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Let’s Explore Science

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An Argument in Favor of Mud Puddles

Adults sometimes assume that science is a collection of known facts – a colossal collection of right answers. Children, likewise, are thought of as empty buckets to be filled with tidbits of scientific knowledge:

- Water freezes at 32 degrees Fahrenheit.
- Some leaves are different colors in autumn because of the absence of chlorophyll.
- Each caterpillar undergoes metamorphosis to become a butterfly.
- Cooling water vapor condenses to form clouds.

By this reasoning, a child’s science education is complete when a prerequisite number of facts are memorized and can be recalled upon request. Flash cards, posters, text books, and video tapes provide a neat, tidy means of depositing knowledge in an organized and efficient manner. Although this philosophy of science teaching can result in the illusion of knowledge, remembering is not the same as understanding.

A child shown pictures and given a set of facts to remember about the natural world may be able to repeat them, but does not have the understanding of the child who has splashed through puddles, stomped through snow, and dug in the dirt. Authentic scientific learning is sometimes messy and often more about asking questions then remembering answers.

In truth, science is about much more than just remembering facts, and children are much more than empty buckets! Author Isaac Asimov described science as “a way of thinking about the world”. If we are to truly share science with children, let’s commit to creating opportunities for meaningful, real world experiences, encouraging children always to wonder, explore, and find out more!
What is the difference between a science experiment and a magic trick?

It’s not a riddle – it a question that may change the way we think about the science activities we share with children.

Candy and soda “geysers”, erupting baking soda volcanoes, and mysteriously appearing invisible ink – all can elicit delighted “oohs” and “ahhs” from children and are often added to lesson plans as science enrichment activities. But, is it really science? The answer depends on the ages and abilities of the children. If an activity includes scientific concepts that the children can begin to understand and apply to later experiences, chances are, it is an age-appropriate science activity. If not, the activity is more like a magic trick: something exciting and fun to watch, but perhaps impossible to “figure out”.

Consider two science activities, each conducted with older three-year-olds

1. In response to the children’s interest in dinosaurs, the teacher constructs a large volcano made of hardening clay. Once dry, she fills the cone of the volcano with baking soda and drops of red food coloring. When vinegar is added, fizzy pink bubbles pour out the top and down the sides of the volcano. The teacher encourages the children to draw pictures of the volcano, and she makes a chart of words that the children use to describe what they saw.

2. When the children return from the playground asking, “Where did the rain puddles go?”, their teacher introduces a science activity. First, she fills a container with well-packed dry dirt, and asks children what might happen if they were to pour water onto the dirt. The children predict that it will make puddles. The teacher slowly pours a cupful of water into the container, as the children observe closely. They are surprised when the water soaks into the dirt; the teacher tells them that it was absorbed.

Next, the teacher asks the children how many cups of water they think the dirt might absorb, charting their responses. The children take turns slowly adding water to the dirt, until water puddles on the surface. When asked why they think this happened, a child responds, “It is all full up already.” Their teacher agrees, telling the children that the dirt is now saturated with water – it can’t hold any more. The children take the container outdoors and set it in a sunny corner of the playground; they’ll check back later to see if anything changes. The teacher also plans to take the children on a walk outdoors after a rain shower to seek more answers to their questions about puddles.
What did children learn from the first (volcano) activity?

Their baking soda and vinegar volcano looked, smelled, and erupted nothing like a real volcano. After all, real lava is molten hot rock, not frothy pink foam. Perhaps the point of this science activity was, instead, to learn about chemical changes. The clay volcano “erupted” when baking soda, a substance with a basic pH, reacted with the vinegar, a mild acid. This reaction created carbon dioxide gas, resulting in bubbles. While older children may be able to understand this chemical reaction, three-year-olds are not. The generalizations that they take away from the experiment – “mixing white powder with clear liquid makes bubbles” – will often not hold true. While the children enjoyed sharing the volcano activity with their teacher, it was not really a meaningful science experience for them.

How does the second (rain puddle) activity compare to the first?

In this activity, the teacher responded to the children’s observation: puddles on the playground in the morning were gone in the afternoon. The dirt and water activity involved real, relevant materials and a simple procedure, and children were encouraged to make predictions throughout. Although they may not retain the new vocabulary words – absorb and saturate – the concepts involved can be recognized and replicated by children in the days or weeks to come. In addition, the teacher planned a rainy day nature walk as a follow-up activity, encouraging children to continue to explore the topic. For three-year-olds, the puddle experiment did a much better job of encouraging scientific thinking and introducing age-appropriate science concepts than the volcano activity.

Does this mean, then, that much-loved activities, such as the baking soda volcano and candy geyser, should be banished from our classrooms until children are old enough to understand the science behind them? Not necessarily.

If you enjoy sharing these activities with young children, do them because they are messy, exciting, and fun – just don’t call it science!

Why do real science?

- An outlet for the child’s natural sense of wonder.
- Builds “foundation skills” – observation, reasoning, problem solving.
- More than just plastic – exposes children to simple yet stimulating materials and real experiences.
- Empowers children as they learn about their relationship with the world.
- Fosters a connection with the natural world.
It All Starts with a Spark

Ocean life in summer, apples in autumn, snowflakes in winter ...

Have you ever found yourself falling back on a preset theme list, perhaps introducing penguins and polar bears in January because “we always learn about arctic animals after the holidays”?

The peril of doing something simply because it is on a theme list - or because it is a seasonal habit - is that it leaves little room to respond to the topics that truly interest your children. Just as the faces and names of the children in the classroom change from year to year, so, too, do their ideas and interests. By responding to the children’s natural curiosity and tuning in to what “sparks” each group of children, a skillful teacher can introduce books, materials, discussions, and activities to foster deep, meaningful learning.

Most often, children become inquisitive about things they encounter in real life. Why, then, do we insist on studying snowmen with young children who live where it rarely ever snows, or ocean creatures with children who have never set foot on a beach? More absurd still are preschool science units on themes such as “our solar system” – subject matter that may capture children’s imaginations but is almost completely beyond their realm of comprehension from both a real world and scientific standpoint. To explore and understand a topic of study, young children must be able to actually experience it, seeing, hearing, touching, and so on.

Instead of following a scripted list of themes, consider letting the local environment and the actions of your children lead you to more relevant subjects. What do you see children making and doing? What captures their interest outdoors or in, prompting them to ask questions and want to find out more? **What sparks your children?**
It should be noted that not everything on the list above will be relevant to every child in Arkansas. Some children live where leaves change color and fall to the ground in autumn, while others live where pine trees are prevalent, or where warmer temperatures mean green trees year round. Some groups have easy access to farms, ponds, or zoos, while others do not. **When selecting projects and topics of study for your children, consider which ones they will be able to experience in real life; these are the topics that will be meaningful to them.**

In addition, the list above is by no means thorough and complete. By spending time working, wondering, and playing alongside your children, you’ll likely add to the list with many more topics inspired by their actions.

Following the children’s lead can be intimidating at first; a class investigation about roly-poly pillbugs or mud puddles may be harder to explain to parents than a lesson plan loaded with more traditional themes. Teachers brave enough to try, though, will be rewarded with eager, enthusiastic children and the satisfaction that comes from creating an environment that fosters authentic learning. **It all starts with a spark!**
Behavioral and Representational Knowledge

Knowledge can basically be thought of as “the stuff we know.” We know lots of things: we know how to do laundry, we know why the sun sets and rises every day, we know how to put gas in our car, and we know that the germs on our hands can make us sick if we don’t wash them. But did you realize that everything we know can be classified into two different types of knowledge?

Behavioral knowledge can be thought of as the stuff we know how to do, like doing laundry or putting gas in our car. The other type of knowledge, representational knowledge, can be thought of as the things that we understand mostly in our minds, such as that germs on our hands can make us sick if they get in our bodies. Behavioral knowledge comes from direct observations and experiences while representational knowledge comes from forming an abstract picture of something in our minds because of things we are told. We can observe and experience the effects of germs in our bodies, but we can only picture the germs in our minds because someone tells us they are there. Germs are too small for us to actually see or feel without a microscope!

As adults, we often use both types of knowledge to do the things we need to do. We don’t stop to think about if we are using behavioral or representational knowledge. Young children use mostly behavioral knowledge: they do things because experience has taught them what seems to work. In the book Engaging Children’s Minds, authors Lillian Katz and Sylvia Chard give us the example of a child learning to ride a bike. The child gains this behavioral knowledge (riding a bike) through practice and experience but has no use for the representational knowledge that goes along with it (the physical science that includes balance, weight, force, and speed).

During the early education years, children’s ideas about scientific concepts begin to move from having mostly behavioral knowledge to gaining some representational knowledge. They are learning to form pictures and ideas in their minds of how things work based on what they already know from their behavioral knowledge. The early education years are an important time to lay the foundation for children’s scientific concept learning so they will gain more representational knowledge as they get older.

When elementary and secondary school teachers can connect the representational knowledge they want children to learn to the behavioral knowledge that children already have, children are more likely to understand and remember those scientific concepts. For example, children have a behavioral knowledge of time because of the routine things they do
Children who consistently follow a routine at home and school have the behavioral knowledge to get through their day without even looking at a clock. By following a routine, discussing the daily schedule, or using a timer during activities (behavioral knowledge), teachers are beginning to show children that time can be measured. This lays a strong foundation for learning about more complex time concepts such as minutes, hours, days, and months (representational knowledge) as children get older and enter their school-age years.

**Examples of Behavioral and Representational Knowledge**

Riding a tricycle (behavioral knowledge) lays a foundation for later learning about force, speed, friction, and simple machines (representational knowledge).

Kicking, throwing, or bouncing a ball (behavioral knowledge) lays a foundation for later learning about force, resistance, and movement (representational knowledge).

Building with blocks (behavioral knowledge) lays a foundation for later learning about force, balance, and stability (representational knowledge).

Cooking experiences and mixing materials (behavioral knowledge) lays a foundation for later learning about both physical and chemical changes in materials (representational knowledge).

Exploring the properties of materials from the earth such as dirt, sand, and rocks (behavioral knowledge) lays a foundation for later learning about earth science and geology concepts (representational knowledge).

Taking care of living things such as class pets or plants (behavioral knowledge) lays a foundation for later learning about biological processes (representational knowledge).

Many Ways to Wonder

When adults consider ways to share science with children, the responses often vary widely. One person thinks of a gardening project, while another plans to make messy “gak”. Others plan cooking projects, a recycling drive, birdwatching, or a sink or float experiment. Who is really sharing science with children? They all are!

Science - from the Latin *scientia*, meaning "knowledge" – is all about making predictions and forming explanations about the natural world. It encompasses a tremendous range of topics, including the studies of plants, landforms, air, water, soil, and animals. If it exists in the natural world, chances are there is a field of science dedicated to its study.

Four of the broadest fields of science are explored below.

**Chemistry**

Chemistry is the science of matter. This science focuses on the composition, behavior, structure, and properties of matter, as well as changes that occur during chemical reactions. While young children do not yet understand the complexities of atoms and molecules, chemistry is still a natural part of their science learning as they mix, mash, dig, and explore.

**Chemistry in the classroom**

- Mix solids and liquids to make mud pies, wet sand sculptures, or salt and flour dough. *What happens when we add more water? Less?*
- Blow soap bubbles or experiment with baby shampoo suds at the water table. *What makes bubbles pop? What happens when you try to catch a soap bubble with dry hands? With wet hands?*
- Create crystals with Epsom salt solution or by making rock candy. *What changes occur as time goes by?*
- Participate in cooking projects with foods that change consistency when cooked. Possibilities include popsicles, pancakes, applesauce, boiled or scrambled eggs, and air-popped popcorn. *How do the foods change? Why might this happen? What effect do heat and cold have on foods?*
- Experiment with freezing and melting ice. Consider bringing in fresh snow from outdoors, adding ice cubes to the water table, or freezing water in a large mixing bowl to create an ice dome. *How does the ice look and feel? How does it change over time? Why might this happen? Are there any ways to make the ice melt more quickly, or more slowly?*
More Chemistry for Kids: Try This!

Rainbow in a Bag

Materials
- Cornstarch
- Refined white sugar
- Water
- Measuring cups
- Saucepan
- Stove or hotplate
- Large bowls
- Large spoons
- Food coloring
- Plastic zipper bags
- Clear packing tape (optional)

Preparation
In a large saucepan, mix 1 Cup cornstarch, 1/3 Cup sugar, and 4 Cups water. Heat and stir constantly, until thickened into pudding-like goo. Remove from heat and continue to stir for one minute. When cooled, divide into three bowls and add a few drops of food coloring to each, making a bowl of red, a bowl of yellow, and a bowl of blue goo.

Activity
Children can place several spoonfuls of mixture from each of two bowls into zipper bags. Seal well and squish to mix. Consider sealing the bags with clear packing tape, if desired. This mixture is non-toxic, but should not be consumed after storage at room temperature due to the risk of bacteria growth.

Extension Activities
- Hang the bags in a sunny window.
- Fingerpaint with the mixture on glossy paper.
- Try mixing all of the colors in a bag, or adding drops of food coloring to bags full of un-dyed mixture. How do results differ?
Physics

Physics is the field of science concerned with motion, energy, and force. Young children busily explore properties of physics each day as they experiment with blocks, balls, wheeled toys, and more.

Physics in the classroom

- Roll down hills, ride wheeled toys up and down small hills, and slide down hills on flattened cardboard. *Is it easier to go uphill, or down? Why? What affects the speed and direction of movement?*

- Roll balls or small cars down building block ramps or through tunnels made from cardboard tubes. *What happens when the ramp/tunnel is propped at a low angle? At a steep angle?*

- Experiment with play balls made of different materials. *Can some balls be thrown higher or kicked farther than others? Why? What happens when you let some of the air out of a ball? What happens when you pump it up again?*

- Work with simple machines, such as levers, gears, and pulleys. *How do these devices work? How do they make our work easier? Where do children see levers, pulleys, gears, wheels, and inclined planes (ramps) in their school or elsewhere in the real world?*

More Physics for Kids: Try This!

**Ramps and Rollercoasters**

*Safety Note:* This activity is suitable only for children over the age of three, who do not put small items in their mouths. Close adult supervision is needed for preschoolers.

**Materials**

- Unit blocks and/or cardboard boxes
- Pipe insulator of varying lengths, cut in half lengthwise
- Masking tape
- Chenille stems (aka pipe cleaners)
- Marbles

**Activity**

Provide a large space and plenty of time to work. Encourage open ended exploration of ways to create tracks to move marbles, using the provided materials. Children may create ramps, bridges, loops, and slides. Talk with children about concepts related to their work. What can they do to make the marbles go faster or farther? How can they communicate with one another and solve problems to expand their creation?
Environmental Science

This is the study of the natural environment, often with a focus on solving environmental problems such as pollution, deforestation, and soil erosion. While young children are not yet ready to fully grasp environmental concerns, they can learn “environmentally healthy” habits and participate in earth-friendly events, building a foundation for sound choices later in life.

Environmental Science in the classroom

- Plant a tree or garden area and care for it throughout the year.
- Participate in a recycling drive, collecting newspapers, plastic bottles, office paper, gift wrap, or other recyclables. Older children may enjoy a field trip to a recycling center.
- Don gloves and work together to clean up a playground area or nearby park. Adults should check the area beforehand to remove hazardous trash, such as broken glass.
- Create an “art scrap” box where children can place construction paper scraps and other small items for reuse later, rather than throwing them away. Also consider collecting “clean junk” – such as cardboard tubes, yogurt cups, milk caps, and bubble wrap – for reuse in collages, sculptures, and other art projects.
- Plan a school-wide Earth Day event.

More Environmental Science for Kids: Try This!

Donation Drive

Materials
- Poster board or large paper
- Markers, crayons, or poster paint
- Large box or laundry basket

Activity
Children can help coordinate an effort to encourage their family and friends to donate items that might otherwise end up in a landfill. Possibilities include a toy, coat, or clothing drive for a local charity, or collecting old towels and blankets to donate to an animal shelter. Talk with children about who might be able to use their outgrown items, and about how this is helpful to the environment and to others. Children will enjoy making posters to advertise their drive and keeping track of collected items. Consider concluding the event with a field trip to drop off the items, or a visit to the classroom by an employee or volunteer from the recipient organization.
Biology

Biology is the science that focuses on living things, including plants and animals. Many children are naturally curious about the living things around them, from dandelions to song birds, acorns to earthworms.

Biology in the classroom

- Plant and observe a variety of seeds and/or bulbs. *How do the plants change over time? What do they need to grow and thrive?*

- Explore a wide range of fresh fruits and vegetables, such as those gathered on a field trip to a farm or farmer’s market. *How do they look, feel, smell, and taste? Do they have stems? Seeds? A core? Where did they come from?*

- Create a bird feeding station near the playground or a classroom window. *Do birds that visit the feeding station all look and act the same, or are they different? What can be observed about the birds’ feathers, feet, and beaks?*

- Collect and care for (and later release) small creatures from the outdoor environment. Possibilities include earthworms, caterpillars, tadpoles, toads, crickets, and crayfish. *What do the animals need to stay healthy and feel safe? How do the animals move about their habitat? What and how do they eat?*

More Biology for Kids: Try This!

Bird and Squirrel Garlands

Materials

- Plastic lacing or lanyard
- Embroidery needles
- Clothespins
- Scissors
- Food to string - possibilities include pieces of bread, O-shaped cereal, grapes, cranberries, orange wedges, peanuts in shells, popcorn

Preparation

Cut food as needed for easy stringing. Cut a 24-36” length of lacing for each child. Tie one end to a clothespin, and the other end to a large embroidery needle.
Bird & Squirrel Garlands (continued)

Activity

With careful supervision, children can string food on their laces. When finished, cut off the embroidery needle and tie the end of the lace to secure. Children can take a walk to choose a tree or bush where they would like to hang their garland. Ideally, select an area that children will be able to observe from their classroom window or playground.

Clip the clothespin to a branch, and drape the garland onto the tree or bush. Check back later to see if the food has been eaten, and don’t forget to collect the lace and clothespin when the food is gone.

Extension Activities

- Ask the children to predict which foods they think birds and squirrels might eat first. Visit the feeders later to check their predictions.
- Do the children think that any other kinds of animals might visit the garlands? How could they test their theories?
- Place one or more of the garlands within easy sight of a classroom window. Place a basket with binoculars, a bird guide, and clipboards with paper and pencils near the window to allow children to record their observations. In addition, consider making a graph of common visitors to the feeder. Children can add a tally mark each time they spot a blue jay, robin, cardinal, sparrow, or squirrel on the feeder.
- During the winter holidays, consider decorating a tree with garlands and other homemade feeders. Birds and other small wildlife will appreciate the meal during the cold winter months, when other food is scarce.

From chemistry and physics to even more specialized fields such as geology (rocks), meteorology (weather), botany (plants), and ornithology (birds), science encompasses countless ways to learn about the world around us.

Consider sharing many different science activities with your children, including a mix of old favorites and new ideas. By doing so, you’ll give children opportunities to dabble in many different fields of science, perhaps discovering a new forte along the way. A brilliant future chemist, marine biologist, or engineer may find their “spark” through activities shared with you.
Science Every Day:  
Process Skills in Early Childhood Science

What does it mean to “do science” in the early years? Many teachers and caregivers find themselves struggling with this question as they think about how to include science experiences in their early childhood programs (Copley and Padron, 1998). Often, teachers and caregivers relegate “science” to small experiments and demonstrations of already known scientific knowledge without realizing that children are engaged in scientific thinking every day! By encouraging children to use scientific process skills that are naturally part of a child’s growing set of thinking skills, adults can “do science” every day in just about any area of the early childhood environment.

What is meant by “scientific process skills?” Basically, process skills are the actions children take when they are learning about the world (Martin, Jean-Sigur, and Schmidt, 2005). The six basic process skills most often used by young children starting at birth are:

- Observing
- Classifying
- Predicting
- Using Numbers
- Inferring
- Communicating

It may surprise us to think about newborn infants doing science, but that is exactly what they are doing as they move, watch, cry and observe the results of their actions with their senses. As children get older, they begin to organize information through comparing, classifying, counting, and measuring objects and materials. By encouraging children to also predict outcomes of actions and events, infer why certain outcomes happen, and communicate with others what they have learned, adults are naturally facilitating the development of scientific thinking.

Children can observe the world using more than just their sense of sight. Touching, tasting, smelling, and hearing are also ways they collect information about the world. In scientific terms, this information is called “data.” When a child observes the wind by feeling it on their face and in their hair, smells the differences in differently scented materials, or listens to sounds they hear in the outside environment they are collecting data. The observations children make through using all of their senses lay the foundation for using other process skills to find out more about the world.
Classifying data children collect through observations is another process skill that begins to develop during the early childhood years. Classifying is also known as “sorting” and there are many different objects and materials children can sort and classify in an early childhood environment. A simple activity for young children to do is to sort different objects or materials by an attribute. An attribute is a characteristic of an object such as its color or shape. Children can classify endless types of objects by physical attributes such as color (red, green, blue), texture (rough, smooth), shape (square, round), or weight (heavy, light), or by conceptual attributes (thing that “go together”) such as healthy food and “junk” food, warm weather clothes and cold weather clothes, or plants and animals.

Predicting gives children an opportunity to think about “What will happen next?” As children are predicting, they are answering open-ended questions about the world. An open-ended question is one that typically can’t be answered with just a “yes” or “no” and one to which there is often no right or wrong answer. By thinking about an event or object and what might happen, children are using both cognitive and creative thinking skills. This lays a foundation for good decision-making and problem solving as children grow older.

As children count and measure both formally and in an exploratory manner, they are using numbers to learn about the world. Very young children may begin to explore counting as they point to object and say the names of numerals, often times not in the right order. They may even count objects twice as they say “One...two...seven...nine!” With plenty of exposure to math materials and games, children become more proficient at counting objects and events throughout their early childhood years.

Using numbers can also be seen as children begin to explore the concept of measurement. Beginning with simple comparisons, a child may exclaim “This block is as long as my shoe!” directly comparing the length of two objects. As they are exposed to rulers and yardsticks as well as non-standard units of measurement (markers, paper clips, books, hands) children may begin to attach numbers to the things they are measurement. Although measurement is typically exploratory in the early childhood years, with exposure to tools and objects to measure, children will begin to understand and use measurement concepts throughout their environment.

When children come up with ideas about why or how something happened, they are using the process skill of inferring. Collecting data through using other process skills helps children to infer why an event or result took place. A child may infer that a car went faster down a ramp than another car because it was heavier, or that a plant in the sun grew faster than a plant that was kept in the dark. Adults have a central role in asking children appropriate questions to encourage inferring. Using language such as “I wonder why...?” and “How could...have happened?” as well as guiding children’s thinking by asking “Do you think...?” or “Let’s look at this...” is an important was to help children infer things about objects and events in the world.
An important but often overlooked process skill is that of **communicating**. When children are asked to communicate what they have learned it reinforces concepts and gives them an opportunity to practice other skills such as literacy, math, and fine motor skills. Drawings, writing, dramatic play, and making graphs of data collected are all examples of how children can communicate the things that they are learning about the world.

Taken all together, the six basic process skills look a lot like the “scientific method” that many adults learned about in elementary school. The scientific method uses observations to collect data about objects and events, and predicting to form a hypothesis about what might happen if an object or event is changed in some way. Counting and measuring are often used in the scientific method to make sense of data, and reflecting back on what was learned uses the process skills of inferring and communicating. By giving children opportunities to use process skills, adults are giving children opportunities to “do science” every day!

### How to Encourage the Use of Process Skills in an Early Childhood Environment

**Observing**

- Provide tools such as magnifying glasses and binoculars to observe collections of objects indoors and things in the outdoor environment.

- Lay a hula-hoop or jump rope in a circle on the ground and help children name all the things they can see inside the circle. It’s amazing all the things you can find!

- Help children observe using all their senses by providing “five senses” activities such as listening, tasting, and feeling. Feely boxes with different objects and textures, tape recorded or natural sounds, and a variety of non-allergenic and highly flavorful food items can be used to encourage children to compare differences and use words to describe things in their environment.

- Provide materials for children to mix such as combinations of flour, water, cooking oil, or cornstarch and ask them to describe how mixtures feel as different materials are added.
**Classifying**

- Provide collections of materials for children to sort and classify in small groups or during center time. Keep in mind things they can classify by physical attributes such as shape or color, or by conceptual attributes such as things that “go together” in some way.

- Compare and classify groups of children as a circle time activity. Classify support children as they compare each other and assign each other to groups with characteristics such as boys or girls, color of clothing, color or eyes, or children with brothers or sisters.

**Predicting**

- Invite children to make predictions about the weather such as “Will it rain tomorrow?”, or “How many days this week will we see the sun?”

- Provide opportunities for children to make predictions about simple experiments such as how many times a ball will roll or bounce, will and object sink or float, or how many scoops or sand will it take to fill a bucket.

- Provide opportunities for more complex experiments in which a variable is changed in some way. For example, allow children will predict what will happen to a seed planted and kept in a dark cabinet and a seed planted a placed in a sunny window.

**Using Numbers**

- Encourage children to use numbers to count small groups of objects. Using numbers can be combined with predicting during “guessing games” in which children guess how many objects are in a jar and then count to find out if they were correct with their predictions.

- Make comparisons between the lengths of different objects. While making comparisons about length doesn’t actually use numbers it lays and important foundation for later assigning a number and unit of measurement to an object. Use measurement language frequently such as “longer than,” shorter than,” and taller, smaller and heavier.

- Provide “non-standard” units of measurement for children to explore. Using items such as books, paperclips, pencils, and their own hands, children can measure larger objects in the classroom and assign a number of units to that object. For example, a child might discover that a table is eight books long, or that a unit block is ten paper clips long.
• Provide rulers and tape measures for children to measure objects in the classroom. While most measurement with standard units and measuring tools is exploratory in nature during the early childhood years, the experience children gain using such tools will lay a foundation for more precise measurement activities during their elementary school years.

Inferring

• When participating in simple or complex experimental activities with young children, adults should use language such as “I wonder why...” or “why do you think...” and then guide children in thinking through why a result could have happened.

Communicating

• Make lists of children’s ideas or predictions about and object or event on chart paper and hang it in the classroom to refer back to when discussing classroom activities relating to that object or event.

• Encourage children to help construct a paragraph about a simple or complex experiment conducted in the classroom. Ask children to contribute sentences and ideas and write them down in front of them on chart paper during a small or large group activity.

• Collect photos of a science-related field trip and display in the classroom with captions describing each photo.

• Make a graph of children’s names that answers a question about something. For example, children can write their names in the appropriate column under the question, “Which do you like better, white bread or wheat bread?”

• Encourage children to draw or sketch items and objects related to a topic of study in the classroom. This is called “representational drawing” and it helps children use their observation skills to pay attention to the details of the object being sketched.

Sources


Sense of Wonder Welcome Here:
Seven Simple Ways to Encourage Children to Explore

1. Hands On
Offer experiences that children can actively participate in, rather than demonstrations to be passively watched.

2. Set Up for Success
When needed, provide smocks, protective glasses, towels, non-slip mats to catch messy spills, and other safety measures protect children and their clothing. Children should be focused on the experience, not worried about getting hurt or making a mess.

3. Appreciate Creativity
Encourage children to explore their own, unique ideas as long as they can do so in a safe and nondestructive manner. A child who does something in a new and unusual way may be about to make a big discovery, and he may just teach you something new!

4. No Wrong Answers
Respect children’s ideas and theories. Just because a child comes to a “wrong” conclusion does not mean that she is not busily engaged in thinking and learning. For example, a child who is conducting a sink or float experiment with a rock, a metal bolt, a yellow duck toy, and a red crayon may come to the conclusion that “only colorful things float”. Rather than tell her that she is wrong, her teacher can encourage her to test her theory using more materials.

5. Get Excited
Whatever your passion is, whether it be gardening, flying kites, or baking bread, share it with the children! Your enthusiasm will be infectious, and the children will be eager to join in the activity with you. Likewise, mirror the children’s excitement when they are energized by a new find or discovery.

6. Make Connections
Discoveries and experiences should not be isolated. Instead, connect them to other events. For example, color mixing at the easel might be linked to fingerpaint at the art table, color paddles at the science table, and colored water in the sensory table. Ask yourself, “How else could we can we investigate this?” and “How can we find out more?”

7. Questions Welcome
Create a curiosity-friendly environment. “Wonder aloud” as you work and play alongside children: “I wonder what would happen if we mixed these two kinds of play dough together?”, or “I wonder where the birds go after they leave our feeder?” When children have questions, encourage them to seek answers. It is OK to tell children that you don’t know the answer to a question. Better yet, say, “Let’s find out!”
The Discovery Center and Beyond

When thinking about the early childhood environment, teachers and caregivers often set up their environments in “learning centers” with types of materials grouped together by interest or learning domain. Most early childhood educators agree that this helps organize their environment and helps children learn where things belong, but often realize that some centers seem to be more popular with children than others. How often do we found ourselves thinking, “I wish I could get my children to play somewhere else besides dramatic play and blocks!” With the right tools and materials, the science or “discovery” center can be a place that sparks children’s interest with its emphasis on allowing children to use all of their senses to answer questions about the world.

Materials for the discovery center should encourage children to use all of their senses as well as practice important math and literacy skills. Some of the most important parts of the discovery center are collections of objects and the tools to use to explore them. Collections of objects can be natural objects such as leaves or pinecones or non-natural objects such as large bolts or blocks to weigh or measure. Tools such as balances, magnifiers, thermometers, and rulers can be used to investigate the collections, and paper and writing utensils can be available for children to draw pictures and record their findings. Books, pictures, and science-related games and activities should also be available for children to use while they spend time in the discovery center.

Materials for the discovery center

Books and photos: Books that depict plants and animals with photographs or realistic illustrations, books related to other age-appropriate science topics (weather, simple machines, etc.), photos of animals, outdoor scenes, flowers, trees, water features such as ponds, streams, or lakes, pinecones, nuts in shells, features of the sky such as sunshine, raindrops, clouds, and rainbows, and other photos of objects related to a theme or science display.

Tools: Magnifiers, balance scales, thermometers, rulers, measuring tapes, platform scale, color paddles, mirrors, prisms, large magnets, flashlights
**Collections:**  magnetic items such as keys, paper clips, and bolts, colorful fabric and paper scraps, pine cones, seed pods, leaves, rocks, nuts in shells, real flowers, pumpkins and gourds, apples, birds nests, fall corn, water and ice cubes, grass, straw, pine straw, or raffia, sticks and twigs, shells, sand, bark, tree log sections, sweet gum balls, wood scraps

**Games and activities:**  gears and gear boards, geoboards, sequencing cards, sorting activities, small balls and ramps, teacher-created games and activities.

In the book *More Than Magnets: Exploring the Wonders of Science in Preschool and Kindergarten*, authors Sally Moomaw and Brenda Hieronymus describe the practice of setting up “science displays” to help children connect with the science process skills that are used in the discovery center. Comparing a good science display to the hands-on exhibits often found in children’s museums, Moomaw and Hieronymus define a science display as “a group of related objects for children to handle and explore.”

The science display activities set up in a discovery center should encourage children to use the process skills of observing, comparing, predicting, using numbers, inferring, and communicating. Using a few standard discovery center tools, collections of found objects, and inviting backgrounds, science displays can give the children a sense of purpose in the discovery center and a chance to practice important science process, literacy, and math skills.

**Science displays should consist of:**

- A collection of objects for children to explore
- Tools that can be used to help children explore materials
- A background display with photos and print related to the collection of materials. Displays can be a small as a fourth of a sheet of poster board and can lean against a wall or be propped on a small easel.
Examples of displays appropriate for an early childhood environment

- Color paddles, a collection of colored fabric and paper scraps, white paper and markers, and a background display of colorful photos with the question “How do colors change?”

- Magnifiers, a collection of leaves and evergreen scraps, paper and writing utensils, and a background display of leaves with the printed words “Leaves come in many shapes, sizes, and colors.”

- Tongs and a few small paper or plastic bowls, a collection of nuts in shells, paper and writing utensils, and a background display of photos of nuts and trees with the printed words “Nuts come in many shapes and sizes.” (Teachers should carefully supervise this activity if small nuts that could present a choking hazard are used)

- Rulers and measuring tapes, a collection of seasonal materials such as apples or pumpkins in the fall, evergreen branches and twigs in the winter, or real flowers in the spring, paper and writing utensils, and a background display of related photos and the printed words “How big are the (type of materials used)?”

- Magnifiers, a collection of rocks of many colors, white paper and markers, and a background display of photos of rocks with the question “What color are the rocks?”

- Balance scale, a collection of small items such as large buttons, colored counters, 1” color cubes, and bolts, paper and markers, and a display of related photos with the question “Which one weighs more?” (Teachers should carefully supervise this activity if small items that could present a choking hazard are used)
Beyond the Discovery Center

While the discovery center is a place where children are encouraged to use their senses and process skills, such interactions with materials are also taking place throughout the early childhood environment. With the right materials, props, and tools, teachers and caregivers can create an environment where scientific thinking takes place all over the place!

At the Sensory Table

- Scoops, shovels, cups, tubes, funnels, and buckets should be added to sand and water so that children can observe how materials change as they are scooped and poured.

- Liquid water color can be added to sand or water so that children can watch what happens as colors mix and are distributed throughout the sand or water.

- A fine medium such as sand can be mixed with a larger medium such as rice or corn and sifters added in the sensory table. Children can watch what happens as they sift the materials and the fine medium separates from the larger particles.

- Various objects can be added to water and children can predict and experiment with which objects will sink and which will float.

- Water can be added to dry sand as children play so they can feel the difference in the behavior of wet sand and dry sand. Encourage children to build and shape the wet sand in ways that can’t be done with dry sand.

- Plastic cups and bolts can be added to water and children predict and experiment with how many bolts can be placed in a floating cup before it sinks.

- Add mild dishwashing soap to water and give children whisks and eggbeaters to use to make suds.

- Add sponges and rags to water so children can explore how different objects absorb water.
In the Block Center

- Provide unit blocks for children to use to explore shapes and how they fit together.
- Encourage children to build tall towers to explore balance and stability.
- Provide cars and balls in the block center so children can experiment with building ramps for rolling props.

In the Art Center

- Mix different materials with paint such as glue or sand to observe how paint sticks differently to paper and other surfaces when mixed with a different medium.
- Allow children to paint with different materials such as twigs, wooden spoons, sponges, marbles, and large paintbrushes to observe how paint moves with different kinds of tools.
- Using a large shallow box, allow children to roll marbles dipped in paint around to explore how tilting the box makes the marbles move and roll.
- Use a variety of painting surfaces such as fabric, foil, burlap, wood, and bubble wrap so children can explore how paint moves on and is absorbed by a variety of surfaces.
- Collect a variety of small collage materials such as large sequins, paper and fabric scraps, shells, cotton balls and pom poms, foam scraps, chenille stems, and twigs so children can explore the properties of glue as they stick different materials onto a surface.
- Using your favorite homemade play dough recipe add liquid water colors drop by drop so children can explore mixing and changing colors.
In the Music Center

- Provide a variety of musical instruments so children can explore different sounds, tones, and loudness and softness of sound.

- Set up a science display that involves comparing two sounds.

- Provide listening activities in which children listen to a variety of sounds and predict what object made the sound.

- Provide a collection of interesting objects for children to play with mallets such as empty and clean butter tubs, cans, or bins.

- Pour different amounts of water in empty glass jars and allow children to explore the different sounds by gently striking the jars with mallets.

In the Outdoor Environment

- Encourage children to explore the properties of objects found in the outdoor environment such as trees, dirt, and rocks.

- Encourage children to look at the clouds (but not directly at the sun!) and describe the kinds of things they see in the sky.

- Provide tools such as buckets, shovels, funnels, sieves, and molds so that children can experiment with the properties of sand and dirt.

- Go on a “listening walk” and encourage children to make a list and describe all of the sounds they hear outside.

Collectibles: 
Inexpensive materials for science exploration

Enlist families and friends to collect these common household materials. Yard sales and thrift shops can also be good sources for inexpensive, interesting items to be used for exploratory play and simple science experiments.

Safety note: Consider the ages and abilities of your children. Small items pose a choking hazard to children under 3 years of age and children prone to placing materials in their mouths.

- Baby food jars – Ideal for holding fingerpaints, bubble solution, and “mixables” for experiments.
- Baskets, bowls, trays – Look for interesting containers made of natural materials, such as unpainted wood and wicker, to contain materials in your discovery center.
- Cardboard tubes – Packing tubes, paper towel tubes, wrapping paper tubes, and even frozen juice cans can be used for cause and effect explorations. Try propping to create ramps for balls or toy cars.
- Detergent scoops – Sturdy, plastic scoops and caps from laundry detergent make fabulous measuring cups for sand and water play.
- Drinking straws – Can be used to blow air or bubbles, or cut into 3 – 4 inch lengths for inexpensive eye droppers. By dipping one end in fluid and covering the other with a finger tip, children can create trap droplets of liquid, releasing them again by removing the fingertip.
- Floral glass – These round, flattened pieces of glass can be used for counting, sorting, and arranging. They are also fascinating on a sunny playground, in the water table and on a light table.
- Fly swatters – Dip clean fly swatters in homemade bubble solution and wave through the air to create mounds of fluffy, foamy, bubbles!
- Ice cube trays – Use for sorting small collections. Or, pair with 3 containers of water, tinted red, yellow, and blue. Children can use pipettes, eye droppers, or drinking straws to mix colors in each compartment of the tray. Or, try freezing colored water; children can mix colors as they fingerpaint with the tinted ice cubes.
• Jar lids – Collect various sizes of lids from baby food jar, mayonnaise jars, and more. Can be used with magnets, or used to showcase tiny objects collected outdoors.

• Kitchen gadgets – Perfect for exploring with play dough, sand, and especially soapy water. Try basters, egg beaters, wire whisks, sponges, slotted and solid spoons, measuring cups, and anything else that seems like fun.

• Mint tins – Lidded metal breath mint tins are perfect for holding small, loose parts.

• Natural objects – Collect sets of rocks, acorns, bulbs, leaves, pinecones, seedpods, twigs, wildflowers, and/or other natural objects found in your area. Children will enjoy examining and sorting the collections.

• Old household electronics – Children in preschool and beyond will enjoy using screwdrivers and other tools to disassemble non-working and unwanted items such as alarm clocks, radios, and telephones. Once the item has been taken apart, components can be used for imaginative inventions of their own.

• Paint brushes – Paint with plain water on natural materials inside or out. Textures and tiny details will become evident as children moisten tree trunks, stumps, leaves, and other found materials. Toddlers will enjoy working with large painter’s brushes, while older children can use watercolor brushes to explore the details of smaller rocks, fossils, and acorns.

• Pans and spoons – Explore sounds and music making with a variety of metals cookware (pots, pans, cookie sheets, muffin tins) and spoons of varying sizes and textures. If the same spoon is tapped on different pans, does it make the same sound? What happens when you tap a pan with different spoons?

• Plastic drink bottles – Fill with a variety of materials for “discovery bottles” to shake, roll, and explore. Or, fill squeeze-top sports drink bottles with safe, scented substances (vanilla extract, peppermint oil, and so on) and add cotton balls to create “scent bottles”. An adult can also use a thumb tack to poke small holes in the neck of a plastic drink bottle, creating an inexpensive “bug box”.

• Rubber hose/tubing – Pieces of tubing encourage problem solving and exploration of properties of gravity during water play.

• Safe mirrors – Small, handheld mirrors encourage all sorts of exploration! Simple mirrors can be created by gluing the shiny, silver material from old Mylar birthday balloons to squares of foam board.

For more exciting ideas, check out the Saint Louis Teacher’s Recycle Center: www.sltrc.com
Up to Our Elbows in Science:  
Ooey, Gooey Recipes for Exploratory Play

Here are some all-time favorite recipes for science and sensory play. Most are suited for all ages, though toddlers should not use materials with toxic ingredients. Toddlers and preschoolers will have a blast mixing, mushing, pounding, and poking as they learn about solids and liquids, color mixing, cause and effect relationships, and more. Older kids will also be eager to join in the messy fun, all the while experimenting with more complex scientific concepts such as properties of solutions and suspensions, evaporation, and surface tension.

Fun Foam

You’ll need a large mixing bowl, a rotary or electric mixer, baby shampoo, and hot water. Food coloring or paint is optional.

Pour 3 Tbsp. of baby shampoo (or other tear-free kids’ shampoo) into the bowl. Add water a ½ cupful at a time, mixing well after each addition. Watch for soft, foamy peaks to form, creating a bowl of foam with a texture similar to shaving cream, but softer.

The ideal ratio of soap to water will depend on the brand of shampoo you use but the end results are fun even if not quite “perfect”! A dash of food coloring, liquid watercolor, or tempera paint can be added for color, if desired.

Ways to play:

- Draw in the foam with a finger - even more fun when the foam is spread on a sheet of aluminum foil!
- Drive toy cars through the foam.
- Heap the foam into cups, muffin tins, and other containers.
- Play in the foam with objects of different weights and textures, such as pennies, ping pong balls, river rocks, and popsicle sticks.
- Try hiding metal objects (bolts, paperclips, small jar lids) to “catch” with magnets.
- Wear swimsuits and body paint with the foam outdoors on a warm, sunny day; use a hose or sprinkler for quick clean up.
Gak and Glubber

These two glue putties have similar consistencies, but they aren’t quite the same. Try them both to decide which one is your favorite!

Gak
You’ll need a large bowl, white school glue and liquid starch (available on the laundry isle at the supermarket). Food coloring is optional. The recipe is made from approximately equal parts of glue and starch. Pour the glue into the bowl. Slowly add starch, stirring often, until the glue holds together like putty. Test consistency by kneading and pulling; if sticky, add more starch a little at a time. Store in an airtight container, such as a plastic zipper bag, when not in use.

Glubber
You’ll need a large bowl, a 1-cup liquid measuring cup, a teaspoon, an 8 oz. bottle of Elmer’s Glue-All, Borax brand laundry powder, and warm water. Pour the entire bottle of glue into the bowl. Refill the glue bottle with water, shake to mix, and pour the water into the bowl. Stir to mix well, adding a few drops of food coloring if desired.

Pour an additional ½ cup of water into the measuring cup and stir in 1 teaspoon of Borax powder. Slowly add the Borax solution to the glue solution, stirring often. Continue to add Borax solution until the substance is slime-like and no longer sticky. Depending on how much you add, your Glubber may be stringy, slimy, smooth, or firm. Experiment to find your preferred consistency. Store in an airtight container, such as a plastic zipper bag, when not in use.

Ways to play

- Roll putty between your hands to make a ball. Place the putty ball on the table. What happens?
- Flatten and drape the putty over the top of a plastic cup or your favorite plastic animals.
- Experiment with kitchen gadgets, such as rolling pins, butter knives, and a garlic press.
- Stand on a stool or chair with a ball of putty in your hand. How long does it take the putty to stretch from your hand to the table top or floor?
- Fold the putty to trap air bubbles between layers of putty. If you do it just right, you’ll be able to make a loud popping sound by squeezing the bubble-filled putty.
- What happens when you hold a ball of putty over the end of a manual balloon pump? (Make a tight seal with your fingers before pumping.)

If putty gets in clothing or carpet, rinse with very hot water.
Clean Mud

You’ll need several rolls of unused toilet paper, a bar of mild soap, a cheese grater or vegetable peeler, a large lidded container (such as a shallow plastic tub), and water. Children can shred the toilet paper into small pieces while an adult grates the soap. Combine the shredded paper and soap in a large container. Add water a little at a time, mixing by hand to the desired consistency; mixture should not be soupy.

Ways to play
- Dig, pat, squeeze, and flatten. Use a finger to poke deep holes in the mud.
- Mold by hand and/or using containers, such as clean, empty yogurt cups.
- Mix in a few drops of liquid watercolor or food coloring.
- Make clean mud pies.
Place lid on container when not in use.
How does the consistency of the mud change overnight? In a week?

Cloud Soap

You’ll need a bar of Ivory soap, a microwave-safe plate, and a microwave. Unwrap the soap and place on the plate. Set the microwave on high power for 2 minutes. As the soap heats up, it will begin to expand. Stop the microwave when the soap has reached its maximum size and is no longer growing. This usually takes 90 seconds – 2 minutes, depending on the power of the microwave. Let soap stand without touching it for at least 2 minutes, then remove and examine.

Ways to play
- Measure the soap before and after heating. How much did it grow?
- Carve the soap with a butter knife.
- Try floating the soap in your water table.
- What happens if you microwave a different brand of bar soap? Why do you think this happens?
Microwave Fun Dough

You’ll need a large, microwave safe bowl, measuring cups and spoons, a large spoon or spatula, regular Bisquick baking mix, salt, cream of tartar, water, and food coloring.

Stir together 1 ¼ C. Bisquick, ¼ C. salt, and 1 tsp. cream of tartar in microwave-safe bowl. In a measuring cup, add food coloring to 1 C. of water. Stir the colored water into the dry mixture a little at a time.

Microwave, uncovered, on high power for 1 minute. Stir, scraping sides of bowl. Microwave, uncovered, 2 or 3 minutes longer, stirring every minute, until mixture almost forms a ball.

Remove dough from bowl and let cool slightly. Knead until smooth; if dough seems sticky, roll in Bisquick powder and knead again.

Super Smelly Fun Dough

You’ll need a large saucepan, measuring cups and spoons, a stove or hotplate, a long spoon for stirring, a packet of unsweetened Kool-aid drink mix, flour, salt, cream of tartar, vegetable oil and water.

Combine 1 C. flour, 1/4 C. salt, 2 Tablespoons cream of tartar, and 1 packet powdered drink mix in pan. Stir to mix dry ingredients. Add 1 C. water and 1 Tablespoon vegetable oil and mix well. Cook and stir over medium heat for several minutes. When mixture forms a ball, remove from heat, cool, and knead until smooth.

Will keep longest in a sealed container in the fridge, but can also be stored in an air-tight container at room temp for up to a couple of weeks.

Ways to play

- How does working with warm dough compare to working with room temperature dough?
- Make batches of dough in the primary colors - red, yellow, and blue. Kids can combine the doughs to explore color mixing.
- Press leaves or shells in the dough to make imprints.
- Try rolling toy trucks through the dough, or make tracks with plastic toy animals or dinosaurs.
- Make a boat out of play dough. Will it float? How many pennies or marbles can the boat hold before sinking? How might you make your boat more buoyant?
- Place a dough creation on a sunny window sill overnight. Does it change? What happens if you leave it there for a week?
**Cornstarch Goop**

You’ll need one or more boxes of cornstarch, water, and a large container for mixing. This activity can be very messy; enjoy it in an easy-to-clean area.

Empty about ¼ box of cornstarch into a large mixing container. Add ½ cup of water and stir. Slowly add more cornstarch and more water, stirring often, until you have a mixture that is similar in consistency to thick pancake batter. When mixed properly, you will end up with an amazing non-Newtonian fluid. Move it quickly, by stirring vigorously, rolling a bit of goop into a ball, etc., and it acts like a solid. Move it slowly, and it acts like a liquid. Food coloring may be added if desired.

**Ways to play**
- Quickly roll a ball of goop in your hands. What happens when you stop rolling and open your hand?
- Try slapping the surface of the container of goop with your hands and throwing a ball of goop at the ground.
- Experiment with sifters, slotted spoons and spatulas.
- Can older kids figure out what “Non-Newtonian” means? (Hint: it has to do with viscosity!) And, how is goop similar to quick sand?

Goop will clog drains! Wipe most of the goop off of hands before washing and dispose of goop in the trash, not down the drain. If goop gets on carpet, let dry completely. When the water evaporates, you’ll have powdery cornstarch that can be vacuumed.

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**Rainbow Cubes**

You’ll need water, liquid food coloring, and ice cube trays.

Fill trays with water and add a few drops of food coloring to each, using different colors in different compartments of the tray. Freeze until solid.

**Ways to play**
- Fingerpaint with the colored cubes on light colored paper, mixing colors as you go.
- Try dabbling with the cubes on different surfaces: wax paper, aluminum foil, a cookie sheet, an old, light-colored bath towel, or corrugated cardboard.
- On a warm day, paint with the cubes on the sidewalk. (Use washable paint to tint the cubes if staining the sidewalk could be a problem.)
- Add colored cubes to the water table.
Go Take a Hike:
18 meaningful nature walk activities for children

1. **Adopt-a-Tree**

   Take the children on a walk to find a favorite tree. Once a tree is selected, explore the tree in many different ways: make a rubbing of the bark with a peeled crayon, lie on your backs to look up at the branches, look for signs of animal life in and around the tree, and use your senses to describe how the tree feels, looks, and smells. Visit the tree periodically throughout the year to see how it changes each season; consider creating a photo book with monthly “portraits” of your adopted tree!

2. **Looking for Leaves**

   When autumn leaves begin to fall, take the children on a walk to collect colorful leaves. Back in the classroom, sort the leaves by color, shape, number of lobes, and other attributes. Read the book *Leaf Man* by Lois Ehlert, and provide large sheets of paper and glue to allow the children to create their own leaf creations.

3. **Putrid Pumpkin Walk**

   When your classroom jack-o-lantern has passed its prime and is getting a little mushy around the edges, give it a final resting place along your group’s favorite nature walk path. Make predictions about what might happen to the pumpkin, and then re-visit it every few days to see how it changes as it decomposes. Pair this exploration with the book, *Pumpkin Circle*, by George Levenson. If a whole pumpkin is used for this project (rather than a hollowed out jack-o-lantern), children may discover pumpkin vines growing in the spring!

4. **Bird Watcher’s Walk**

   How many different kinds of birds can children spot? Go bird watching, using either real binoculars or pretend ones made from halved paper towel tubes. Encourage children to move quietly so as not to scare the birds, and to use soft voices to share descriptions and locations of birds that they spot. (“I see a big, brown bird up in the tree.”)

   Teach children a simple bird call: by making a “psssh, psssh, psssh” sound, they can mimic the sound of a baby bird. Curious adult birds will fly closer to investigate!
5. **Shadow Seeking**

On a sunny day, go for a walk to explore shadows. Where can children see their shadows, and where do they disappear? How can they make their own shadows longer or shorter? If you have access to sunny sidewalk or basketball court, let children work with partners to trace around one another’s shadows using chalk. What do they notice about the shadows of tree branches? Where do the shadows go when it is cloudy?

![Sunlight over a road with shadows]

6. **Windy Day Walk**

Go for a walk on a very breezy day. What evidence can children see of the wind? Look closely at the trees, grass, and other natural features along your favorite path, and look for clouds moving in the sky. Give each child a long piece of crepe paper streamer or silk ribbon to carry with them as they walk. Can they tell which way the wind is blowing? What happens to the streamers when the group goes inside?

7. **Sounds All Around**

Take your group on a short walk and find a safe, comfortable place to sit down together. Have the children sit quietly with their eyes closed for 1 – 2 minutes listening to the environmental sounds around them. Afterwards, children can describe what they heard (car, barking dog, someone sneezing, bird, wind, etc.) as you write a list. Have the children close their eyes again. This time, ask them to silently point in the direction of each sound that they hear.

Small groups of school-agers and older preschoolers may be also interested in using clipboards and pencils to make a sound map. After drawing a small portrait of themselves in the middle of a sheet of paper, they can draw symbols to represent the sounds that they hear in front, beside, and behind them.

8. **Tracks in the Snow**

Bundle up on a snowy day and go for a walk. What happens when children walk through the snow? What other kinds of tracks can they find in the snow? (Check under and around bird feeders.)

Find an open, snowy area where there are no tracks yet. Call on individual children to try walking, running, hopping, skipping, and stomping across the snow. How are each set of tracks different?
9. **Rainy Day Walk**

Collect enough umbrellas for a small group of children. While another adult stays indoors with the rest of the class, take small groups of children for a walk in the rain. Talk about all the ways that the world looks, sounds, smells, and feels different when it is raining. Where do children think that birds, squirrels, and other animals go when it rains? Where does the water go? When they return to the classroom, children may be eager to draw pictures or write stories inspired by their rainy day walk.

10. **Exploring Puddles**

After a heavy rain, take the children to a safe, paved area where puddles have collected. Encourage children to use chalk to draw around the outside edge of each puddle. Return again every hour or two, again tracing each puddle’s outline with chalk. Children should be able to see evidence that the puddles are shrinking. Why do they think that this is happening?

In the spring, also keep an eye out for Spring Peeper frog tadpoles in muddy puddles that have been wet for several days. Collect a few tadpoles to bring into the classroom for observation.

11. **Animal Tricks, Tracks, and Traces**

It can be hard to spot animals on a nature hike, but it is often easier to find signs that animals have been there. Go for a walk to look for evidence of animals, such as shiny snail trails, tiny insect holes at the base of trees, and cat prints on car hoods.

If you would like to explore animal tracks even farther, find an area where you can make a bare patch of dirt. Moisten well to make mud, and place a tasty treat (such as cut fruit or bread with peanut butter) in a dish in the center of the mud patch. Chances are, the treat will be gone when you visit the site again. Were any animal tracks left behind to provide clues about the treat’s taker?

12. **Collecting Tiny Things**

Make a bracelet of masking tape, sticky side out, around each child’s wrist. As you go for a walk, encourage the children to collect tiny objects – such as small leaves and acorn caps – to stick to the tape.
13. Camouflage Connections

Why is it that you can go for a long walk in the woods and never see an animal? Help children understand camouflage with this simple activity.

Cut colored pipe cleaners to make 30, 3-inch-long “caterpillars”. Make half of the caterpillars bright colors - such as pink, yellow, and orange - and half natural colors – dark green, brown, and tan. While the children are elsewhere, scatter the caterpillars in along a pre-determined path. After showing the children a sample “caterpillar”, walk the group along the path, encouraging them to collect any that they see. Don’t stop and search – just walk through at a normal pace.

Regroup afterwards and count the caterpillars. Were children able to find all 30? Chances are, they were able to find all of the brightly colored caterpillars, but few of the natural-colored ones. Why? Return to the area to search for the remaining caterpillars. Back in the classroom, children can glue a caterpillar of their choice to paper and use makers to draw a scene in which it would be camouflaged. (For example, a pink caterpillar on a pink flower.) Why do children think that the insects would want to be camouflaged?

14. Micro-Hike

Find an open, natural area that your group can safely explore. Place a hula hoop or large loop of rope on the ground for each small group of 2-4 children. Encourage children to explore the area inside their hoop using magnifying glasses, BBQ picks, tweezers, and other small tools. What do they find when they look very closely at this area? After children have had time to explore, ask, “What would this area look like to you if you were an ant or a ladybug?” Some children may want to draw pictures of write stories about this topic.

15. Bug and Spider Safari

Go on safari in your play yard or along a favorite path. Look for insects and spiders along tree trunks, along the edge of buildings, and under rocks. (For safety, remind children never to put their hands or feet into spaces that they cannot see, such as inside fallen logs.)

Collect insects in bug boxes and/or use a digital camera to snap pictures of each creature you encounter. Go online to identify insects at www.enature.com, and make a book of photos of your finds.
16. Color Chip Scavenger Hunt

Collect paint sample chips in various colors from the hardware store. Glue or tape the chips into muffin tins, selecting a different color for each section. As you go for a nature walk, encourage small groups of children to collect natural items of each color to place in the corresponding section of their tin. Use the collected items for a color wheel mural of natural objects, or for sorting activities.

17. Paper Cameras

For each child in your group or small group, cut a 2-inch by 4-inch rectangle from the center of a piece of laminated black paper. Introduce these to children as “paper cameras”. As you explore a natural area, children can use their paper cameras to take “memory photos” of beautiful or interesting objects. Demonstrate how they can hold the camera about a foot in front of their face while focusing on a favorite flower, rock, etc. As the mock cameras help them focus their attention, many young children will view small objects with keen awareness. Later, provide crayons or paint to allow children to create a representation of one of their favorite compositions.

18. Take a Rock for a Walk

How do seeds get where they are going? Often, they “hitch a ride” on a passing animal or pant leg. To explore the concept of traveling seeds, bundle a large rock in a piece of felt or an old sock. Tie with a length of yarn to create a leash.

As you walk past weedy areas, use the string to drag the rock through the weeds. Back at the classroom, remove the felt or sock from the rock and examine carefully. Do children see any seeds on the fabric? Plant the material under an inch or two of potting soil. Water well, and keep moist; in a few days, your seeds may sprout!

Safety and supervision note: children will need adult help to remember not to swing the rocks on the ends of their strings. This activity may be best suited to small groups of children. Or, allow one child at a time to take a turn “walking the rock”.

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Quotable Quote

“Weeds are flowers too, once you get to know them.”
– Eeyore, from A.A. Milne’s *Winnie the Pooh*
Caring for Creatures

Talking about Tadpoles

“They’re so swimmy. They waggle their tails to go all around.” – Madison, age 3

“They are kind of greeny-brown and slick. Does the mud make them that color?” – Adnan, age 5

“Where’s the nose? I don’t think it has a nose.” – Brandon, age 4
“That’s because there’s nothing to smell under the water.” – Dayja, age 5

“They have little feet now, and knees. They didn’t have those on the other day, before.” – Adnan, age 5

“How do those teensy weensy legs turn to big frog hoppers?” – Madison, age 3
“When they get vitamins from the algae. Algae is like vegetables for tadpoles.” – Dayja, age 4

“The little one is kissing all along the glass – kiss, kissy, kiss.” – Blake, age 3

The statements above were made by a small group of preschoolers as they observed a tank full of spring peeper tadpoles, collected the week before from a mud puddle near their playground. Magnifying glasses and clipboards, pencils, and paper placed near the tank encourage the children to look closely and record what they see.

During the next few weeks, the children continue to tend the tadpoles - feeding them, providing fresh water, checking each morning for changes, and making countless sketches - until the tadpoles turn to tiny frogs, ready to be released outdoors.

Collecting and caring for creatures from the natural world can provide a priceless opportunity for children to get an “up close and personal” look at real animals. Through careful observation, children discover firsthand how living things act and react, grow and change. Sketching, measuring, and photographing the animals can help children record their learning. Conversations with peers and adults allow them to share ideas and theories, ask questions, and build vocabulary, while books and other resources can be used to build upon existing knowledge.

On the next few pages, you’ll find guidelines for responsible small animal care, plus tips for collecting and caring for small creatures indigenous to Arkansas.
Three Principles of Animal Care

1. Protect
Even for short periods of time, animals need an environment that provides comfort and protection. For stays lasting more than a few hours, food and water should also be provided. Consider lighting and climate; animals should not be left behind in a dark, cold classroom for extended periods of time. Animals of any sort should only be collected for classroom use if there is a responsible adult devoted to their wellbeing.

2. Respect
Children can be taught that living things should be treated with kindness and care. Help them understand that crowding, loud voices, and banging on cages/containers can frighten animals, and provide positive reinforcement when children behave calmly and quietly in the animal observation area.

3. Release
No matter how small, these are wild creatures and should be returned to their natural environment after a short time. An observation period ranging from several hours to several weeks will allow your children an up close experience with the animals. After that, return them to where they were found.

Caring for Caterpillars

Collection
Caterpillars are soft and delicate. Rather than trying to pick up a caterpillar directly, coax it onto a leaf or twig, which can then be used to transport the creature safely. Caterpillars with spines should not be handled with bare hands, as the spines can prickle or irritate skin.

Housing
Provide a solid container, such as a “critter keeper” box or large glass jar. Fill the bottom with an inch or two of lightly moistened soil or sand, similar to that where the caterpillar was found. Some caterpillars burrow to pupate (change to moths) and this will allow them to do so. Also include a few sturdy sticks or twigs, propped securely at an angle, to accommodate chrysalis-making caterpillars. Provide a sturdy, ventilated lid for the container, or cover with cheesecloth or mesh secured with a rubber band.

(Hint: To make ventilation holes in a plastic jar lid, grasp a small nail with pliers and heat with a lighter; use the pliers to poke the hot nail through the lid to make holes. This should be done by an adult, out of reach of small children.)
Care and Feeding

Include fresh leaves from the plant where the caterpillar was found, as this is a likely food source. A small tray of wet cotton balls will provide needed moisture. Leaves can be replaced and cotton balls moistened with a spray bottle as needed.

Observe your caterpillar closely, watching for evidence that it is eating the provided leaves. Some caterpillars can only eat certain plants. If the caterpillar does not eat the leaves that you have provided, try collecting other plants from around the area where the caterpillar was found. Round holes or chewed edges on leaves are good evidence that a plant is viable caterpillar food! Try offering new and old leaves, and even flowers, until a food that your caterpillar eats is found. After that, continue to offer this food daily. Some caterpillars will also eat bits of apple or carrot.

Growth and Change

The caterpillar will continue to eat and grow, often reaching twice its original size or more. Eventually, it will prepare to pupate by burrowing into the ground or by creating a chrysalis or cocoon. During this time, disturb the container as little as possible, moistening the soil/or sand lightly only if it becomes very dry.

Many caterpillars collected during the spring and summer months will emerge as butterflies or moths after 2 – 4 weeks. Caterpillars collected in the fall may pupate throughout the winter months, emerging in the spring.

When the butterfly or moth emerges, its wings will be wet and fragile; do not handle the butterfly, but ensure that there is a stick/twig or other provision to allow it to rest while drying its wings.

Letting Go

After a few hours, the moth or butterfly’s wings will dry completely, and the insect will begin to pump its wings by flapping them steadily. At this point, it is ready to go free. Take the container outdoors, as near as possible to the area where the caterpillar was collected. Remove the lid from the container and place it on the ground; soon, the butterfly or moth will find the opening and fly away.

More to Know

How do I know what kind of caterpillar I have?

It can be fun to wait and be surprised, but the Discover Life webpage can also help identify common caterpillars. Picture cues make this a fabulous first introduction to taxonomy for small groups of children ages 3 and up. http://pick4.pick.uga.edu/mp/20q?guide=Caterpillars
What is the difference between a butterfly and a moth?

- Moths often have thicker bodies than butterflies.
- Butterflies have “clubbed” antennae (narrow, except for a thick tip), while moths have straight or comb-like antennae.
- When resting, some butterflies hold their wings vertically, while all moths hold their winds horizontally.
- Butterflies are most active in the daytime, while moths are more active at night.
- Butterflies are often more brightly colored than moths.

Below, a butterfly is pictured at left, a moth at right.

What is the difference between a cocoon and a chrysalis?

A butterfly creates a chrysalis, which is made of hardened protein. Most moths make cocoons, which are spun from silk.

More to Do
Prepare for your caterpillar’s big transformation by sharing books about butterflies.

- From Caterpillar to Butterfly by Deborah Heiligman and Bari Weissman
- Are You a Butterfly? by Judy Allen and Tudor Humphries
- Where Butterflies Grow by Joanne Ryder and Lynne Cherry
Caring for Crayfish

Collection
Crayfish (also known as crawdads) can be found in shallow, rocky streambeds. Look for them beneath small rocks near the edge of the water. Crayfish skitter backwards when startled, so one easy collection method is to reach into the water in front of the crayfish while simultaneously placing a small fish tank net behind the crayfish. Once you have caught a crayfish, transport it in a container of shallow water collected from the stream.

Housing
An aquarium makes an excellent crayfish home. Line the bottom of the aquarium with rocks and pebbles of various sizes. Collecting the rocks and pebbles from the same stream as the crayfish is ideal. If this is not possible, rinse any other rocks thoroughly to remove possible hazards such as lawn care chemicals, as well as soil that can cloud the tank. Crayfish like to dig and burrow, so consider creating a home from an upturned flower pot or a commercial aquarium “cave”. Aquarium gravel may be added under and around larger rocks, if desired.

Add a mixture of the stream water used to transport the crayfish and bottled or filtered water at room temperature. Do not use chlorinated tap water, unless a de-chlorination product designed for aquarium use is added. The water should be at least as deep as the crayfish’s head when standing on the rocks, and can be deeper. If you plan to keep the crayfish for more than a few days, an aquarium filter may also be used to help keep the water clean.

Care and Feeding
Place only one or two crayfish in the tank; they are territorial creatures and will fight if crowded. Likewise, if two crayfish are housed together, they should be of a similar size. Very large crayfish may kill very small ones.

Shrimp pellets, available in the fish section of most pet stores, make a nutritious and appealing meal for crayfish.

Crayfish may be handled gently and can become tame, but can pinch if agitated. Children and adults should wash hands thoroughly after handling the crayfish, food pellets, or any contents of the tank.

Growth and Change
Crayfish shed their shells as they grow. The discarded shell may appear to be a dead crayfish at first. Crayfish should not be handled soon after shedding, as they are at their most fragile at this time.
Letting Go

After an observation and care period, crayfish collected in the wild may be returned to their natural habitat. If possible, release the crayfish in the area where they were originally collected. Crayfish purchased at bait shops or pet stores should not be released into the wild, as they may spread disease or compete aggressively with indigenous species.

More to Know

How is a crayfish different from a lobster?

Lobsters and crayfish are both crustaceans, and are very similar. They have the same body structure: the same number of legs, the same number of antennae, a long tail, two claws, and a hard outer shell. Crayfish do not grow as large as lobsters, however, and are found in freshwater. Lobsters live in salt water.

More to Do

Encourage the children to observe the crayfish’s movements closely. Does it move about the tank using legs? Claws? Tail? Can children mimic the crayfish’s movement?

Caring for Crickets

Collection

Crickets can often be found in grassy areas along the edge of walls, or in the soil at the base of tall grass. Crickets sometimes also venture into homes and schools in search of food, and may be discovered by children in cool, dark corners.

Gently lift the cricket and place it in a “critter keeper”, roomy bug box, or jar with ventilated lid. Crickets can gnaw through cheesecloth and even fine metal screen, so their home must be made of glass or sturdy plastic. If you prefer not to handle the cricket, gently place a paper cup over it. Slide an index card under the cup, creating a “floor” that traps the cricket inside the cup. Lift cup and card together and carry to your desired container; remove the index card to release the cricket.

Housing

To create a comfortable home for your cricket, add a bed of dirt to the container floor. Provide leaves, sticks, bark, rocks, and/or other natural materials for climbing and hiding.
Care and Feeding

Crickets prefer warmer temperatures of 75 – 90 degrees, but do just fine at room temperature. They should be protected from very cold temperatures. Cricket containers should not be left in direct sunlight.

Crickets will eat almost anything! Popular foods include bird seed, rolled oats, bits of apple and potato, and small pieces of bread. Provide small amounts of food at a time and remove any food that begins to appear old or spoiled.

Water can be provided via a damp sponge or moistened cotton balls. Standing water should never be left in an insect cage; insects can easily drown in pooled water.

If you plan to keep your cricket(s) for more than a few days, droppings will need to be removed from the cage periodically.

Growth and Change

If two or more crickets are housed together, mating may occur. The female cricket will lay small, black eggs in a moist location. If eggs are found, remove them from the cricket container, and place them in a separate, covered and ventilated container containing moist soil. Moisten lightly daily using a misting spray bottle. In about three weeks, tiny, light colored cricket nymphs will hatch.

Care for and feed the small crickets as you do the adults, and observe as they grow, molt, and grow some more. Once they are larger, they can be housed with the adult crickets or released outdoors. Most crickets have a life span of 8 -10 weeks, so adult crickets may die during their time in captivity.

Letting Go

Return the crickets to the outdoors. Any grassy or wooded area can make a suitable home.

More to Know

How do crickets make that “chirping” noise?

Male crickets “chirp” by rubbing the grooved ridges on the underside of one of their front wings against the sharp edge of their other front wing. It is said that crickets sing more when they are warm. If your cricket does not chirp at all, it is most likely a female.
More to Do

Conduct a cricket taste test. Cut a small piece from an apple, a potato, and a carrot. The pieces should each be as close to the same size as possible. Ask children to predict which food they think the cricket will like best, and make a chart of their responses. Place the three pieces of food in the cricket’s container, encouraging children to check back often to see if they can observe the cricket eating. After 24-48 hours, remove the food and examine closely. Which was the cricket’s favorite food? How can children tell?

An old legend says that you can determine the exact temperature by counting the number of chirps a cricket makes during a 15-second interval, then adding 37 to the number to get the correct temperature in degrees Fahrenheit. For example, if he chirps 33 times in 15 seconds, the temperature is precisely 70 degrees where the cricket is sitting. School-age kids may enjoy testing this theory.

Caring for Earthworms

**Collection**

Earthworms can be found in the cool, moist soil beneath rocks and along the edge of buildings. They are especially easy to collect after a heavy rain shower, when they crawl to the surface of the ground. Worms may be gently gathered by hand; they will not bite or harm a child in any way.

**Housing**

To create a worm habitat, fill an aquarium or large jar with alternating layers of soil and sand, each measuring about one inch thick and ending with a top layer of soil. These materials should be collected from outdoors; some commercial play sands and all non-organic commercial potting soils contain chemicals that will kill worms. Leave at least two inches between the top layer of soil and the top of the jar or tank.

Prior to adding the worms, slowly add about ¾ cup of water to moisten the soil. Gently place the worms onto the soil surface, then cover the container with a ventilated lid or a piece of fine mesh or cheesecloth, secured with a rubber band.
Care and Feeding
Worms can eat most organic matter, including fruit and vegetable peels, coffee grounds, and grass clippings. Mix small amounts of food into the top layer of soil every few days. As the food decays, it will become the perfect worm chow.

Mist the soil with a spray bottle daily, taking care not to overwater. If the worms come to the surface soon after watering, you’re adding too much water.

Growth and Change
Over time, your worms will create an elaborate system of tunnels throughout the container. Worms are most active in the dark, so consider creating a cover from dark-colored construction paper or a paper grocery sack. By covering the container when children are not actively observing it, you will encourage the worms to build tunnels more quickly, and closer to the sides of the container, where they can be viewed more easily.

Letting Go
Worms may be kept for several weeks. Afterwards, gently dump the entire contents of the container onto the ground in a warm, shady, soil-rich area. Do not release earthworms purchased at a bait shop into the wild, as the introduction of a non-native species can threaten local worms and result in overfeeding and soil compaction.

More to Know
Where are the worm’s eyes and mouth? How do it see and eat?
Earthworms do not have eyes. Instead, they have light-sensitive cells in their outer skin. These cells don’t enable earthworms to see images, but they give the worm’s skin the capacity to detect light and changes in light intensity.

Worms do have a mouth, but it is very tiny. Worms do not have teeth. This is why they can only eat soft, decaying food that they find in the soil.

More to Do
Worms love old, dead leaves. Scoop several large armfuls of decaying leaves from the forest floor into a sturdy container, such as a shallow plastic storage tub. Children can use magnifying glasses and picks, such as b-b-q skewers (or popsicle sticks for younger children) to explore the leaves. Children may discover worms and insects that call the leaves home, as well as a wide range of organic matter. Encourage children to discuss how the leaves look, smell, and feel. Older children may also want to photograph or sketch their findings.
Caring for Tadpoles

Collection

In the springtime, tadpoles can be found in pools of standing water, including puddles and along the edge of ponds. Frog eggs – small, jelly-like balls that are dark on one side and light on the other, or clear with a dark dot in the center – can also be collected from standing water. Tadpoles and eggs may be gathered with a small net, or by gently scooping with a container, such as a cup or bucket. Transport the animals/eggs in a container of water from the area where they were collected.

Housing

Tadpoles may be housed in an aquarium, fish bowl, or sturdy plastic container. A larger tadpole pond can be created in a child-sized plastic swimming pool outdoors, though tadpoles kept in an unprotected outdoor environment may be discovered and eaten by birds and other natural predators. Line the bottom of the container with rocks and pebbles prior to adding water; this will create spaces for tadpoles to hide.

Tadpoles prefer shallow water, and the best “starter” water is a mix of water collected from the same site as the tadpoles and fresh, dechlorinated water. If tap water is used, first treat with dechlorination drops, available at most pet stores.

As the tadpoles mature, they will also need a way to get out of the water. Consider adding a slopped set of rocks to create a “bank” on one end of the container, or place a sizable tree branch at an angle in the tank, so that it is only partially submerged and creates a stable ramp that allows frogs to easily crawl out of the water. In addition, you will want to consider adding a cover to your container as the tadpoles grow to frogs; this will prevent the tiny frogs from climbing out and becoming lost in the classroom.

Care and Feeding

Most tadpoles will eat bits of spinach and/or lettuce, including thawed frozen spinach. Flaked fish food may also be fed. Feed small amounts up to three times a day, and avoid overfeeding, as this can create quickly impact the water quality and sicken the tadpoles.

Unless a very large container is used, water will need to be freshened every few days. Scoop out and discard approximately 1/3 of the water in the container, replacing it with fresh, dechlorinated water at room temperature. Always add and remove water slowly and carefully to avoid harming the tadpoles.
**Growth and Change**

In time, the tadpoles will grow larger, their bodies becoming more elongated and frog-like. Back legs will develop first, followed by front legs. The tail shrinks, and the gills stop functioning as lungs take over. Smaller frog species, such as the spring peeper, may complete this metamorphosis in as little as a few weeks. Bullfrog tadpoles, on the other hand, may take up to two years to grow into frogs.

As the tadpoles grow into frogs, water in the tank should become more shallow. Flaked fish food can be added to the diet to meet nutritional needs as the tadpole transforms from herbivorous tadpole to carnivorous frog. New frogs are most sensitive to temperature change, and should not be exposed to air temperatures less than 60 degrees Fahrenheit.

**Letting Go**

Frogs should be released as soon as possible after they emerge from the water. Most frogs are hard to feed in captivity, and will not live long unless released. If frogs are kept in captivity, you may try feeding small crickets, meal worms, or other live insects. A frog that does not readily eat should be released promptly. When returning frogs to the wild, place them at the edge of the body of water where they were collected, out of but near -the water.

**More to Know**

**What is the difference between a frog and a toad?**

Frogs have smooth, moist skin, while toads have dry, bumpy skin. In addition, most frogs can be described as long and lean, while toads are short and stout. Frogs have webbed feet and move about by hopping or swimming; toads have webless toes and move about by walking or hopping, though they can swim if they must. Some breeds of frogs live in water much of the time, but all toads live on dry land, returning to the water only to lay eggs. Both frogs and toads begin life as tadpoles.

**More to Do**

Snap a close-up photo of a tadpole every 2-3 days, recording the changes that occur as it grows into a frog. These photos can be used for a display board, as well as for sequencing by the children. Older children may also enjoy sketching the tadpoles.
Out and About in the Natural State

From roaring waterfalls to serene lakes, limestone bluffs to wildflower-filled meadows, the natural beauty of Arkansas is abundant. On the next few pages, you’ll find information on child-friendly walking trails, hiking trails, and other nature experiences throughout the state.

Arkansas Arboretum Loop, Pinnacle Mountain State Park
This half mile trail is paved for easy stroller and wheelchair accessibility. Children will enjoy the audio recordings along the trial, while adults may be interested in the garden areas featuring plants native to each of the state’s geographical regions. Stop by the visitor’s center to meet some live, local wildlife!
Exit #9 off I-430 at Little Rock; seven miles west on AR 10, then go two miles north on AR 300;
www.arkansasstateparks.com/pinnaclemountain/

Arkansas River Valley Nature Center, Fort Smith
Operated by the Arkansas Game and Fish Commission, the nature center includes an aquarium area, interactive exhibits, and several short hiking trails. Some trails are paved or boardwalk, accessible to strollers and wheelchairs. Convenient restrooms.
8300 Wells Lake Rd Fort Smith; www.rivervalleynaturecenter.com

Big Dam Bridge, Little Rock
Enjoy spectacular views of the Arkansas River as you walk, jog, or bike across this 4226-foot long, vehicle-free bridge connecting Little Rock and North Little Rock. Towering up to 90 feet above the river, the bridge provides a unique vantage point for viewing the river and the working Murray Lock and Dam below. Guardrails make the experience safe for young children with close supervision. Eight observation areas provide space to relax, take in the scenery, and learn more about the history and ecology of the area. Watch for water birds and river reptiles!
7600 Rebsamen Park Rd, Little Rock, or 4000 Cooks Landing Rd, North Little Rock;
www.bigdambridge.com

Bona Dea Trail, Russellville
This multi-use fitness and nature trail, located along the banks of Lake Dardanelle, provides a number of different, looped routes to explore. Trail lengths start at just .2 miles of paved, accessible trail, but those looking for a longer walk will find an additional 3.5 miles of paved and gravel trail. You can visit many times and never have the same hike twice. Enjoy up-close views of the wetland and low woodland habitats, and keep an eye out for waterfowl. Convenient restrooms. AR 326 off Scenic 7 Byway, Russellville
Butterflies and Blooms Trail, Lake Charles State Park
Spring and early summer are perfect times to view wildflowers planted on both sides of this short, easy trail. Packed gravel may make accessibility difficult for wheelchairs and standard strollers. For more adventure, older children may prefer the hilly, 1.5-mile White Oak Loop Trail, which travels into the hardwood forest before emerging along the lake shore. From Hoxie, go eight miles northwest on U.S. 63, then six miles south on AR 25; www.arkansasstateparks.com

Crane Fly Trail, Logoly State Park
This ¾ mile gravel trail provides some of school-agers’ favorite things: a pond with a boardwalk and dam, a picnic area, steep hills and, best of all, a swinging bridge! The nearby visitor’s center often includes live reptile exhibits. From U.S. 79 at McNeil, go one mile on County Road 47 (Logoly Road) to the park; www.arkansasstateparks.com

Crater of Diamonds State Park, Murfreesboro
A different kind of nature experience! This one-of-a-kind park allows visitors to dig for natural crystals and even diamonds. Best of all, it is “finders keepers”! Digging takes place in a large, plowed field, the top layer of an ancient volcanic pipe where gemstones were deposited thousands of years ago. Bring your own tools, or rent tools on site. Children under age six can dig for free; a small fee is charged for older children and adults. Don’t forget sunscreen and drinking water, and consider digging during the cooler morning hours if you visit during the warm weather months. At Murfreesboro, take Ark. 301 and go southeast approximately 2 1/2 miles to the park; www.craterofdiamondsstatepark.com

Delta View Trail, Cane Creek State Park
This looped, hilly, but not-too-challenging, trail provides forest and lakeshore experiences. Benches offer a chance to rest and enjoy an overlook of Cane Creek Lake. This is a great place for spotting deer and enjoying dogwoods and other flowering trees in spring. Provide at least 3 hours to hike this trail with children. The park also offers a unique kayak trail and kayak rentals – a perfect adventure for older children and teens! From Star City, go five miles east on Hwy. 293; www.arkansasstateparks.com

Discovery Loop, Delta Rivers Nature Center
This half mile, paved and boardwalk trail is accessible to wheelchairs and strollers. Children will enjoy the Black Dog Lake overlook, as well as an up-close look at Black Dog Bayou. Be on the lookout for alligators and other water reptiles, as well as birds of prey. Visit the nature center while you’re there
to see interactive exhibits and two aquariums. You may even catch an alligator feeding time!
Convenient restrooms. 1400 Black Dog Road in Pine Bluff’s Regional Park; www.deltarivers.com

Habitats Trail, Crowley’s Ridge Nature Center
This accessible, quarter mile trail explores pond, ridge, prairie, and bottomland forest habitats; watch for butterflies and hummingbirds in the center’s blooming gardens. A large diorama and observation deck provide plenty to do indoors. Check the website for a schedule of periodic stories and activities provided by Arkansas Game and Fish Commission employees. Convenient restrooms. 600 E. Lawson Road, Jonesboro; www.crowleysridge.org

Friendship Interpretive Loop, Jessieville
Situated in the Ouachita Natural Forest, this scenic, wheelchair and stroller accessible trail is the perfect place for a picnic! Enjoy peaceful pine forests, a bird and wildflower-filled meadow, a pond overlook, and wonderful wooden bridges. Convenient restrooms. Just outside of Jessieville, 18 miles north of Hot Springs on Highway 7; look for the visitor’s center.

Garvan Woodland Gardens, Hot Springs
Carefully landscaped gardens spotlight hundreds of native Arkansas plants. Children will enjoy the small waterfalls and rock gardens. Most trails are wheelchair and stroller accessible. A children’s “adventure garden” has been recently added, including a unique treetop boardwalk, a cave, climbing slopes, a natural maze, and more. Admission is charge, but reduced rates are available for groups. 550 Arkridge Road, Hot Springs; www.garvangardens.org

Knapp Loop, Toltec Mounds State Park
This archaeological park includes Native American ceremonial mounds dating from A.D. 600 to 1050. Measuring almost a mile in length, the paved, barrier-free Knapp Trail takes walkers past several mounds and along a boardwalk on Mound Pond. Look for cypress trees and turtles here. Much of the trail is sunny; don’t forget the sunscreen and water! Convenient restrooms. 490 Toltec Mounds Road, Scott, AR; www.arkansasstateparks.com

Lost Valley, Ponca
One of the state’s hidden treasures! This moderately-difficult, 2 mile trail takes hikers through hardwood forest, past a boulder-filled dry creek bed, along a natural bridge and through massive rock formations carved by wind and water, before climbing uphill to a waterfall that cascades from a natural cave. Consider bringing flashlights to explore the cave; a 200 foot, muddy
crawl will lead young explorers to a large, underground room with a second, secret waterfall! This trail includes bluffs and slippery creek crossings. It is not ideal for the youngest hikers, unless they have very close supervision. Hwy 43 from Boxley toward Ponca; look for signs.

**Louisiana Purchase Boardwalk**, Brinkley
Follow elevated boardwalk trail through a headwater swamp that would be un-accessible otherwise. Take a moment to sit quietly and listen to the sounds of the living wetland, including the hum of insects and the call of birds and frogs. Dense cypress trees make this short trail feel “a million miles away” from home! Historical markers located along the trail may interest older children/teens. Bugs are plentiful in summer; don’t forget the insect repellant! From I-40 at Brinkley, take U.S. 49 and travel 21 miles south, then go two miles east on Ark. 362 to the park; [www.arkansasstateparks.com](http://www.arkansasstateparks.com)

**Old Townsite Trails**, Arkansas Post National Monument, Gillett
Located on a peninsula between the Arkansas River and Post Bayou, this unique site is not only a treasure for the history buff, but a perfect site for spotting wildlife, as well. Choose between 1.4 miles of paved, wheelchair and stroller accessible walking path, or 1.6 miles of gravel and dirt nature trail, or do both for a longer hike. The trails explore a variety of ecosystems, including pond, hardwood forest, and river. Be on the lookout for bald eagles, and expect to see lotus plants in full bloom during the summer months. Convenient restrooms. 1741 Old Post Road; 9 miles south of Gillett via US165.

**Orchard Trail**, Ouachita National Forest, Mena
This fully accessible, half mile trail provides a peaceful journey through towering pine trees. Short, safe, and level, the trail is perfect for even the youngest hikers, and is also ideal for sharing nature activities with older children. Make bark rubbings, lie down to get an ant’s eye view of a tree, or try out a bird call. One mile north of Mena on Highway 88, next to the Forest Service’s East End Visitor Center.

**Periwinkle Trail**, Felsenthal National Wildlife Refuge, Crossett
This 1.5 mile trail allows school-age hikers to explore pine forest, meadows, and a pond. Plenty of bridges and a vine-covered archway make this an interesting route! This low-lying trail can be muddy during rainy weather, and is closed during hunting season. Call 870-364-3167 to ensure that the trail is open and safe for hiking, and don’t forget the insect repellant! Convenient restrooms. 5 miles west of Crossett on Highway 82, near the Crossett Harbor RV Park; [www.fws.gov/felsenthal/](http://www.fws.gov/felsenthal/)
**Riverside Park, Searcy**
This lovely, 99-acre park contains something for everyone, including several wheelchair and stroller accessible trails, picnic areas, playgrounds, and scenic Little Red River overlooks. A great place for spotting squirrels, birds, and other hardwood forest animals, as well as birds, amphibians, and reptiles that make a home near the river. Restrooms. *Riverside Park Road, Searcy;* [www.cityofsearcy.org/parks/](http://www.cityofsearcy.org/parks/)

**South Arkansas Arboretum; El Dorado**
Managed by South Arkansas Community College, this site offers a maze of connecting trails through forest, pond, and meadow habitats; hiking routes can be as simple as a paved, level ¼ mile, or up to 2 miles or more in length through hilly terrain. The many options make this an ideal site for children of all ages, and exploring will lead to many exciting discoveries, including waterfalls, hidden nooks, and wildflower glades. *Mount Holly Rd, behind El Dorado High School*

**Tanyard Creek Nature Trail, Bella Vista, AR**
A looped, gravel trail with several choices of length and route. Children will enjoy the swinging bridge, bluffs, and impressive waterfall, and there are plenty of shallow, rocky stream areas to explore. Trail includes a few steep drop-offs; close adult supervision is imperative! Convenient restrooms. *Approx. 1 mile west of Town Center, Hwy 340, Bella Vista;* [www.beautifulbellavista.com/tanyardcreek](http://www.beautifulbellavista.com/tanyardcreek)

**Waterfowl Way, Millwood State Park**
This easy, level, 1.5 mile loop visits a bog, a prairie, and hardwood and pine forests. Be on the lookout for signs of beaver activity! Many species of migratory waterfowl can be seen here, especially during the fall and winter months. The trail includes a picnic area. *16 miles north of Texarkana on Hwy 71, then 9 miles east on Hwy 32;* [www.arkansasstateparks.com](http://www.arkansasstateparks.com)

**Wildflower Garden Trail, Bull Shoals State Park**
This wheelchair/stroller accessible trail offers a peaceful, ¼ mile stroll through acres of native wildflowers. Visit several times during the spring, summer, and early fall to see hundreds of different species in bloom! Benches provide a perfect place to observe, sketch, and photograph songbirds, hummingbirds, butterflies, and busy honey bees. *From Mountain Home, travel six miles north on AR. 5, then go eight miles west on AR 178;* [www.arkansasstateparks.com](http://www.arkansasstateparks.com)
The Youngest Scientists: Discovery from Day One

Wonder. Explore. Find out more.
These are the essential elements behind scientific discovery; from the first studies of the laws of gravity, to revolutionary inventions such as the steam engine and light bulb, to modern day space exploration, these simple principles are a driving force.

And yet, these same simple principles are universally shared by every infant around the world! Scientific curiosity is present from birth. Infants and toddlers are natural born scientists, driven by an innate curiosity about their world and the desire to explore and find out more.

What does science look like for infants and toddlers?
It is important to remember that babies do not have our past experiences and background knowledge. The infant’s world is a mystery, full of new surprises. Baby doesn’t sit around and passively wait to be taught new things; she is ready to explore, and does so almost every waking minute!

- When tiny Rosa first bats at toys, she learns that she can use her body to make things happen. She’s building spatial awareness.
- Six-month-old Anton’s caregiver covers a teddy bear with a blanket and then whisks the blanket off to reveal the hiding bear; Anton chortles with delight. He’s discovering object permanence.
- When a ball rolled against a wall bounces back to one-year-old Sydney, she experiments with cause and effect.
- Fourteen-month-old Kosuke toddles across the grass to splash with his bare feet in a puddle left by the hose. What a wonderful sensory discovery!
- Autumn, age two, can’t quite reach her sippy cup from her booster seat at the table. She give the tablecloth a gentle tug, and – voila! –the cup slides into reach. She used logical reasoning skills to solve her problem.
- Toddler Sean pulls all of the red, oval-shaped, pop beads out of the box to make a “choo-choo train”. He’s building classification skills.

They aren’t wearing lab coats, but inside our playful infants and toddlers are active minds, busily learning about the results of their actions on the world around them. It’s not “just play” – it is science!
Creating an exploration-friendly environment for infants and toddlers

**Open-ended toys and materials.** Some toys are better for discovery play than others. For example, an electronic toy telephone that rings and talks may be fun for dramatic play, but does not offer many opportunities for experimentation. A set of simple wooden blocks, on the other hand, can be used for stacking, sorting, banging, and more. In fact, you may be surprised to see the electronic toy tossed aside as the toddler chats eagerly into a rectangular block “telephone” instead!

Many of the best learning toys are:
- Simple
- Used for genuine “cause & effect” learning
- Can be used in more than one way.

While every toy may not fit the criteria listed above, offer at least some toys that do!

**Organized materials.** Not much can be done with a handful of stray, mismatched toys dug from the bottom of a toy box. Set the stage for successful discovery by grouping toys by purpose and providing complete toys in good repair (for example, a complete set of nesting cups).

**Tantalizing textures.** Rather than filling the room with plastic toys alone, consider also including materials made of many different materials. Possibilities include:
- Silky scarves
- Metal pots, pans, lids
- Wooden rattles and toys
- Natural materials, such as sanded “tree cookies” or large, sturdy sea shells

**A room with a view.** Encourage visual exploration by providing access to windows and safe mirrors, ideally at the child’s eye level. Consider placing nature attracting elements (such as hummingbird feeders, bird baths, and flower boxes) outside the window to lure birds, butterflies, and other creatures into easy view.

**Room to move.** Arrange spaces that allow little learners to creep, crawl, scoot, and toddle, and to interact with balls, blocks, and other toys. Carefully supervised tunnels, large boxes, low ramps/mats, and pull-up bars also encourage exploration.
How can the caregiver facilitate learning?

A carefully structured environment can do much to stimulate explorative play, but the actions of a thoughtful and knowledgeable caregiver can truly transform the child care hours into a time for meaningful discovery.

**Time for play.** The most carefully-arranged play space does little for the baby who spends her waking hours in a crib, swing, or saucer! Provide plenty of “floor time” for exploration by mobile infants and toddlers. When working with non-mobile infants, bring materials to the child, or bring the child to the materials. For example, a young infant might be placed on a soft rug, with several different, appealing rattles in easy reach.

**Planned activities.** The human brain thrives on a balance of both familiar and novel experiences. In addition to providing an environment full of carefully selected and well-organized materials, plan special activities to stimulate exploration. Possibilities might include:

- Playing with ice cubes or exploring fresh snow brought in from outdoors
- Blowing soap bubbles
- Exploring real autumn leaves; fresh, whole fruits or vegetables; or other natural materials with careful supervision
- Arranging a visit from a safe, live animal, such as a well-trained therapy dog
- Sharing first art experiences using safe, non-toxic materials

**Many ways to play.** Allow children to use materials in their own, unique way, as long as the use is safe and non-destructive. For example, one young toddler might use a plastic Easter basket for collecting toy eggs, while another places the basket on her head for a hat, and a third pairs the basket with a small blanket to make a bed for a doll. By avoiding the assumption that there is only one “right” way to use the basket, their caregiver allows them to explore in many different ways.

Babies explore with their hands, feet, mouths, and bodies. Toddlers often experiment with dumping out toys, putting containers on their feet or heads, and crawling on or under furniture. Supervision and safety guidelines are needed, but try to welcome any exploratory play that is not potentially harmful.
Once, twice, one hundred times or more. Infants and toddlers – and all scientists – learn through repetition. Through their actions, they often seek to find out, “If I do it again, will I have the same result?” This willful replication can be seen when an infant shakes and throws a rattle over and over, or when a toddler carefully fills a bucket with sand, only to dump it out and begin again.

A skillful infant/toddler caregiver recognizes that the very young child’s repetitive behaviors are linked to discovery, and takes dropped sippy cups and dumped toys in stride.

Partners in play. Get down on the floor and join infants and toddlers in their play. Few things are more delightful to a child than an enthusiastic adult to share in her discoveries! As you play alongside the child, you can help provide words for her actions. (“You pushed the rubber ducky under the water, but it popped right back up again! The duck floats!”)

While it is important not to take a puzzle piece or toy away from the child to do it for her, you may occasionally model a “next step” in play. For example, a child who is shaking a toy top may benefit from you saying, “Look – you press down the handle, and it spins around!” while modeling this action.

Explore the great outdoors. Make outdoor experiences a daily priority for your group, bundling up to explore chilly days and slathering on the sunscreen before heading out for summer fun. Plan interesting stroller routes, and be on the lookout for neighborhood pets, plants in bloom, and busy squirrels and songbirds; take time to point out these wonders to the children. In the play yard, encourage children to investigate grass, dirt, tree trunks, and any other accessible natural features.

The path to life-long learning begins at birth. By carefully planning the environment and joining in children’s playful explorations during the infant and toddler years, you help set the stage for remarkable discoveries!
Science Talk with the Youngest Learners

When playing alongside infants and toddlers, taking stroller rides, and sharing day to day routines, use a wide range of words to describe what the children see and do.

**Sensory experiences**

- “The teddy bear is soft and fuzzy.”
- “This truck has knobby tires; the tires have bumps on them.”
- “Our baby wipes are cold and wet.”
- “Your applesauce smells like cinnamon and apples.”
- “Do you hear the dog barking? Ruf-ruf-ruff”

**Actions and reactions**

- “You’re banging it! It’s very loud!”
- “When you kicked the ball, it rolled all the way across the room.”
- “The spoon dropped to the floor.”
- “When you shake the rattle, I hear a noise.”
- “What do you see in the mirror?”

**Outdoor encounters**

- “The warm sun is shining on your face.”
- “Look! There’s a bluebird on the fence post.”
- “Do you feel the wind blowing your hair?”
- “I see raindrops rolling down our window pane.”
- “You found a big, yellow leaf. I wonder where it came from?”

Young children develop receptive language skills long before expressive language skills. That means that they understand many more words that they can use. When “science talk” is introduced in response to real life events (such as talking about flowers while taking a stroller ride through a garden area), concepts become real and meaningful to children.

In addition, the caregiver who provides positive attention by talking with children about their experiences models the skills of observation and description and gives value to the children’s actions. Children are more likely to be curious and active learners when they have an attentive and enthusiastic adult to share in their discoveries!
Science Skills, Methods, and Knowledge for Infants and Toddlers

Scientific Skills & Methods
Infants and younger toddlers (Birth to 18 Months)

Widely held expectations
- Child shows interest in surroundings by focusing on faces and objects in close range
- Child gathers information through the senses (mouthing, grasping, reaching, etc.)
- Child repeats actions that have been successful in reaching a goal
- Uses cause and effect strategies (drops toys over side of highchair, etc.)

Child’s role
- Learns about the environment through movement and sensory exploration (seeing, hearing, touching, tasting, etc.)
- Shows initiative and curiosity (pursues interesting object – first visually, then by reaching, crawling, etc.)
- Manipulates new toy to discover what it will do
- Pats, pushes, squishes, and pounds materials such as fingerpaint and play dough to experience how it feels

Adult’s role
- Provides toys and materials that encourage safe, active exploration based on the child’s abilities (rattles, balls, water play, etc.)
- Describes the child’s actions and the properties of objects as the child explores and manipulates them
- Supports the child’s interest in and exploration of the environment, indoors and out

Environment includes
- Materials accessible throughout the day for observation, exploration and manipulation (rattles, blocks, activity boxes, etc.)
- Opportunities to experience natural objects and events (weather, living creatures, plants)
**Scientific Skills & Methods**

**Older toddlers (18 to 30 Months)**

**Widely held expectations**
- Child begins to develop scientific skills and methods
  - Makes observations, describes objects and actions in the environment
  - Begins to make comparisons between objects that have been observed
  - Demonstrates initiative and curiosity in exploring the environment
- Child uses descriptive words in speech
- Child uses senses, materials, events in nature, and the environment to investigate and expand knowledge

**Child’s role**
- Explores the environment and uses objects in a variety of ways to find out how they work, what they can do, etc.
- Describes objects and actions (big ball, run fast, lights off, etc.)
- Initiates activity and makes choices (toy to play with, clothing to wear, etc.)
- Uses water and sand toys to explore texture, weight, measurements, cause and effect

**Adult’s role**
- Provides materials that invite and encourage safe manipulation and exploration (including blocks, puzzles, art materials, books, puppets)
- Promotes children’s active exploration of the environment, both indoors and outdoors
- Talks with children about their activities (including open-ended questions)
- Encourages children’s curiosity and answers questions

**Environment includes**
- Materials accessible throughout the day for observation, exploration and manipulation, including natural objects and events (plants, fish tank, balance scales, water and sand toys, etc.)
- Opportunities to experience and interact with sand and water, sunshine and rain, plants and animals
Scientific Knowledge
Infants and younger toddlers (Birth to 18 Months)

Widely held expectations
- Child uses all five senses to explore and understand surroundings
- Child begins forming a basic understanding of simple cause and effect relationships
- Child begins to point to and name common objects in the environment

Child’s role
- Explores strategies to create a result (shakes rattle to see if it produces a sound, tries to activate musical toy, etc.)
- Gains knowledge about the environment through observation and physical manipulation (banging hard objects together produces a sound, stack of blocks falls when pushed, water splashes)
- Names some natural items (dog, tree, bird, etc.)

Adult’s role
- Provides natural objects for children to explore, both indoors and out, as well as experiences related to science concepts (wind chimes, animal sounds, various textures and scents, etc.)
- Names natural objects and describes comparisons between objects (big/little, soft/hard, wet/dry)
- Provides books, pictures, and toys that represent nature realistically (including photos of animals rather than cartoon-type animals)
- Talks with children about everyday events as they occur in nature

Environment includes
- A variety of materials from the natural world, both indoors and outdoors (plants and animals.)
- Outdoor spaces that promote observation of natural objects and events
**Scientific Knowledge**  
**Older toddlers (18 - 30 Months)**

**Widely held expectations**
- Child develops scientific knowledge through active exploration of the environment  
  - Shows interest in the natural world  
  - Interacts with materials to gain knowledge about them  
- Child develops understanding of simple cause and effect relationships  
- Child shows interest in scientific concepts related to space and time  
- Child shows increased knowledge and memory for details and routines

**Child’s role**
- Gains knowledge about the environment through physical manipulation (puts shapes in shape sorter, engages in sand and water play, etc.)  
- Recognizes and identifies properties of objects (big/little, hot/cold, in/out)  
- Expands vocabulary related to scientific concepts: names animals, describes weather (rain, snow, sun, etc.)  
- Increased independence in routines, such as washing hands and eating with utensils.

**Adult roles**
- Provides natural objects for children to observe and explore, both indoors and outdoors  
- Provides books, pictures, and toys that represent nature (photos of animals rather than cartoon-type animals, etc.)  
- Talks with children about natural objects and everyday events as they occur in nature  
- Encourages children to make comparisons between objects (big/little, soft/hard, wet/dry, fast/slow)

**Environment includes**
- A variety of materials, both indoors and outdoors, from the natural world (plants, animals, collections of natural objects)  
- Outdoor space that promotes observation of natural objects and events  
- Opportunities for further exploration, such as nature walks or visits to a garden area.
Sharing Science with School-Agers

Fiddling, fooling around with materials, and asking, always, “What if?” and “Why not?” School-age kids naturally love to try things to see what happens, continuing the curiosity-driven explorations of childhood.

As children move from the preschool years into elementary school and beyond, their understanding of scientific concepts matures. Young people are soon ready to tackle more complex topics, including engineering, chemistry, and technology. Project-based learning is especially effective, allowing youth to work on long-range endeavors over several days, weeks, or even months, building upon preexisting knowledge with ever-increasing involvement.

Not all school-agers are excited about science activities, however. Some students are convinced that they aren’t good at science, or that science is only for boys or only for “nerds”. Others associate science with schoolwork – something dry, difficult, and far from fun! In addition, some adults may be reluctant to share science activities with children out of fear that they will not know all of the answers, or that the activities will be too complicated, messy, or expensive.

Teachers planning science activities for the out-of-school hours face several challenges: How do we find a balance of programming that is both enjoyable and educational? And, where can we find enrichment activities that kids will be eager to participate in?

Here are some top ways to plan successful science activities for your school-agers.

1. Plan ahead. Make sure that you have all of the materials, loose parts, and instructions that you need to be successful. Be prepared for spills, and have extras of anything that might be broken or damaged. It’s a rookie mistake to set kids up for an experiment using a raw egg, for example, only to drop and break your one and only egg before the experiment is even underway! Gather and prepare materials in advance so that kids aren’t left waiting. And, if you’re doing an experiment with a desired outcome, test it out ahead of time - before the kids arrive – to make sure that everything works as planned. By conducting a “test run”, you’ll avoid the gooey, gluey mess that comes from having the whole group use the wrong ingredients in that putty recipe you’ve been planning!
2. **Follow their lead.** What excites your group? Talk to kids and watch closely as they work and play to find out more about their interests. One group might be fascinated with fossils on the playground, inspiring you to invite a paleontologist to visit, set up a leaf-casting activity with clay or plaster, and book a field trip to the museum. Another group might be much more interested in animation, sparking projects where they build a zoetrope device, film a short clay-mation movie, and work with computer animation software. The skillful teacher builds upon student interests, encouraging them to find out more.

3. **Be fiddle-friendly.** Keep in mind that not every science experience needs a predetermined outcome, though. Kids often have more fun and learn more from a chance to experiment freely with a wide range of intriguing materials than from watching a science demonstration or following a rigid set of directions. For example, rather than having everyone fold the exact same paper airplane, how about providing the group with a variety of papers, balsa wood pieces, and odds and ends (buttons, milk caps, tape, and so on) with the challenge to create their own flying machines? No two will be the same as kids eagerly construct, test, and modify their own unique designs.

4. **Diverse activities for your diverse group.** Consider offering a wide range of activities to appeal to many different students. A student who is unsure about a messy chemistry activity may welcome the opportunity for a nature walk, while a student who finds gardening boring may light up (pun intended!) when you suggest a project about circuits and electricity. Consider inviting kids to join clubs based on their interests. Possibilities are almost endless, including topics such as cooking, robotics, insect collecting, and kite making. Many teachers find that, when activities optional and students are given a choice to participate or not, group participation and engagement actually increase. When youth participate because they want to – not because they have to – they are more likely to become excited and wholeheartedly involved in learning.

5. **Consider the “wow”-factor.** While every group is different, it is usually a safe bet that kids will respond to activities that are messy, gross, or exciting! Slime, rockets, tie dye, and anything that involves smashing, crashing, or exploding almost always get the “thumbs up” from kids. Projects such as these awaken children’s enthusiasm and get them onboard with the idea that science can be “cool”. Curiosity will be rekindled in even the most jaded of students; they’ll soon be asking “how” and “why”, and eager to find out more.
Check out the links below to find fantastic science activities for school-agers.

**Dragonfly TV**
Suited for kids in kindergarten through sixth grade, the Dragonfly TV website includes short “video investigations” from real kids, along with prompts to help students plan and carry out their own experiments. Favorites include a gravity fountain, edible “glass”, and a homemade seismograph.  
http://pbskids.org/dragonflytv/

**ZOOM**
Another offering from PBS, the ZOOM page provides suggestions for wide range of hands-on activities, including science projects, ideal for kids in grades 3 – 6. Kids will enjoy experimenting with yeast, making milk plastic, building geodesic domes, and more. Includes a special parents and teachers section with tips for adults who may feel unsure about leading science activities.  
http://www.pbskids.org/zoom/

**Steve Spangler Science**
Science icon Steve Spangler offers a wide range of experiment ideas for kids in kindergarten through middle school and beyond. His site sells cool science products like “instant snow”, slime making kits, and solar balloons, but there are also plenty of experiments here that can be conducted with common household materials. Check out the exploding pumpkins, elephant’s toothpaste, and Alka-seltzer lava lamp activities!  
www.stevespangler.com/

**Exploratorium**
Geared toward older students, the Exploratorium website encourages in-depth explorations of topics ranging from astronomy, to geology, to understanding the human body and brain. Also check out the “science snacks” section for quick, easy activities for school-agers in kindergarten and up.  
www.exploratorium.edu/explore/ and www.exploratorium.edu/snacks/index.html

**Science Bob**
A wide range of experiments that will appeal to kids in kindergarten and beyond. Try the eggshell “geodes”, make your own high-bounce balls, or make a cup scream. Great photos of most experiments are included. Groups can also submit their own, favorite ideas for possible inclusion on the site.  
www.sciencebob.com
Resources

When selecting books for science learning, consider both accuracy and appeal. Realistic illustrations and/or clear photos should be paired with an interesting text that suits the ages and abilities of the children. As with all science activities, books connected to real world experiences are often most valuable. Look for books that relate to seasonal changes, local wildlife and weather, and other “current events” in the natural world and children’s lives. A few of our favorite books are listed below.

Board books for infants and toddlers

**Black on White** and **White on Black**, by Tana Hoban
These wordless books feature silhouettes of common objects strikingly rendered in black and white on a solid background. Visually stimulating for even the youngest infants, the books also encourage toddlers to point out and name favorite things.

**Little Feet Love**, by Anthony Nex
Photos, large textured areas, and simple, descriptive text document grass, sand, leaves, and other surfaces loved by little feet. Also look for partner book, “Little Hands Love”.

**Splash!**, by Roberta Grobel Intrater
This book considers ways to play in water, including the tub, rain puddles, and more. Sharp, close up photos of playful babies will intrigue infants and toddlers.

**Touch and Feel: Pets**, by Nicola Deschamps
Part of the DK Touch and Feel Series. These sturdy board books feature realistic photos and touchable textures.

Simple books for toddlers and younger preschoolers

**Have You Seen My Duckling?**, by Nancy Tafuri
Follow a mother duck as she looks for her missing duckling in this beautifully illustrated book. Children will enjoy searching the detailed pages and will encounter many other pond creatures in the process.

**My Big Animal Book**, by Roger Priddy
This oversized board book includes appealing animal photos sorted by “habitat”: in the home, at the farm, and at the zoo. Interactive, rhyming text is perfect for sharing with small groups of young children.
Snail Trail, by Ruth Brown
Get a snail’s eye view of a garden in this charming yet realistic book. Rich with descriptive words and directional concepts, this book packs a lot of learning into a short tale.

We’re Going on a Leaf Hunt, by Steve Metzger
This is the story of three children searching for and collecting fall leaves from different trees. Repetitive text is reminiscent of the popular, “Going on a Bear Hunt” rhyme.

Books for preschoolers

Gilberto and the Wind, by Marie Hall Ets
A little boy explores the different ways the wind plays, such as blowing dirt, flying kites and turning umbrellas inside out.

Night Sounds, by Frank Gallo
Children can hear actual recordings of coyotes, owls, crickets, and more. Tabs are pulled to reveal the source of the sound, making this a wonderful title for read-aloud guessing games. Also look for companion title, Bird Songs.

Pop! A Book About Bubbles, by Kimberly Brubaker Bradley
This book provides factual information about bubbles and displays photographs depicting different aspects of bubbles. It also provides some ideas for experiments and a bubble recipe.

This is the Sunflower, by Lola M. Schaefer and Donald Crews
Vibrant, simple illustrations and repetitive text describe the life cycle of a sunflower.
For Pre-K and early elementary

*Backyard Books* series, by Judy Allen and Tudor Humphries
These clever books include detailed illustrations and fascinating facts about earthworms, ladybugs, ants, snails, and other common creatures.

*Cloud Dance*, by Thomas Locker
This beautifully illustrated book shows various types of clouds with simple lines of descriptive text. Also look for Locker’s other books, including *Sky Tree*, *Water Dance*, and *Where the River Begins*; all skillfully blend art and science in picture books worth sharing year after year.

*If You Find a Rock*, by Peggy Christian
Soft, hand-tinted photos are paired with a simple text that perfectly captures many of the reasons why so many young children seek out and pocket rocks.

*One Bean*, by Anne Rockwell
This book depicts the life cycle of a bean plant and pairs well with classroom seed-sprouting activities. One of many simple science books by author Anne Rockwell. These and slightly more complex titles by authors Gail Gibbons and Ruth Heller make a great addition to the classroom science library.

For upper elementary and beyond

*How to Be an Explorer of the World*, by Keri Smith
This interactive book encourages close observation, documentation, and collection in a manner that will inspire discovery. This title would make an excellent choice for a youth nature or art club.

*Pond*, by Gordon Morrison
This appealing watercolor sketchbook pairs lovely illustrations with diagrams and facts about the pond habitat, making this book especially suitable for mixed age groups. Also look for other titles by Morrison, including *Nature in the Neighborhood* and *Oak Tree*.

*Sneaky Science Tricks*, by Cy Tymony
This book includes dozens of clever and impressive “tricks” using common household objects, along with the scientific explanations to back them up. One of several titles in Tymony’s “Sneaky” series.

*The Everything Kids’ Science Experiment Book*, by Tom Robinson
Experiments for ages 8 and up, ranging from very simple to more complex, exploring biology, chemistry, physics, planet earth, and the human body. Clear instructions and follow up questions add to the book’s value.
Books for teachers

I Love Dirt!, by Jennifer Ward
This book includes hands-on, seasonal nature activities that will appeal to children from the toddler to pre-teen years. Not all are suited for group care settings as written, but most can be adapted.

Infants and Toddlers at Work, by Ann Lewin-Benham
Inspired by Reggio practices, this book focuses on the use of simple, meaningful materials for exploration by infants and toddlers.

More than Magnets: Exploring the Wonders of Science in Preschool and Kindergarten, by Sally Moomaw and Brenda Hieronymus
This well-illustrated book is packed with age-appropriate physics and chemistry activities for young children.

The Young Scientists series, by Ingrid Chalufour
Titles in this comprehensive series include Discovering Nature with Young Children, Building Structures with Young Children, and Exploring Water with Young Children.

Internet Resources for teachers

http://nstacommunities.org/blog/category/earlyyears/
The early childhood (K-2) blog for the National Science Teachers Association. Features frequent posts on topics of interest to K-2 classroom teachers about doing science in an early childhood environment.

http://www.project2061.org/publications/earlychild/online/
A publication from the 1998 Forum on Mathematics, Science, and Technology Education. Features articles on many topics of interest including cognitive development and research on early childhood math and science education.

http://www.extension.org/pages/Science_in_Child_Care
Contains articles and resources for early childhood science activities including a searchable database on hands-on classroom activities for children of all age ranges.