Science and Technology

A hundred or more years ago, science primarily involved the study and classification of nature. As chemistry and physics took their place alongside biology, science became increasingly concerned with how things change when acted upon in different ways. Early science is therefore more than memorizing information about the biological and physical world. Curriculum developers and researchers Rochel Gelman and Kimberly Brenneman point out that “to do science is to predict, test, measure, count, record, date one’s work, collaborate and communicate” (2004, p. 156). In other words, science is as much about the investigative process as it is about knowing facts and formulas. And science also uses math, literacy, and social skills.

Early science learning has many parallels to early mathematics. Both involve manipulating materials and ideas, observing the properties of objects and events, sorting things according to properties, making predictions about what will happen, and drawing conclusions based on what actually happens. In science, however, children are not only concerned with the quantitative aspects of their world, they also explore its qualitative aspects. As their scientific minds develop, young children are engaged in the following activities:

- **Observing** is paying attention to something to learn about its properties. Preschoolers gather data and make discoveries about the physical world using all their senses. For example, they look at, smell, touch, and taste vegetables in the garden as they simultaneously listen to the humming bees or chirping birds in that environment. Because so much of the world is new to them, young children observe and collect data virtually all the time.

- **Classifying** is sorting or grouping things together, separating and comparing what is the same from what is different based on one or more attributes. This process includes organizing information, fitting new information into existing categories, or changing categories to fit the new information (for example, recognizing that red beads and blue beads can be further subdivided into small and large beads, that is, beads can be sorted by the attributes of both color and size).

- **Experimenting** is testing an idea to see if it is true (accurate or valid) or trying a solution to see how and if it works. For young children, purposeful exploration is the hallmark of experimentation. They investigate materials and actions to discover their properties and to determine how things change when they are acted upon by people or events. For example, they experiment to see how fast toy cars go when the angle of a ramp changes from shallow to steep.

- **Predicting** is making an “educated guess” (rather than a wild one), based on one’s knowledge, however limited that knowledge may be by adult standards. Predicting depends upon being able to hold a picture (mental representation) in mind, an ability that develops gradually in the preschool years. Young children do not always verbalize their predictions, but you can infer them by watching the next step in their experiments or the look of satisfaction (or surprise) when their predictions do (or do not) come true.

- **Drawing conclusions** is describing, reflecting upon, and explaining what one has observed — accurately or not — and then fitting it into one’s system of knowledge and understanding. Children construct knowledge in their own way. They form theories and make generalizations based on their experiences. The more varied and in-depth these experiences are, the more data they have upon which to base conclusions.

- **Communicating ideas** is sharing one’s questions, observations, predictions, and conclu-
Small-Group Times to Scaffold Early Learning

Science and Technology

for school. Computers can also play a vital role in learning about other content areas, but only if they are used correctly (Hyson, 2003). Rather than emphasizing rote drill-and-practice, software should be age-appropriate, open-ended, and designed to promote discovery. Technology can also increase children’s ability to manipulate things; sometimes they can move objects on the screen more easily than they can move actual objects. However, computers should never replace real objects, which provide other sensory feedback and foster motor skills. If your program has computers for children, small-group time is a good way to introduce new software, and appropriate programs can supplement hands-on learning. Also, “contrary to initial fears, computers do not isolate children. Rather they serve as potential catalysts for social interaction” (Clements, 1999, p. 122). When using computers, children solve problems together, talk about what they are doing, help and teach friends, and create rules for cooperation. They often prefer working on the computer with a friend to doing it alone.

In the following small-group activities, young children have the opportunity to act like scientists as they interact with materials and apply their thinking and reasoning abilities to explain what they observe. For more ideas on including science materials throughout the room and creating scientific learning opportunities for young children throughout the day, see *Real Science in Preschool: Here, There, Everywhere* (Neill, 2008).

**References**


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**Children naturally enjoy observing and thinking about nature.**

**Early exposure to scientific processes and ideas helps to develop positive attitudes toward science.**

**Early scientific experiences establish a foundation for later formal education in the sciences.**

**Children can understand simple scientific concepts and begin to reason scientifically.**

**Using scientifically informed language (e.g., if-then statements) at a young age helps children develop an eventual understanding of more complex scientific concepts (e.g., causality).**

**Young children are beginning to reason scientifically, and science experiences help to develop scientific thinking about the world.**

Discussions about early science education often raise questions about the use of computers. Educators agree that preschoolers need to be familiar with basic technology to get ready...
26 Bubble, Bubble
Children blow bubbles, comparing their attributes and exploring differences in bubbles blown with straws and tin cans.

**Time of day:** Small-Group Time **Content Area:** Science and Technology

<table>
<thead>
<tr>
<th>Materials</th>
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<tbody>
<tr>
<td><strong>Materials for each child and teacher:</strong></td>
</tr>
<tr>
<td>• Tinfoil pie pans containing about an inch of dishwashing liquid and water (check proportions so the solution is neither too watery nor too thick to make bubbles)</td>
</tr>
<tr>
<td>• Drinking straws</td>
</tr>
<tr>
<td><strong>Shared materials:</strong></td>
</tr>
<tr>
<td>• None</td>
</tr>
<tr>
<td><strong>Backup materials:</strong></td>
</tr>
<tr>
<td>• Tin cans with both ends open (taped if they’re sharp)</td>
</tr>
</tbody>
</table>

**Beginning**
- Say something like: Last week we had bottles of bubbles and bubble wands during outside time. Several of you said that you would like to try the bubbles again, to see if you could make bigger ones or ones with funny shapes.
- Say: I have some other materials you can use to blow bubbles. Demonstrate putting a straw into the bubble-making solution in a pie pan, and blow on the straw. Ask children to move “like bubbles” to the next part of the daily routine.

**Middle**
- Circulate among the children as they experiment with the materials, observing and commenting on what they do. Talk about how they blow their bubbles (e.g., with short/fast or long/slow breaths), what the bubbles look like (e.g., size, shape, colors, shine, how they attach to one another), how the bubbles feel (e.g., soft, wet, squishy), and so on.
- Encourage children to describe and think about what they are doing and seeing, asking questions and making comments such as Why do you think the bubbles stick together? Did you blow differently to make the big bubbles and the small bubbles? I wonder what makes the colors?
- Keep children focused on the bubbles if they get distracted. For example, if you notice Ella is beginning to get other children wet by splashing in her pie pan, you might suggest she ask Natalia to show her how she blows her bubbles.
- Midway through the activity, introduce the tin cans. Talk to the children about the differences in the bubbles they make with the tin cans compared to those they make with the straws.

**End**
- Put a large tub or bucket in the middle of the table, and ask children to dump their bubble liquid in the tub. As children are washing their hands, let them know where they will find the materials tomorrow (either in the water table inside or outside, in tubs outside, and so on).
- Ask the children to move “like bubbles” to the next part of the daily routine.

**Ideas for follow-up**
- Bring the pans of bubble liquid outside, along with a variety of bubble blowers (i.e., blowers that make regular and irregular shapes).
- Encourage children to experiment with the bubbles, for example, to see what happens if they lightly touch the bubble with a wet finger, then touch it with a dry finger.
- Talk about other items that have or produce bubbles, such as shampoo, bubble bath, dishwashing liquid, laundry detergent, the car wash, and so on.
- For children who have trouble blowing, provide other tools for making bubbles (e.g., egg beaters, bubble wands of different sizes and shapes, pieces of mesh with large holes).

**Adaptations for children with special needs**
- Encourage children with visual limitations to use their other senses to experience the bubbles (e.g., feel and smell them, listen to hear if they pop).

**Developmental range: Supporting children at different levels**

**Earlier**
- Children may:
  - Stir the dishwashing solution with the straw.
  - Get excited about the bubbles they are making (e.g., Buzz-buzz! I’m doing bubbles!)
  - Suck the liquid up into the straw instead of blowing it out the straw.
  - Blow many bubbles, pausing to pat and feel the growing mound of bubbles in their pan.
  - Pop bubbles at random.

- Adults can:
  - Acknowledge what children are doing (e.g., You’re stirring the straw and making waves. You blew hard and made your own bubbles).
  - Ask children to blow (on the top of the adult’s finger) like they might if they were blowing out candles on a birthday cake. Share that they have to blow inside the straw the same way.
  - Ask children to describe what they are doing and imitate their actions (e.g., Tell me how to blow bubbles the same way you did. How did you pop your bubbles?).

**Middle**
- Children may:
  - Exclaim about the growing size of their bubble mound (e.g., Mine’s getting hugest!).
  - Count how many bubbles are spilling over the pie pan onto the table (e.g., I made 1…2…3…4…5, bubbles on the table!).
  - Poke through their bubble mound until they pop all the bubbles.

- Adults can:
  - Use descriptive words to comment on what children are doing (e.g., You blew some large bubbles on this sideway, but tiny little ones on the top).
  - Ask children to suggest a way to blow bubbles that are large (or small, thick, or thin, etc.) and try out the child’s ideas.
  - Use descriptive words to encourage children to describe what they notice (e.g., Mine feels soft like the top of my kitten’s head).

**Later**
- Children may:
  - Begin to notice cause and effect (e.g., if you blow really hard, you get millions of tiny bubbles).
  - Notice differences in their bubbles (e.g., The one I made with the straw are strongest, not the ones with the can — they pop easy).
  - Notice the colors in the bubbles (e.g., This one looks like a rainbow).

- Adults can:
  - Ask children to predict what will happen if they blow really hard, really slow.
  - Ask children to talk about differences in the bubbles made with the can and the straw. Accept their explanation(s) about why those differences exist. Comment and encourage them to elaborate on their ideas (e.g., So are you saying these are bigger because the hole is bigger? You think the colors are from the metal in the can?).
  - Add new vocabulary (e.g., transparent, translucent, iridescent) when commenting on bubbles.