

# A HEAD START ON SCIENCE

ENCOURAGING A SENSE OF WONDER



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ENCOURAGING A SENSE OF WONDER

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# PREFACE

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## Origin of This Activity Book

**A** *Head Start on Science: Encouraging a Sense of Wonder* is a book of 89 activities that have been used successfully by hundreds of teachers in Head Start programs across the country. For this book, they were modified to be used by an even greater variety of early childhood educators, including day care, preschool, and K–2 classroom teachers.

The book has its roots in a project that dates back to 1996. At that time, the Department of Science Education of California State University, Long Beach (CSULB), in cooperation with the Head Start Program of the Long Beach Unified School District, undertook a project called “A Head Start on Science.” Support came from a grant from the Head Start Bureau of the U.S. Department of Health and Human Services.

The purpose of the project—which continues today—was to “demonstrate, evaluate, and replicate a summer institute prototype designed for Head Start teachers, teacher assistants, and home visitors.” The goal has been to prepare institute participants to foster a lifelong interest in science among children in early childhood settings. For that to happen, Head Start educators themselves have to become more confident and enthusiastic about their own “sense of wonder” about the world.

During the first summer institute, participants were teachers and teacher aides from Head Start centers in Long Beach, California. An independent evaluator provided the project with data to refine the institute plans and materials for replication in Long Beach and elsewhere. Products to assist in sharing the prototype institute with others include a teacher’s guide, a project website, a 12-minute descriptive video, and a “how to” manual for those planning to replicate the institutes.

More recently, a grant from the American Honda Foundation supported the establishment of a National Center for Science in Early Childhood at California State University, Long Beach. The center brought teams of educators from across the United States to participate in leadership training at CSULB during the summers of 2000 and 2001. As a result, there now exists a national network of over 20 “A Head Start on Science” dissemination and training centers.

From the beginning, overall guidance for the project was provided by a National Advisory Board made up of experts from Head Start, science education, and early childhood education programs. Day-to-day efforts of the project have been guided by persons with expertise in these same fields. Project staff are also actively involved in sharing what is being learned with Head Start, early childhood, and science education audiences across the country. We hope you will find, as earlier users did, that the activities will encourage a sense of wonder among our littlest scientists.

— William C. Ritz  
Project Director  
“A Head Start on Science”

## ABOUT THE EDITOR

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**W**illiam 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. During a four-year affiliation with the Eastern Regional Institute for Education (ERIE), his service as an elementary science consultant took him into classrooms throughout New York and Pennsylvania while he also completed doctoral studies in science education at SUNY 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, including the Young Scholar's Ocean Science Institute, the Project to Improve Methods Courses in Elementary Science, Project MOST: Minority Opportunities in Science Teaching, and A Head Start on Science.\*

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\* A list of "A Head Start on Science" project staff and other collaborators is on p. 337.

# INTRODUCTION

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## Our Theme

In 1956, Rachel Carson wrote a book 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 adventures in 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 gave them names as well. He learned as the two of them 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” (Carson 1956)\*. This curriculum, *A Head Start on Science*, was written to help adults facilitate young children’s learning as they work as partners to explore their world. We hope your sense of wonder will be heightened as you observe children, as their curiosity leads them to answer their own questions about everything they see, hear, smell, and touch.

## Our Beliefs About Science Education and Young Children

- Early childhood teachers build on the “sense of wonder” present in all children.
- Young children learn about science through play.
- Doing science comes naturally for young children.
- The science processes that young children engage in are more important than learning science facts.
- Early childhood science teachers serve as “facilitators” of learning, as opposed to “instructors.”
- As children engage in science experiences, adults observe children's actions and listen to their conversations so that they can follow children's leads.

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\* *The Sense of Wonder*. Copyright © 1956 by Rachel Carson. Copyright renewed 1984 by Roger Christie. Reprinted by permission of Frances Collin, Trustee.

## Introduction

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- Science processes occur in all parts of the classroom and outdoors, not just at the science table.
- Children are intrinsically motivated when they have materials to enjoy, have some control over their learning, and enjoy success when involved in science processes.
- Children and adults should feel free to engage in science processes, 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 explore, represent, and share their discoveries.
- Children learn best when they have their own science materials to explore.
- Trial and error, 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, regardless of gender and ability, needs to have equal access to science experiences.
- Young children with disabilities are best served in classrooms where they are involved in science processes along with typically developing peers.
- Adults need to model excitement and enthusiasm when involved in science processes 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 to children about science, it is important to honor their 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 activities.

## The Role of Questioning in Science

### Listen to Children

You will notice that we have included a caution 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.”

### Follow Children’s Leads

Another caution we have included is: “Follow children’s leads when deciding which two or three 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 Jaime 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. 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 in which she is obviously interested.

### 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 Brian asks, “What do snails eat?” wait a bit then turn his question back to the group by asking, “How can we find out?” This 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, then follow their lead! Ask children what they think snails might like to eat, then spend the rest of the activity time putting out various foods to see which become “snail food.”

### Ask Genuine Questions

The questions you ask should always be genuine. They should usually 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

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and will often dampen a child's enthusiasm. Genuine questions lead to conversations, comfortable times when adults and children share thoughts and ideas, when both share control of the learning.

### *What Kinds of Questions Are Best?*

- Questions that follow children's interests or leads
- Questions to which you may not know the answer
- Questions that have many correct answers; each person has his or her own
- Questions that are genuine and lead to conversations

### *Examples of the Best Questions*

- "How would you describe it?"
- "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 Science Processes

Sometimes you will want to encourage children to engage in particular science processes. In that case your questions will be less open-ended but will still have many correct answers:

- "See if you can find other materials in the room that your magnets will attract?" (experimenting)
- "Are any of these rocks shinier than yours?" (observing, comparing)
- "What is the same about all these plants?" (observing, classifying)
- "What did you find out about what snails eat?" (communicating, classifying)

## Encourage Children to Use Science Tools

Sometimes you may want children to make regular use of the science tools:

- “What can you find out with the hand lens?”
- “Which one is the heaviest? Could you use the balance to find out?”

These questions encourage children to explore, to experiment, and to communicate their findings. They are not questions you use to quiz children to find out if they know the “correct” answer.

## 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. Often the child will add to his or her initial response or even change his or her answer.

## Comments and Questions That Facilitate Learning

Following is a list of comments and questions that will 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 ....”
- “Well, what do you think it is?”
- “I don’t know. What could we do to find out?”
- “What do you think those (things) might be?”
- “I wonder what that (critter) might like to eat?”
- “Paul, you did a nice job of being gentle to that mealworm!”

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- “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 that marble roll farther?”
- “Please 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 blocks 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?”
- “Does this remind you of something you've seen before?”
- “Can you think of a way to make your shadow longer?”
- “Try drawing a picture that shows me 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 scientists.

## The Importance of Science Processes

**A** *Head Start on Science* emphasizes encouraging a sense of wonder within young children through their use of the science processes. There are three ways of looking at the meaning of process. First, an emphasis on process usually implies a corresponding de-emphasis on science factual “content.” But don’t get the wrong impression! Science content is still there—children learn about their everyday world by examining and exploring such things as snails, plants, rocks, and shadows. But the emphasis is not on spoon-feeding them specific information about these objects and phenomena. Rather, they are encouraged to expand their perceptions of the world by learning how to observe such things as silkworms changing into moths, how to compare the smells of various foods, how to classify leaves collected on a walk, and how to communicate what they have learned.

A second meaning of process centers on the idea that how children learn science should resemble what scientists do. Scientists observe, classify, infer, carry out experiments, and communicate their findings. How have they become able to do these things? Presumably, they learned to do them, over a period of many years, by practicing them. We believe that just as the people of science have learned to gain information in these ways, the elementary forms of what they do can begin to be learned by very young children.

A third meaning of process introduces the idea of human intellectual development. From this point of view, processes are in a broad sense “ways of processing information.” Such processing grows more complex as the individual develops from early childhood on. The intellectual skills that are developed allow a child to get much more information from a simple observation than they could have before these skills were developed. Therefore, a child observing a snail will see much more than just a slow-moving object in the grass. She or he will notice the sticky trail the snail leaves, will compare the snail to other slow-moving objects, will observe what the snail eats, and will begin to ask questions about and comment on the snail’s environment and other things of interest.

There are four processes\* that we feel are developmentally most appropriate for very young children:

1. Observing: seeing, hearing, feeling, tasting, and smelling
2. Communicating: oral, written, and pictorial
3. Comparing: sensory comparisons and linear, weight, capacity, and quantity comparisons
4. Organizing or Classifying: grouping, sequencing, and data gathering

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\*Adapted from American Association for the Advancement of Science (AAAS) Commission on Science Education. 1967. *Science—A process approach: Purposes, accomplishments, expectations*. Washington, DC: American Association for the Advancement of Science. Reprint, 1968.

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# Using the Activities

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

Each activity includes the following components:

- Investigation: A simple description of the activity that includes the main point of the investigation.
- Process Skills: A list of the science-process skills children will use during investigation.
- Materials: A list of all materials needed to complete the investigation.
- Procedure: The procedure is divided into four sections:

*Getting started:*

Suggestions for beginning the investigation. Most include a caution for the adult to watch children and listen to what they say before asking questions.

*Questions and comments to guide children:*

Examples of questions and comments that will focus children’s 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,

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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 process skills. 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 hand lens 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 the investigation might end. This includes various ways children might communicate their findings, including participating in discussion, drawing, or graphing. It sometimes involves including children in the clean-up process or in deciding where to store materials.

**Follow-up Activities:** Many of the investigations include suggestions for follow-up activities using the same or similar materials that will help children make additional discoveries. Of course children love repetition, so you may want to repeat a popular activity exactly the way it was originally presented before introducing variations.

**Center Connections:** Center connections remind you to keep the materials you have been using available to children so that they can continue to make discoveries on their own. Art connections suggest ways children can represent their work through painting, drawing, and making models.

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### Literature Connections:

Teachers can use the books in the “Literature Connections” lists in a variety of ways, including as read-alouds and for story dramatizations and expanding science content. When teachers use versions of the printed word—by recording children’s observations and by displaying and reading related book—children increase their understanding of how printed language works. Thus it is important that written materials and books with science themes be an everyday part of the classroom environment.

The books listed in each activity include titles recommended by the Head Start on Science curriculum developers and by teachers who have used the activities in this book in their classrooms. A special effort was made to include books from the NSTA “Outstanding Science Trade Books for Students K–12” lists of the past decade.

### Assessment Outcomes and Possible Indicators:

The “Head Start Child Outcomes Framework” (see Appendix A for the complete framework) is intended to guide early childhood education programs in their ongoing assessment of the progress and accomplishments of children and in their efforts to analyze and use data on child outcomes in program self-assessment and continuous improvement. The framework is composed of 8 general domains, 27 domain elements, and 100 examples of more specific indicators of children’s skills, abilities, knowledge, and behaviors.

Science activities include many of the elements in all eight domains. (In fact you will find it almost impossible to find a developmentally appropriate science activity for young children that does not cross domains!) So, for example, any activity in which children are discussing what they are discovering will include indicators under the “Language Development” domain and the domain

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element “Speaking and Communicating.” Possible indicators might be one of the following:

- Develops increased abilities to understand and use language to communicate information, experiences, ideas, feelings, opinions, needs, questions, and other varied purposes.
- Progresses in abilities to initiate and respond appropriately in conversation and discussions with peers and adults.
- Uses an increasingly complex and varied spoken vocabulary.

For each activity, we give the three to six most prominent domain indicators. As you conduct the activities with children, you will discover many other indicators that are not listed that you can measure for some of the children in your group. For example, you may notice a non-English-speaking child responding for the first time to directions given in English. Another child may spontaneously count to 10 while gathering rocks. Each of the eight child outcomes domain indicators has been identified for some of the activities, but only science indicators have been listed for all activities.

What to  
Look For (Rubric):

Although you may use a rubric in your agency’s assessment tool that uses different terms than ours, the rubric we provide—“What to Look For”—will easily convert into the measurements you are currently using. The following general rubric has been adapted for each activity.

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Not Yet	Lack of interest or curiosity about the subject
Emerging	Reluctant to participate in activities where the subject is examined; only looks; shows some curiosity about the subject
Almost Mastered	Willing to look, touch, listen, and discuss subject either in a group or independently; shows curiosity and may begin to ask questions
Fully Mastered	Independently notices; willing to explore; listens and describes and asks about the subject; shows a strong natural curiosity

Family Science Connection (in English and Spanish):

A Family Science Connection concludes almost every activity. These connections, which are intended to be photocopied and sent home with students, extend the learning that has taken place at school and involve the whole family in a pleasurable 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.

## Teaching Respect for Living Things

Young children are often highly attracted to animals, insects, and many reptiles—especially those that can fit in the palms of their hands. These creatures bring squeals of joy and excitement from most children as their faces light up with wonder, watching the uniqueness of all tiny creatures. Bringing “critters” into your early childhood setting can be a marvelous decision. You simply need to plan for the proper care of them.

A sound first step is to select creatures such as insects (e.g., consider caterpillar-to-butterfly kits). 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, which in turn can pose electrical dangers. It is also wise to steer clear of “hairy” critters that often have the dander that can cause allergic reactions or asthmatic flare-ups. Using the internet, your local pet store, or biological supply houses as resources, learn about the habitat and food needed for the critter of your choice. Encourage the children to help with creating the habitat for their new “guest” to live in. Talk about proper feeding and care of the critter and ask the children to help you with the responsibilities of caring for this living creature. Before your new “guest” is brought into your classroom or learning setting, take time with the children to help them understand how this critter is different from plastic, rubber, or other toy critters they may have played with at home. Help them to understand how to respect and honor their new “guest’s” food, handling, habitat, and space needs. You can ask them to draw pictures and create stories about a living creature similar to your new “guest” in which they tell or show how we can all help these creatures to live a healthy life in our setting.

Be aware that some children will show some fear of some creatures. Do not try to force them to handle creatures that scare them. (And it is very important for *you* not to react negatively!) Begin by asking them to observe interesting features of the critter from outside the critter’s glassed or caged area. Over time, most children will eventually want to handle the critter once their fears subside and their confidence grows.

When incorporating the use of animals into the doing of science, 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. Also consider inviting park naturalists, veterinarians, or 4-H members to bring

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animals into the classroom to demonstrate proper handling.

In some of the activities in *A Head Start on Science* you and your children are encouraged to find some sort of critter in your own neighborhood. When you do, make certain that children understand the importance of *returning* that living thing to its own “home” after the activity ends.

Animals provide wonderful opportunities for children to question and wonder as they watch them move, eat, drink, and play. Try to follow the children’s questions and allow them to safely explore what it is they wonder about the animals in their care or those they see in the natural environment.

### Resources: Respect for Living Things

“Animals in the classroom.” Head Start Guidelines for Animals in the Early Childhood Classroom. [www.head-start.lane.or.us/administration/policy/health/classroom-animals.html](http://www.head-start.lane.or.us/administration/policy/health/classroom-animals.html)

“Learning to care through kindness: A guide for teachers. Alberta (Canada) Teachers Association. [www.sacsc.ca/PDF%20files/Resources/Humane%20Education.pdf#search=%22respecting%20animals%20in%20the%20classroom%22](http://www.sacsc.ca/PDF%20files/Resources/Humane%20Education.pdf#search=%22respecting%20animals%20in%20the%20classroom%22)

“NSTA position statement on responsible use of live animals and dissection in the science classroom.” [www.nsta.org/positionstatement&psid=44](http://www.nsta.org/positionstatement&psid=44)

## Children With Special Needs Can Do Science

*All* children can and should do science—starting at a very early age. The science they do should flow from their natural curiosities. Teachers and caregivers of children with special needs may find themselves in pathways that are new to them, with unfamiliar curricula, adaptive technologies, equipment, and other special learning supports. Don't let these new pathways overwhelm or threaten you! They may be new for you, but, as the facilitator of early learning, you need to become familiar and comfortable with all that is available to help support the learning of science by all children. You need not take on these tasks alone, nor all at one time. Let your journey begin with the special needs children currently in your classroom.

### Physical Special Needs

#### *Children With Allergies or Asthma*

Children with allergies and asthma are present in virtually all childhood settings. 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 a certain food from use in your 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 full original lesson. Choosing alternative foods, working with latex-free gloves, eliminating cleaning products and their odors from the classroom environment, choosing 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.

We know that physically active children typically are healthier children and going outside to play is often part of the daily program. However, 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 summer 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 special needs and plan for lesson alternatives accordingly. If you are aware ahead of time, the lesson adjustments needed are usually fairly easy to make.

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### *Children Who Are Hearing or Sight Challenged*

The world of science must not be closed to students 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 lessons to support exploration based on the child's strengths. This may mean enlarging printed text and pictures, using adaptive technologies in the classroom, making sure all lessons 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 learners in your setting, and discussing how all people are able to learn and contribute in unique ways to our society. The ideas offered in the resource list on page xxviii will help you to make instructional changes based on children's hearing or visual special needs.

### *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 students 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 these children. You may also need to adopt or adapt lesson materials or science tools to make activities possible for those with fine-motor challenges or those using prosthetic limbs. After you have modified the classroom environment and science tools, then 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 or vehicles must be taken into consideration when planning outdoor science activities and field trips.

### **Cognitive and Emotional Special Needs**

Some of your children may have developmental or cognitive impairments, learning disabilities, or sociological or emotional challenges. All of these challenges may negatively affect student attention, engagement, and achievement. But each challenge also brings its own unique set of triggers, trials, and learning implications to the fore-

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front. 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 the child.

Science activities can often be door-openers for children coping with learning challenges. The open-endedness, inquiry-based, student-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 celebrate what children think, what they question, and what they wonder about are wonderful facilitators of all children, especially those with cognitive and socioemotional challenges.

### Cultural and Linguistic Special Needs

As communities around the nation increase in cultural and linguistic diversity, so, too, does the diversity of the children you see each day. Ultimately, research tells us that accepting, respecting, honoring, and celebrating all children’s cultures and languages are important first steps in accepting a child fully as a person and as a learner. Science activities offer us great ways to support English language learners as well as to invite full participation into the learning community.

Because hands-on investigations and open-ended activities build on the natural curiosity of children, they help to overcome many language or cultural barriers. Teachers and caregivers can offer the science challenges in multiple languages, use pictures to support conceptual understanding, and support the ways students communicate and interact through language, drawing, and the use of manipulatives. Science should not be thought of as a vocabulary-laden, text-based curricular area, but rather a field of study that is curiosity-based, question-driven, and open-ended. Thinking of science in this way will make it a wonderful common ground on which to bring children of all languages and cultures together as a learning community.

### Resources: Children With Special Needs

“Child care centers and the Americans with Disabilities Act—Frequently asked questions.” U.S. Department of Justice. [www.usdoj.gov/crt/ada/childq%26a.htm](http://www.usdoj.gov/crt/ada/childq%26a.htm)

“Coping with crisis: Helping children with special needs—Tips for school personnel and parents.” National Association of School Psychologists. [www.nasponline.org/neat/specpop\\_general.html](http://www.nasponline.org/neat/specpop_general.html)

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“Early childhood and elementary education disability resource information.” *www.disabilityinfo.gov/digov-public/public/DisplayPage.do?parentFolderId=73*

“NSTA position statement on students with disabilities.” *www.nsta.org/positionstatement&psid=41*

Porter, L. 2002. *Educating young children with special needs*. Thousand Oaks, CA: Sage Publications. *www.sagepub.com/booksProdDesc.nav?contribId=526620&prodId=Book225572*

“Responding to cultural and linguistic diversity: Recommendations for effective early childhood education—A position statement.” National Association for the Education of Young Children. *www.naeyc.org/about/positions/pdf/PSDIV98.PDF#search=%22early%20childhood%20cultural%20and%20linguistic%20challenges%22*

Schwartz, I. S., S. L. Odom, and S. R. Sandall. “Including young children with special needs.” Redmond, Washington: New Horizons Learning, Childcare Information Exchange. *www.newhorizons.org/spneeds/inclusion/information/shwartz3.htm*

## Safely Doing Science With Young Children

Wonderful science learning happens when young children enthusiastically explore their worlds. As teachers and caregivers of these 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.

Observing/  
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. Since these are not usually available to teachers of young children, however, consider using blunt objects for probing. Some teachers use such things as craft sticks, cotton swabs, and unsharpened pencils because they are not sharp and yet 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 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 students’ 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 to discuss words and concepts such as *smooth*, *rough*, *bumpy*, and *patterned*. At times, however, touching objects can be unsafe. For example, it is important to help young children learn the proper way to “touch” hot and sharp objects or elements 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

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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, plants' thorns and needles, saws, and animals' spikes and teeth are all sharp and can easily cut or puncture children's fingers. Helping children recognize sharp objects and their potential dangers is an important first step. Next, limit the number of sharp objects in your learning environment. That would include sharp corners on furniture, playground equipment, and toys. Finally, help the children to understand how to carry sharp objects with their points or sharp edges pointed away from their bodies and to alert an adult immediately if anyone is cut or punctured by a sharp object. Small cuts may only require cleansing (using antibacterial soap) and a Band-Aid, while deeper cuts may require medical attention and stitches. Puncture wounds often require medical attention as the wound can easily become infected.

### Smelling and Tasting:

From birth, children put their hands in their mouths and near their noses as their primary ways of experiencing the world. As you know, this doesn't stop when they become involved in day care or preschool. Much of the excitement of experiencing the everyday world comes through tasting new foods and smelling new smells. Without becoming over-cautious, 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 foodstuffs or things identified by trusted adults as *foods that are safe to eat*. Furthermore, they 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 (e.g., to peanuts or chocolate) among all children in your care before including any foodstuffs in your classroom activities.**

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**Listening:** One way to experience the details and nuances of the world around us is to use our ears—to sit quietly and *listen*. Assisting children to acquire this skill will help them to become better observers of their environments. An outdoor environment where the children can close their eyes and hear the sounds of nature from the insects, animals, and birds is a perfect place to begin your listening training. If you're in the middle of a city, this still works—except that the sounds will be different! Less desirable would be using tapes or CDs of nature, city, or industry sounds to substitute for this natural experience.

In any case, it is important to remind children to take care of their ears and their hearing throughout their lives. If noises or music are so loud that a sound hurts your ears, the sound level is unsafe and precautions should be taken to keep your 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, wearing ear plugs to dampen the noise level should be the second choice. In today's world where even young children have music and video hand devices with personal earphones or "earbuds," it is important to educate everyone as to 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 the ear drum.

### General Caution for All Outside Activities

Extended time outside exposes children to damaging ultraviolet radiation, which is cumulative. Offer parents the option of providing children sunscreen and/or protective clothing to reduce exposure on a regular basis.

Remember that some children have allergies to pollen, grass, and so forth. Parents should be consulted about these possible allergies.

### 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

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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.

## 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 learning settings. The reminders and suggestions in the paragraphs above, together with the information found in the section on children with special needs (pp. xxv–xxviii) 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/natural disaster procedures, and parent notification plans in place at their school or caregiver sites. Knowing and following these procedures is vital to the safety of all children.

## Resources: Safety

“First aid and safety.” Kids Health. [http://kidshealth.org/parent/firstaid\\_safe/index.html](http://kidshealth.org/parent/firstaid_safe/index.html)

“Food safety quiz for kids.” Food and Drug Administration. [www.fda.gov/oc/opacom/kids/html/wash\\_hands.htm](http://www.fda.gov/oc/opacom/kids/html/wash_hands.htm)

“Health, safety and nutrition for young children: Information resource links.” [www.headstartinfo.org/infocenter/guides/healthsafetynutrition.htm](http://www.headstartinfo.org/infocenter/guides/healthsafetynutrition.htm)

“NSTA position statement on safety and school science instruction.” [www.nsta.org/positionstatement&psid=32](http://www.nsta.org/positionstatement&psid=32)

“Why is hand washing important?” Centers for Disease Control and Prevention. [www.cdc.gov/od/oc/media/pressrel/r2k0306c.htm](http://www.cdc.gov/od/oc/media/pressrel/r2k0306c.htm)

Graham, L. 2001. “Farm safety for young children.” Iowa State University, University Extension. [www.extension.iastate.edu/Publications/PM1592.pdf#search=%22science%20safety%20with%20young%20children%22](http://www.extension.iastate.edu/Publications/PM1592.pdf#search=%22science%20safety%20with%20young%20children%22)

Kwan, T., and J. Texley. 2002. *Exploring safety: A guide for elementary teachers*. Arlington, VA: NSTA Press.

Texley, J., N. Visconti-Phillips, F. Hess, and K. Roy. 2003. *Safety in the elementary science classroom* (a flipchart). Arlington, VA: NSTA Press.

# SIMPLE GRAPHING FOR YOUNG CHILDREN

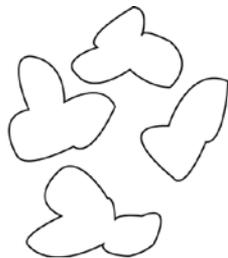
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**Purpose:** Making graphs is one way to document children’s investigations. Graphs can help children make sense of their discoveries by giving them a visual representation of their findings. They reinforce the science processes of observing, comparing, classifying, and recording information.

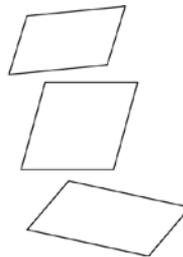
**Procedure:** There are many different ways to make graphs with children. The rule of thumb is, The younger the child, the more concrete the graph should be.

1. The most concrete graphs use real objects. For example, if children were investigating which bird food is most popular with birds, and there were three choices—popcorn, stale bread, and birdseed—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:

**POPCORN**



**BREAD**



**BIRDSEEDS**



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), place pictures of the pies along a horizontal line and then have children “vote” for their favorite by placing their photos 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.

In this day of digital cameras, here is an easy way to get a supply of children's photos:

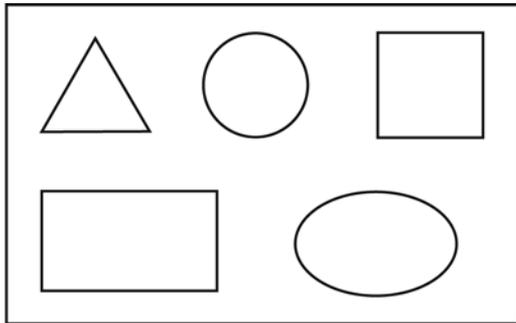
- Take digital "head shots" of each child.
  - Take your picture files to a store that prints digital photos and request that a "contact sheet" be made. A contact sheet can also be produced by using a photo software program such as "Photoshop Elements" or "Picassa" (available free online). (You will need access to a printer.) For specific instructions, access the software's "Help" menu and request information about printing "contact sheets."
  - You can cut the contact sheet into separate small photos of each of the children, or, to save on printing costs, you can use a copy machine to make 20–30 copies of each sheet. Each contact sheet typically displays 24 pictures. Use a paper cutter to separate the sheets into photos of identical size.
  - If you place each child's set of photos in an envelope with his or her name on it, you will have extra photos ready to let the children record their "votes" on any number of issues!
  - If you do not have access to a digital camera, get some black-and-white film and take "head shot" pictures as described above. When you take the film for developing and printing, request a "contact sheet" and then proceed as described above.
3. A similar graph could use children's symbols in place of their photos. Younger children will, however, relate more readily to photos than to symbols.
  4. A 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 would put their names under the picture of the basket (or you could write it for them); those who used pipe cleaners would put their names under the picture of the pipe cleaner; and so forth.

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5. Another type of graph is sometimes done on a sorting mat. This is a piece of poster board or a tray of some sort that is divided in half. After children have experimented with magnets for several days, for example, they could help you put magnetic objects on one side of the graph and those that are not magnetic on the other side. This activity is very concrete, but it will need adult help to decide on the categories (in this case, “magnetic” or “not magnetic”).
  
  6. A “bar” graph helps children to see changes in plants, insects (e.g., silkworms) or animals (e.g., ducks). For example, when measuring plant growth, give the children strips of paper about one inch wide. 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. Have children keep their strips in an envelope. When the plant has grown big enough to send it home, have children glue their strips onto a piece of construction paper. Most will glue them randomly, but some may put them in order of size. Ask questions like “Which strip shows how small your plant was after it was first planted?” “Which shows how big your plant is now?”

# SCIENCE TEACHING BOARDS AND BOXES

All of these teaching aids may be used while doing science activities or can be kept at the science center for the children's use year-round.

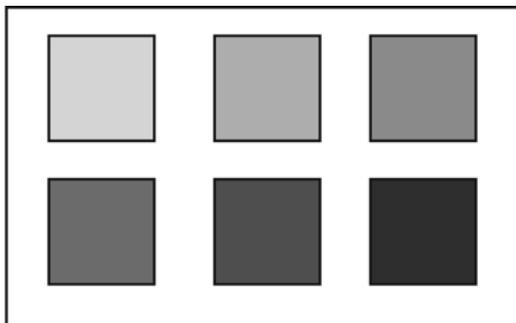
## Shape Board



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

*How to use:* (1) Refer to the board whenever you want to help the children recognize and match the shape of different items. (2) Have children use/sort items on the boards that are similar in shape.

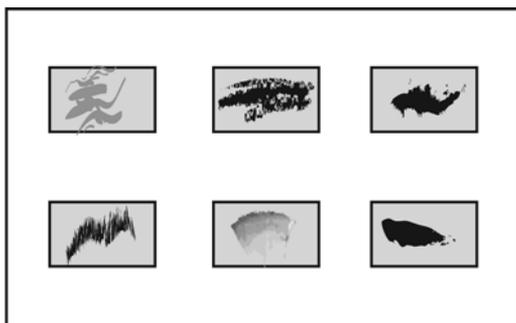
## Color Board



*How to make:* Cut out different-color squares and glue them on the board.

*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 the board that are similar in color.

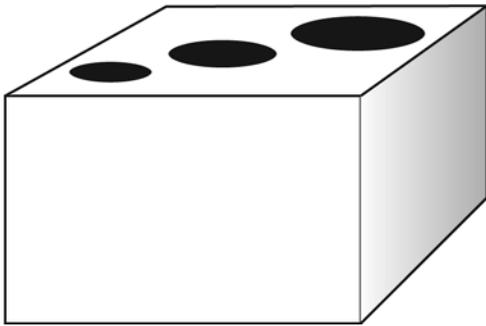
## Texture Board



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

*How to use:* (1) Refer to the board to recognize and match items to various textures. (2) Have children sort different items on the board that are similar in texture.

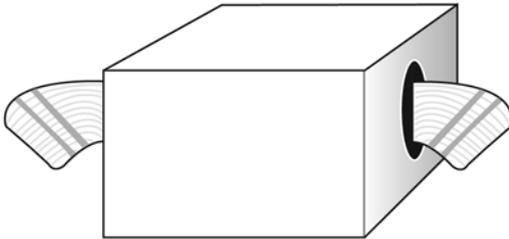
### Size Box



*How to make:* Cut three different-size holes on the lid of a shoe box. Place cardboard “walls” to separate sections inside the shoe box for each size hole. Label holes from smallest to largest—e.g., 1–3.

*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.

### Feely Box



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

*How to use:* The children should put their hands through the sock top and into the box to feel an object. Two children can use the box at the same time and communicate what each one is touching.

## 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 indoor and outdoor environment, we have listed materials under the areas in which these items might be stored.

	<b>Purchased</b>	<b>Found</b>
<b>Block Area</b>	Hard wood unit blocks Small cars Tape Pipe insulators Marbles	Cardboard tubes Hard wood unit blocks
<b>Art Area</b>	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	Water Bowls of various sizes Newsprint Coffee filters Spoons Pie pans Strawberry baskets Soda-can-holder plastic rings Straws Cardboard tubes from rolls of toilet paper Tubing Plastic egg cartons Colored telephone wire String

(continued)	Purchased	Found
<b>Dramatic Play</b>	Equal-arm balance Flashlights Different fabrics Measuring cups Terrarium Fish aquarium	Food cans Flowers Different scents Scarves Paper bags Plastic bottles Wooden clothespins Keys Homemade can telephones
<b>Manipulatives</b>	Magnets Hand lenses Prisms Bottle caps Eyedroppers Marbles	Various size containers
<b>Book Area</b>	Animal books Critter books Weather books Construction books Machine books Nature books Literature books	Field trip photos Child-made books Newspaper and magazine science photos Museum pamphlets Nature center pamphlets
<b>Music</b>	Purchased instruments Cassette/CD player Tape recorder Cassettes/CDs Bean bags	Homemade instruments Homemade sound cans Tapes of familiar sounds Scarves

(continued)	Purchased	Found
<b>Outdoors</b>	Balls Balance beam Large wooden blocks Bug boxes Swings Slide, climber Water table Sand Sandbox Camera Resealable plastic bags Sand and water toys Vegetables Fruit	Trees Plants Flowers Critters Leaves Water



## Section 3:

# Physical Science

## RAMPS

**Investigation:** Changing the angle of a ramp to affect the distance that an object will roll

**Process Skills:** Observing, comparing, communicating

**Materials:** Paper towel rolls (cut in half lengthwise), table tennis balls, marbles, small cars, blocks, tape

### Procedure:

#### *Getting started:*

Show children how to make a ramp by taping the top of a paper towel tube to a block. Let children experiment by rolling various objects down their ramps. Watch what children do and listen to what they say before you ask questions.

#### *Questions and comments to guide children:*

- Which object went the farthest?
- Why do you think the \_\_\_\_\_ went farther than the \_\_\_\_\_?
- How could you make your ball go farther?
- I wonder what will happen if I put another block under the ramp like this.

#### *What children and adults will do:*

Children will experiment with all three objects (table tennis balls, marbles, small cars) and may find other objects to try. After a while, encourage children to vary the steepness of the ramp. Ask them to tell you what happened when they did.

#### *Closure:*

Hold a final “race” by having all the children let go of their objects at the same time to see which travels the farthest. (The tops of the ramps need to be lined up first.) Use adding-machine tape or measuring sticks to compare distances.

### Follow-up Activity:

Outside, put long boards, large blocks, and balls together so children can experiment further with ramps.

### Center Connection:

Add pieces of pressboard or plywood to the block area so children can use them for ramps.

### Literature Connection:

#### *Train Song*

by Diane Siebert, Thomas Y. Crowell, 1990.

#### *Wheels*

by Venice Shone, Scholastic, 1990.

#### *What Is a Plane?*

by Lloyd G. Douglas, Children’s Press, 2002.



# RAMP S

## Assessment Outcomes & Possible Indicators\*

- **Science A-3** Begins to participate in simple investigations to test observations, discuss and draw conclusions and form generalizations.
- **Science B-3** Develops growing awareness of ideas and language related to attributes of time and temperature.
- **Language Development B-1** Develops increasing abilities to understand and use language to communicate information, experiences, ideas, opinions, needs, questions and for other varied purposes.
- **Approaches to Learning C-2** Grows in recognizing and solving problems through active explorations, including trial and error, and interactions and discussions with peers and adults.

\*Source: "Head Start Child Outcomes Framework." See Appendix A in this book for the framework.

## What To Look For

<b>Not Yet</b>	Child shows no interest in experimenting with ramps.
<b>Emerging</b>	Child watches as others experiment with ramps; tries out a ramp several times but does not use all items.
<b>Almost Mastered</b>	Child experiments with all three objects to see which rolls fastest, but does not try changing the angle of the ramp; discusses findings with adults and peers.
<b>Fully Mastered</b>	Child experiments with all three objects, then tries changing the angle and height of the ramp to see if it affects the speed; repeats activity at another time without adult direction.



## FAMILY PAGE / PÁGINA PARA LA FAMILIA

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### RAMPS

#### Family Science Connection:

**In the house or yard, build** a ramp with things from around the house. Use chairs, tables, wood boards, towel rolls, or toys and see how creative you can be and still get objects to roll down this homemade ramp. **Talk** about the favorite objects that were rolled down the ramp and **compare** why these objects were most fun to watch.

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

- What objects rolled the fastest? What objects rolled the slowest?
- What objects were the most fun to watch as they rolled down the ramp? Why?

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### RAMPAS

#### Ciencia en familia:

**En casa o en el patio, construyan** una rampa con cosas que tengan en casa. Usen sillas, mesas, tablas de madera, rollos de toallas, o juguetes y vea cuán creativos pueden ser y hacer que rueden objetos hacia abajo en esta rampa hecha en casa. **Hablen** acerca de los objetos favoritos que rodaron sobre la rampa y **comparen** por qué esos objetos fueron los que más les gustó observar.

**Comentarios o preguntas** que pueden *despertar curiosidad* en esta actividad:

- ¿Qué objetos rodaron más rápido? ¿Qué objetos rodaron más despacio?
- ¿Qué objetos fueron los más divertidos de observar cuando rodaban hacia abajo de la rampa? ¿Por qué?

## Section 6: Seeds



# PONDERING PUMPKINS: THE INSIDES

**Investigation:** Investigating the insides of pumpkins

**Process Skills:** Observing and communicating

**Materials:** One or more pumpkins; newspapers to cover table surfaces; small paper cups; a stiff, serrated table knife

### Procedure:

#### *Getting started:*

Give each group of children a pumpkin. Ask children to tell you what they think is inside the pumpkin.

#### *Questions and comments to guide children:*

- Is the inside of your pumpkin mostly full or mostly empty?
- What does the stringy stuff do?
- What does the inside feel like?
- It looks like the seeds are attached to something inside the pumpkin.
- How are the seeds alike? How are the seeds different?

#### *What children and adults will do:*

After finding out what children think the insides of pumpkins are like, have an adult carefully cut open the pumpkins in half horizontally around the middle. There is a great tendency to start pulling things apart without careful observation. Caution against initial, frenzied pulling and digging. Instead, as you ask questions, model careful looking with minimal digging and tearing. As you learn more, dig deeper and explore further in search of answers to questions. Ask the children to share what they have discovered about the insides of pumpkins. Return to some of the questions and find out how different children answer those questions.

### Follow-up Activity:

After washing and drying the seeds on a clean, sanitized surface, bake some of the seeds in an oven (add salt and steak sauce for flavoring) and then invite the children to taste some of the baked seeds. (CAUTION: Remember to check on possible food allergies before tasting.)

Have the children help you glue all the seeds from one pumpkin in a single line (end to end) on strips of paper. Tape the strips of paper together to see how long the single line of seeds from one pumpkin will stretch. You'll be amazed.

Make a pumpkin pie from scratch using the pumpkins from this lesson. Have the children notice the change in the pumpkin material from its raw state to its cooked state (heat changes the properties of materials).

### Center Connection:

Plant some of the dried pumpkin seeds and see if they grow.

### Literature Connection:

#### *Pumpkin, Pumpkin*

by Jeanne Titherington, Greenwillow, 1986.

#### *Pumpkin Circle: The Story of a Garden*

by George Levenson, Tricycle Press, new ed., 1999.



# PONDERING PUMPKINS: THE INSIDES

## Assessment Outcomes & Possible Indicators\*

- **Science B-1** Expands knowledge of and abilities to observe, describe and discuss the natural world, materials, living things and natural processes.
- **Language Development B-1** Develops increasing abilities to understand and use language to communicate information, experiences, ideas, opinions, needs, questions and for other varied purposes.
- **Language Development B-3** Demonstrates increasing ability to set goals and develop and follow through on plans.

\*Source: "Head Start Child Outcomes Framework." See Appendix A in this book for the framework.

## What To Look For

<b>Not Yet</b>	Child shows no interest in exploring the inside of a pumpkin.
<b>Emerging</b>	Child watches others, then begins to tentatively explore the inside of a pumpkin; shows some interest in the seeds and other materials found in the pumpkin.
<b>Almost Mastered</b>	Child explores the pumpkin, pulling out seeds and other materials, commenting on what is discovered and answering some of the adult's questions.
<b>Fully Mastered</b>	Child eagerly explores the inside of a pumpkin, commenting and asking questions; independently compares and/or counts the seeds.



## FAMILY PAGE / PÁGINA PARA LA FAMILIA

### PONDERING PUMPKINS: THE INSIDES

#### Family Science Connection:

When it comes to that family event of carving pumpkins into jack-o'-lanterns, take time to explore the outside and inside of the pumpkin as you create your jack-o'-lantern. Notice that the seeds are attached to the “stringy stuff” on the inside of the pumpkin. Marvel at how many seeds there are in one pumpkin. Explore other fruits in your home and see how many seeds are in those fruits and how the seeds are arranged and attached inside the fruits. Compare pumpkin seeds with other seeds.

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

- Are seeds grouped together inside a pumpkin? Are they grouped together in other fruit?
- I wonder if other fruits have as many seeds as a pumpkin.
- Will our seeds grow if we plant them?
- I wonder what part of the pumpkin is used to make pumpkin pie.

### ¿QUÉ PASA CON LA CALABAZA? (INTERIOR)

#### Ciencia en familia:

Cuando llegue la faena familiar de cortar calabazas para formar jack-o'-lanterns, tómese el tiempo de explorar el interior y el exterior de la calabaza al crear su jack-o'-lantern. Vea que las semillas están unidas por esa “*cosa fibrosa*” dentro de la calabaza. Maravílese de la cantidad de semillas que hay en una calabaza. Explore otras frutas en su hogar y vea cuántas semillas hay en esas frutas y cómo están acomodadas y unidas las semillas dentro de las frutas. Compare las semillas de calabaza con otras semillas.

**Comentarios o preguntas** que pueden *calidad de asombro* a esta actividad:

- ¿Están las semillas en grupos dentro de una calabaza? ¿Están agrupadas en otras frutas?
- Me pregunto si otras frutas tienen tantas semillas como una calabaza.
- ¿Crecerán nuestras semillas si las plantamos?
- Me pregunto qué parte de la calabaza se usa para hacer el pastel de calabaza.

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