XVII. SCIENCE

Children at Play: The Science Activity Center

Children are natural scientists who actively seek information about their surroundings. They try to understand their world through observation and experimentation. The natural curiosity shown by children leads to learning.

Rachel Carson captured the essence of children's interaction with their world in her book, A Sense of Wonder (1956).

> *A child's world is fresh and new and beautiful, full of wonder and excitement. It is our misfortune that for most of us that clear–eyed vision, that true instinct for what is beautiful and awe–inspiring, is dimmed and even lost before we reach adulthood. If I had influence with the good fairy who is supposed to preside over the christening of all children, I should ask that her gift to each child in the world be a sense of wonder so indestructible that it would last throughout life, as an unfailing antidote against the boredom and disenchantments of later years, the sterile pre-occupation with things that are artificial, the alienation from the sources of our strength.* (pp. 42–43).

Science is both a product and a process. As a product, science is an organized body of knowledge about the physical and natural world. As a process, science entails exploring, observing, and experimenting. It is especially important that young children participate in the process of science, because the skills they develop will carry over to other curricular areas and be useful for the rest of their lives. These skills include observing, comparing, describing, predicting, communicating, classifying, and measuring.

Science should not be treated as an isolated discipline. Consider how a study of trees integrates with other discipline areas. The number of seeds produced in a particular seed pod can be calculated. Seeds from trees can be collected and compared. Leaves and bark can be used in art activities, such as crayon rubbings. In the autumn, leaves can be raked into a big pile; children can jump into the pile and, using their senses, describe how leaves look, sound, feel, and smell. The children can create a "tree diary" that includes some of their observations of the tree through the seasons. Pieces of wood can be used for various construction projects, such as building bird feeders. Tree cross-sections can be used to count and compare tree rings and used to estimate the age of the tree. Children can visit the local park or forest. Fruit from apple or cherry trees can be used in a classroom cooking activity.

Before planning any science activity, the teacher must evaluate it in order to ensure the children's safety. For example, before permitting children to jump into a pile of leaves, the teacher should determine that it contains no broken glass or other dangerous materials that would make the activity unsafe for children.

Setting Up a Science Program

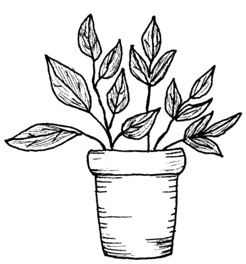
Scientific inquiry fits readily into the rationale of the Step by Step Program and its emphasis on activity centers that are stocked with different materials for children to explore. Activities to foster the development of science skills should be integrated into all curriculum areas. An important way to individualize and extend learning is to set up science stations in the room.

Science Areas

Ideas for the science activity center include:

- A place for displaying science-related items. This area can become a "mini-museum" where children can share collections or objects or place cages for classroom animals. A small table, pedestal, or pretty box may be used to display sea shells, crystals, a bird's feather, or a butterfly's wing. The teacher, children, and parents can supply the objects.

- A place for frequently used science materials; such as magnets, magnifying glasses, color wheels, and prisms. Shelves are labeled with pictures and words so children can remove and return materials to their original place. Children will begin to take responsibility for the proper care of these materials.



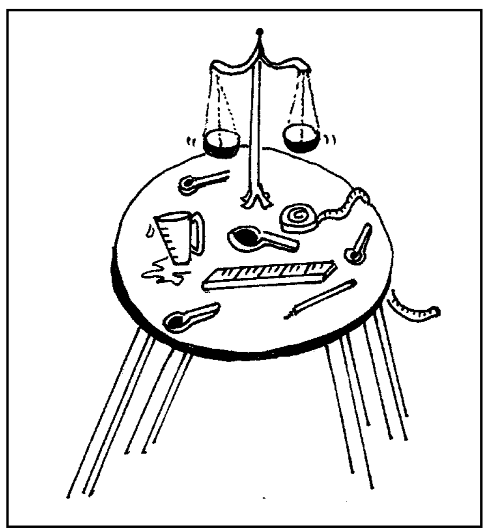
- A sunny windowsill, where children water and care for a variety of plants and seedlings.

Materials and supplies that are frequently used can be kept in clearly labeled boxes. To keep the science activity center dynamic and interesting to children, the materials, displays, and themes should be rotated and changed whenever the children begin to lose interest in them.

Active exploration should form the core of the preschool science curriculum. Science experiences lead to the development of lifelong skills. Examples of skills and how they may be applied include:

- *Observing*. Temperature, wind, clouds, colors, shapes, textures, smells.
- *Questioning*. What will sink? What will float? Where can I find a bird's nest? How fast will the snow melt?
- *Comparing*. Which container will hold the most? Which seeds grow the tallest?
- *Classifying*. Gather a collection of leaves. Then put all the smooth leaves in one bag and the rough leaves in another bag.
- *Communicating*. Tell us a story about a snake. Draw a picture of our garden. Tell us how to keep the blocks from falling off the truck.

Science Materials



Collecting appropriate materials for the science activity center is a continual process that should involve children, parents, teachers, and community members. Letters to parents and local businesses can include lists of materials needed, and monthly newsletters can acknowledge contributions. Recyclable materials, such as Styrofoam trays, plastic cups, empty soda bottles of all sizes, assorted bottle caps, cardboard pieces, wood scraps, and fabric squares are all useful materials for creative technology challenges.

A master list of needed science supplies can be posted in the classroom. When something is donated, cross it off the list. Parents can keep up with classroom needs by looking at the list on a regular basis.

The following is a partial list of useful materials for a preschool science activity center:

Aquarium	Glue	Rubber bands
Baking soda	Hammers	Rubber tubing
Balance	Hand lenses	Sand paper
Barometer	Hourglass	Scales
Batteries	Kites	Screw drivers
Beans and seeds	Liquid soap	Screws
Bolts and nuts	Locks and keys	Shoe boxes
Bones	Magnets	Small cages
Buckets	Measuring cups	Sponges
Candles	Nails	Spoons
Clocks	Old magazines	Stethoscope
Coffee cans	Plastic bags	String
Compass	Plastic cups	Sugar
Dry soap	Pliers	Sundial
Egg cartons	Popsicle sticks	Thermometer
Food coloring	Potting soil	Toy boats
Funnels	Prism	Watering can
Fur	Pulleys	Wood
Gardening tools	Rocks	Yarn

Integrating Science Skills with Activity Centers

The Step by Step Program organizes classroom equipment and materials into activity centers that encourage children's play and work. Science skills can be integrated into each activity center. For example:

The **Literacy Activity Center** provides opportunities to use children's observations of a classroom pet to compose a story, create picture books about clouds and weather, or compose a song about the feeling of sunshine on a cold day. Books on animals, plants, machines, weather, and other science topics should be on display.

The **Block Activity Center** provides opportunities to compare how many small blocks are needed to balance four large blocks, to place a group of blocks in order from smallest to largest, or to design a building as tall as the children. Planks and boards can be used as ramps for small balls or vehicles to roll down. The block center could become an insect colony such as an ant city or a beehive.

The **Dramatic Play Activity Center** provides opportunities to experiment with different situations, observe how adults behave and to imitate them in play, and test ideas and consider change. Games can be encouraged such as, "What Would Happen If. . .?" This game allows children to act out different scenes such as, "What would happen if the mouse got loose?" "What would happen if the lights went out?" "What would happen if the snow was so deep that it came over the top of our boots?" or, "What would happen if you became an ant? . . . a bee? . . . a caterpillar?"

The **Outdoor Environment Activity Center** provides a wealth of opportunities to integrate science skills. Drawing tree shadows, comparing the color of leaves, turning over a rotting log, looking for footprints in the mud, listening to birds, observing ants and other insects, and growing a garden are a few examples.

The Teaching Team's Role

In <u>A Sense of Wonder</u> (1956) Rachel Carson wrote about the role of the preschool science teacher:

> *I sincerely believe that for the child, and or the parent seeking to guide him, it is not half so important to know as to feel. If the facts are the seeds that later produce knowledge and wisdom, then the emotions and the impressions of the senses are the fertile soil in which the seeds must grow. The years of early childhood are the time to prepare the soil. Once the emotions have been aroused — a sense of the beautiful, the excitement of the new and the unknown, a feeling of sympathy, pity, admiration or love — then we wish for knowledge about the object of our emotional response. Once found, it has lasting meaning. It is more important to pave the way for the child to want to know than to put him on a diet of facts he is not ready to assimilate* (p. 45).

An effective science teacher knows that young children quickly perceive the teacher's attitude about science. If the teacher is excited about exploration, asks questions, and demonstrates the "let's find out" attitude basic to science learning, children absorb and model that enthusiasm.

In the beginning, the science teacher's role is to help the children observe common objects and events. Once the children have fully investigated these objects and events, additional materials are presented. The role of the teacher is to provide interesting materials work and play — to encourage children to question as they manipulate the materials and to begin to find ways to find answers to their questions. As children feel the textures of different soils in an activity center, they may begin to question why they are so varied. The responsive teacher would then provide magnifiers, assorted rocks, containers of water, and other materials that children might use to experiment. Providing materials and time to experiment and some guided activities will encourage children to discover answers to their questions.

When confronted with new materials, children pass through three predictable stages. The first is a period of experimentation. The duration of the experiment period will vary, depending on age, ability, and previous experience. The child will explore the materials using all senses — sight, touch, smell, and, with the teacher's or adult's consent, even taste.

The second stage is the introduction of necessary vocabulary related to the new materials. The vocabulary is best introduced while the new materials are actually being used. The teacher might ask open-ended, probing questions such as: "What can you tell me about this?" or, "How are you going to do that?" or, "What are some different things you could try?" During these exchanges, it is important for teachers to value children's views of the world and listen carefully to their inventive meanings for words and ideas. The teacher provides new language, helps the child by writing about the material, encourages the child to draw pictures, and reads stories about the materials.

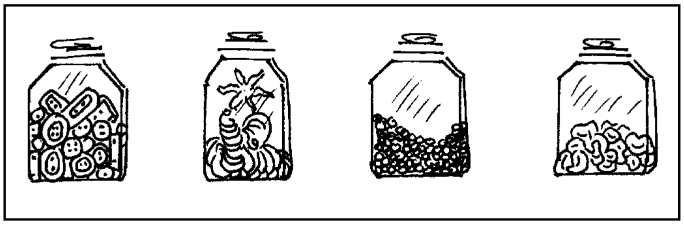
The third stage involves identifying a problem — often a question that the child has posed during the discussion. After the problem has been identified, the teacher encourages the child to search for solutions or answers.

Using soil exploration as an example, the new materials might include buckets of different types of soil (rich organic garden soil, hard–packed clay, and sandy soil), spoons and trowels, plastic containers, a source of light, wooden shelving, radish seeds, and a watering can. The vocabulary encompasses soil characteristics, including color, texture, smell, and plant nutrients. The teacher might ask, "What will happen if the three soils get wet?" or, "What is the best way to plant radish seeds?" He might encourage the exploration of a question raised by a child that leads to experimentation with the materials. The teacher supports this process by providing and organizing the materials, observing the children at work with the materials, and asking questions to encourage the children to explore the materials as deeply as they are able. Teachers can use their observations to modify and extend the children's thoughts and help them grow toward a better understanding of the phenomenon.

Science Activities and Projects

The Classroom Museum

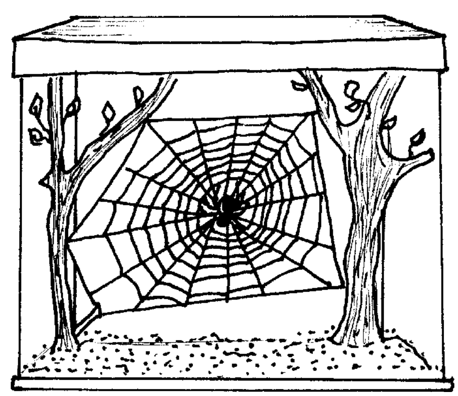
A classroom museum gives children the opportunity to see and handle interesting materials. Collect rocks, feathers, leaves, teeth, seeds, shells, bark, fur, fabric,



insects, and other objects. Use boxes of various sizes, egg cartons, and plastic containers to arrange and store the collection. Opportunities for interactions with the objects — observing, comparing, classifying, predicting, and communicating — are essential. This can be encouraged through guided discovery, for example, the teacher suggests: "Let's find out which rocks will mark on tile or cement."

Introducing live animals into the preschool classroom offers many excellent opportunities to develop science skills. Most children are fascinated by living things. Establishing a small aquarium with a secure top to hold beetles, crickets, or caterpillars and butterflies can enrich the preschool science curriculum. A collection of live animals in the classroom offers children the experience of caring for the animals, determining their food, water, and shelter needs, and comparing the classroom habitat to the animal's natural habitat. The teacher can keep a classroom journal of children's observations of the behavior of classroom animals. The teacher must stress the need to care for and respect animals. Insects and animals from nature should be returned to their natural habitats after a short period of classroom observation.

The class may create a seed museum that features a favorite seed or seed pod chosen by each child. Children can classify seeds by size, color, texture, or shape. They can put seeds with a rough texture on a piece of sand paper and place smooth seeds on a piece of typing paper. Different colors of construction paper could be used to classify seeds according to color. Children can use pictures of flowers to try to match seeds with the plants they come from.



Outdoor Science

The experiences of young children's day-to-day lives provides the content for the early childhood science curriculum. Children take an active interest in exploring objects and phenomena that they encounter in their surroundings. Children need time to tell others what they see, what they think, and what it makes them wonder about. As teachers provide materials for guided discovery they should set aside time for students to talk about what they are observing and for comparing observations. Teachers are encouraged to have children work in small groups, in teams, and individually. Opportunities to interact with living things in ways that promote respect should be provided.

The school grounds or a local park provide year–round opportunities for children to develop science skills. Special planning is required to canvass the community to determine what sites are available, how the children will work in the outdoor classroom, and whether parents are available to help. Sending a note to parents informs them of the objectives and gives them an opportunity to be involved.

Themes are used to focus the activities in the outdoor classroom. For example, the neighborhood plant study could include walking around the school or community and observing different types of plants—where they grow, how they are shaped, how they are similar, and how they are different. The teacher can make a list of children's questions about plants, reframing their comments as questions to extend their ideas. The teacher can also model how to begin to find answers. For example, asking: "Is the plant growth on the north side of the building different from that on the south side?"

Exploring local trees might be a theme. Children can gather leaves from each different tree and, with the help of the teacher or parent, create a book of mounted leaves on clear plastic wrap or waxed paper. Children can do bark rubbings with paper and crayons to compare texture from tree to tree. Winter buds can be examined and seasonal changes in a particular tree observed. Stories can be collected about animal activities observed on or near a tree.

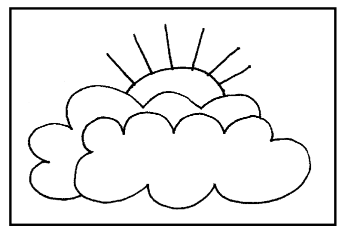
Weather observations and comparisons can be a regular feature of the outdoor classroom. What can the children see that is affected by the wind? Where do the leaves go in the wind? Where does the water go when it rains? Who has left tracks next to the mud puddle? Which materials in the playground feel hot after they have been in the sun? Which feel cool?

Children can observe ants. Where are they going? What kind of food do they like? Will they be attracted to a piece of apple or a piece of bread? Can children follow the ants' path on a sidewalk with a piece of colored chalk? Can children move and communicate like the ants?

Water

Most young children like to explore water. They bathe in water, drink water, and like to play with it. After a rain shower, young children, and even older children and adults, take pleasure in stepping into every puddle they can find. Exploration with water includes the concepts of sinking, floating, and absorbing. Children begin to understand that water is a necessary element for living things.

Some of the concepts about water that are useful for teachers of young children in planning a water activity center include:



Water evaporates. Guide the children's observations of water in a container on the radiator, not on the radiator, in direct sunlight, and in complete shade. Paint a sidewalk or chalkboard with water and observe the drying process. Which surface will dry faster? What happens if you add salt to the water or use hot water?

Water is needed to maintain most plant life. Observe the differences between two plants, one watered and one not watered. Start some seeds in two similar containers with similar soils. Provide water for only one of the containers.

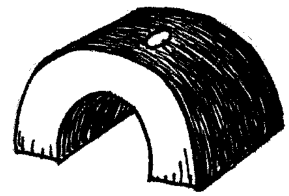
Water can mix with some liquids and not mix with others. Mix water with milk, juice, salad oil, honey, or other liquids. Clear plastic containers with lids provide good mixing and observing vessels. Which other liquids would the children want to mix with water?

Water soaks into some materials. Put water on different types of fabric, different types of paper, and other materials to observe the rate of absorption.

Rain and water from melted snow flow in streams and rivers. Walk around the school or neighborhood to observe where the rain water goes. Observe a local stream and write a story about what you see. Is there evidence of birds or fish? Is the stream polluted?

Water can be used to investigate and manipulate physical properties. Provide children with opportunities to explore the physical properties of water by gradually introducing containers, funnels, spoons, tubing, sieves, sponges, and floating materials. A sink, plastic dishpan, children's pool, or metal tub can be used. Additional materials include food coloring, soap, and materials to do sinking and floating experiments.

Magnets



The concept of magnetism — that magnets create a magnetic field or force of attraction or repulsion — can provide young children with an opportunity to develop numerous science skills. Experimenting with magnets, iron filings, and other metal objects helps to develop observation, comparison, predicting, and communication skills.

One good way to manage the iron filings is to create magnet boxes. Magnet boxes are small boxes made of cardboard or clear plastic. (The latter is more effective for seeing results.) Place iron filings in the box and cover it with heavy plastic wrap. Seal the box completely with clear tape. The sturdy, escape–proof box can be used by children to move a magnet along the outside of the box and observe the reaction of the iron filings to the magnetic pull. Magnet boxes allow children to work independently with magnets and iron filings. A team of parents can help assemble enough magnet boxes for a small group or the whole class.

A related idea is to have the children draw a city, including the network of streets, on a paper plate. Small model cars, made of metal or with metal glued to the bottom, can be directed along the road network by moving a magnet along the back of the paper plate.

Magnetic attractions can also be part of an art activity. Use small boxes to confine this activity. Cut paper to fit inside the bottom of the box. Drip several drops of paint on the paper. Put a small metal object, such as a paper clip, on the paint drops. By sliding the magnet underneath the bottom of the box a design is created. For variety, change objects or add another color of paint.

By testing classroom objects and objects brought from home, children can create a classroom list of the characteristics of magnetic objects — which are attracted, or not attracted. Predicting whether an object is magnetic or not can lead to discussion and experimentation.