and then try it out.



Sorting Box

How to make: Divide a shallow box in half.

How to use: Children can use the box to sort groups of objects into two (or four) categories. For example, after children have explored with magnets for several days, they could put objects that are magnetic on one side of the box and those that are not magnetic on the other side. A Sorting Box is very concrete, but children may need adult help to decide on the categories.

Basic Materials List

Materials for science activities in an early childhood setting are simple and easy to find. You may be surprised at how many of the suggested materials you already have or have easy access to. Because science happens everywhere in your classroom and outdoor environment, we have listed materials under the areas in which these items might be used or stored (see pages xxxiv–xxxv).

Area	Purchased	Found
Block Area	• Wood blocks • Small cars • Tape • Pipe insulators • Marbles	• Small cardboard boxes • Paper towel tubes • Wood blocks • Wood flooring samples
Art Area	• Paint • Flour • Glue • Food coloring • Tissue paper • Salt • Cornstarch • Pipe cleaners • Liquid soap • Borax • Sorting trays • Paintbrushes • Paper towels • Colored paper • Markers • Crayons • Feathers • Colored chalk • Clay • Yarn	• Water • Bowls of various sizes • Newsprint • Coffee filters • Spoons • Pie pans • Strawberry baskets • Straws • Paper towel tubes • Tubing • Egg cartons • Plastic bottle caps • String
Dramatic Play	• Balances • Flashlights • Different fabrics • Measuring cups • Terrarium • Aquarium	• Food cans • Flowers • Different scents • Scarves • Paper bags • Plastic bottles • Wooden clothespins • Homemade can telephones • Keys

Continued

Basic Materials (*continued*)

Area	Purchased	Found
Manipulatives	• Magnets • Magnifiers • Prisms • Eyedroppers • Marbles • Seashells • Rocks • Measuring tools	• Various-sized containers • Plastic bottles and caps • Large buttons
Book Area	• Science and nature nonfiction books • Science-themed story books	• Field trip photos • Child-made books • Science-related photos from magazines • Museum pamphlets • Nature center pamphlets
Music	• Purchased instruments • MP3/CD player • Tape recorder • CDs • Audio tapes • Bean bags	• Homemade instruments • Homemade sound cans • Audio recordings of familiar sounds • Scarves
Outdoors	• Balls • Balance beam • Large wooden blocks • Bug boxes • Playground equipment • Water table • Sand • Sandbox • Camera • Resealable plastic bags • Sand and water toys • Vegetables • Fruit	• Trees • Plants • Flowers • Leaves • Bugs • Birds • Water • Rocks

7

Nature Walks

Every school is located within walking distance of interesting living things such as birds, plants, and even pets; natural objects in a wide variety of colors and shapes are just outside your classroom. To develop the basic observational skills important in science and in everyday life, children need many experiences noticing and describing things in their environment. Going on nature walks near their school will help children to understand that there are interesting things to look for no matter where they are. Collecting things in nature allows children to organize and compare objects and to make collections that can be observed and discussed. Although, going on a nature walk requires no materials, we would suggest you get into the habit of giving your children magnifiers to take along. You will soon find that children reach for their magnifiers whenever there is anything new to examine.

Selected Internet Resources

Pets

Pets in the Classroom, PreK to 2nd Grade Lessons

- *www.petsintheclassroom.org/pets-in-the-classroom-teacher-lesson-plans-prek-2nd*

Centers for Disease Control: Animals in Schools and Daycare Settings

- *www.cdc.gov/features/animalsinschools/index.html*

Nature Walks

Turn Any Walk into a Nature Walk

- *www.naeyc.org/our-work/families/turn-any-walk-nature-walk*

Why Kids Need to Spend Time in Nature

- *https://childmind.org/article/why-kids-need-to-spend-time-in-nature*

Trees and Leaves

PreK Teaching Unit on Trees

- *www.massaudubon.org/content/download/13467/209564/file/PreKTeachingUnits-TREES.pdf*

Leaf Activities for Young Learners

- *www.plt.org/educator-tips/leaf-activities-young-learners*

Connecting Children with Nature: Learning about Trees

- *www.scholastic.com/teachers/blog-posts/sharon-taylor/connecting-children-nature---learning-about-trees*

Nature Bracelets

Investigation: Finding interesting objects in nature to make into a bracelet

Science practices and skills: Classifying, observing

Materials: 2-inch-wide masking tape

Safety: Before taking children outdoors, check with parents for the children's environmental allergies (pollen, bees, etc.) and make sure that the area is safe and free of poisonous plants, tripping hazards, herbicides and pesticides, trash, and other hazards.

Procedure

Getting Started

Make a masking tape bracelet for each child by placing a piece of masking tape around the wrist, sticky side out. Go outside and tell the children they can make "nature bracelets" by picking up interesting objects such as leaves, grass, flowers, and twigs and placing them on the tape. Have extra tape available so they have a bracelet for each wrist if desired.

Questions to Guide Children

- What did you find?
- Can you find more (leaves) that look the same?
- Can you find something longer? Shorter? Softer? Harder? A different color?

What Children and Adults Will Do

Watch carefully to see what children choose to put on their bracelet. Some will make a pattern of just two or three materials; others will choose randomly. Some may discover that sand and small rocks stick to the tape too! When you notice what they are choosing, you can ask appropriate questions that encourage them to think about and describe the objects they chose for their bracelets. To expand the thinking, point out what different children are doing and encourage them to compare bracelets.

Closure

Gather children together and ask them to share their bracelets. Ask them to describe the different items they put on their bracelets and to explain why they chose those items.

Extending the Activity

Follow-Up Activity

You can repeat this activity in different locations and at different times of year. The flowers of spring

and the fallen leaves of autumn will inspire very different bracelets. Talk with children about how their bracelets are different from last time.

Center Connection

During outdoor time, have tape available so that children can choose to make additional nature bracelets. Put any extra items in the art center; let children make a class mural out of the extra things they have collected.

Literature Connection

Science Outside by Susan Canizares and Betsey Chessen, Scholastic, 1999.

Let's Find It: My First Nature Guide by Katya Arnold, Holiday House, 2002.

We're Going on a Leaf Hunt by Steve Metzger, Cartwheel Books, 2005.

NGSS Connections and HSELOF Indicators

NGSS
LS4.D: Biodiversity and Humans • There are many different kinds of living things in any area, and they exist in different places on land and in water. (2-LS4-1) **PS1.A: Structure and Properties of Matter** • Matter can be described and classified by its observable properties. (2-PS1-1) **Science and Engineering Practice: Planning and Carrying Out Investigations** • Make observations (firsthand or from media) and/or measurements to collect data that can be used to make comparisons.
HSELOF
P-SCI 1. Child observes and describes observable phenomena (objects, materials, organisms, and events). • Describes observable phenomena using adjectives and labels, such as lemons taste sour and play dough feels sticky. **P-MATH 8. Child measures objects by their various attributes using standard and non-standard measurement. Uses differences in attributes to make comparisons.** • Uses comparative language, such as shortest, heavier, or biggest.

What to Look For

Preparing	Child does not participate in making a nature bracelet.
Attempting	Child participates with the help of an adult; does not participate in group discussion.
Exploring	Child collects items for their bracelet; asks questions about the items; discusses the items with peers and adults.
Connecting	Child collects items for their bracelet; sorts and compares the items independently; ask questions and shares discoveries with peers and adults.

Family Science Connection

At home, put some masking tape (with the sticky side out) around your child's wrist for the day. At the end of the day, cut the tape off and observe, identify, compare, and match the various objects that stuck to the tape. Another way to try this activity is by attaching the tape to your child's shirt. This way will allow for easier movement while playing.

Comments and questions that may add a sense of wonder to this activity:

- Wow, what did you collect on your sticky bracelet today?
- Tell me about the smallest thing that stuck to the bracelet and about the biggest thing that stuck.

Ciencia en Familia

En casa, pongan cinta adhesiva (con el pegamento por fuera) alrededor de las muñecas de su hijo/a por esedía. Al final del día, corten la cinta adhesiva y observen, identifiquen, comparen, y encuentren pares entre los varios objetos que se encuentran adheridos a la cinta adhesiva. Otra manera de hacer esta actividad es colocando la cinta adhesiva en la camisa/blusa de su hijo/a. Así será más fácil que su hijo/a se mueva mientras juega.

Comentarios y preguntas que pueden despertar curiosidad en esta actividad:

- Veamos, ¿qué recogimos en nuestras pulseras adhesivas hoy?
- Cuéntame que es lo más pequeño y lo más grande que se pego en la pulsera.

Index

A HEAD START ON SCIENCE

Encouraging a Sense of Wonder

2nd Edition

"I found this book to be a great resource for early childhood education teachers. The introduction was very informative and gave an excellent overview of what to consider when teaching young children science. ... [A Head Start on Science] allows educators of young children to provide a discovery-focused, inquiry-based learning environment for all children ages 3–7. All the activities are student-centered and teacher-guided to provide a fun, multisensory approach to learning science."

—NSTA Press reader Gilbert L.

This thoroughly updated resource is bursting with useful features early childhood educators will love, including learning frameworks, connections, standards, and assessments. But the best part is how stimulating the book can be for young scientists. It builds on children's innate curiosity through 89 developmentally appropriate, teacher-tested activities in life, Earth, and physical science.

Specifically written to engage children in preK through grade 2, *A Head Start on Science, Second Edition* is

- **Full of fun.** Whether they're making magnetic mazes or creating sand sculptures, children will love exploring the senses, weather, animals, water and water mixtures, seeds, and nature. Rather than focusing their attention on science facts, the goal is for children to make discoveries on their own.
- **Versatile.** The activities are suitable for preschools, elementary schools, informal science settings, and home schools. Children as young as 3 can observe and explore new and familiar materials. PreK–2 students will enjoy the challenges of investigating, organizing information, and trying out new ways to communicate results.
- **Convenient for teachers.** The book's introduction is like a short course in how to do science well with children. Each activity provides a follow-up activity, center connection, and literature connection to extend the science learning and link it to other parts of children's school days. So that both the fun and the learning can continue at home, each activity also provides a family page, written in English and Spanish.
- **Designed to support relevant standards.** Each activity also links to both the 2015 Head Start Early Learning Outcomes Framework and the *Next Generation Science Standards*.

In short, *A Head Start on Science, Second Edition* is a teacher-friendly guide for doing science well with young children. As the editors write, "We hope your 'sense of wonder' will be heightened as you interact with children, watching as their curiosity leads them to explore and find answers to their own questions about all that they experience about the natural world."

Grades PreK–2

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