

Science Process Skills in Early Childhood

Science process skills (also called Science Practices) are the skills that scientists use in the process of doing science. These are actually the same skills that we all use in our daily lives as we try to figure out everyday questions and interact with the world in a scientific way. Science skills are usually integrated together and used alongside one another.

Observing

Science begins with observation. It is the first and most fundamental of the process skills. Observing includes seeing, but also hearing, smelling, tasting, feeling (textures, temperatures etc.) and other sensory observations. By observing with their senses, children gather data about objects and phenomena. It is important to note that the ability to make good observations is essential to the development of the other process skills. Observations are often recorded through notes or drawings.

Asking Questions

Curiosity is at the heart of scientific investigations. Children are naturally curious and have a built in drive to ask questions to make sense of their world. With support from adults, children can begin to develop the skill of asking focused questions that allow them to proceed further with science investigations.

Comparing and Contrasting

Making observations naturally leads to making comparisons. Comparing and contrasting require children to sharpen their observations and to focus on details to identify similarities and differences. The process skills of comparing and contrasting are the basis for making groups and classifications.

Classifying

Classifying is the process whereby children group and sort objects, people or events. To classify, children make comparisons between objects, noting their similarities and differences. Young children can sort a set of objects such as rocks, leaves, seeds into subsets. They can sort by properties such as color, size, shape, texture, float/sink, magnetic/non-magnetic. Children should be given opportunities to group the same set of objects in different ways and to come up with their own criteria for sorting.

Predicting

Children make predictions when they formulate an idea about what they think will happen at a future time. Simple experiments involve predicting as children consider, “What would happen if...?” Predictions are based on observations and prior experiences. Predictions help develop awareness of cause and effect – “If we do..., then what will happen?”

Experimenting

Young children can conduct simple experiments to test out their ideas (hypotheses). In early childhood, experiments are often spontaneous, but as children get older, teachers can help them be more thoughtful about planning their investigations. Doing experiments introduces children to the process of making a hypothesis and of identifying and controlling variables. However, it is not reasonable to expect that children will be systematic in their experiments at a young age.

Using simple tools to observe and gather information

Young children can use real tools such as magnifiers, thermometers, eyedroppers or pipettes, tweezers, measuring spoons and cups, binoculars, rulers, and balance scales to expand their observations, to conduct investigations and to gather data. Make these tools part of everyday experience, not just during designated science times.

Measuring

Measuring is the quantification of a child's observations through standard or nonstandard units. Young children can measure length, volume, weight, temperature and time. Standard units of measurement include inches, feet, pounds, seconds, minutes or days. Nonstandard units don't require that children understand how to use measuring devices such as rulers, scales, timers, or calendars. Nonstandard measuring can be done using jumps, shoes, blocks, crayons, etc. In all cases, the items used to measure need to all be identical (e.g. brand new crayons) so that the unit of measurement is consistent.

Drawing Conclusions

Drawing conclusions is about processing and interpreting observations and results from experiments. Since young children's preliminary conclusions are based on their own often-limited personal observations and prior knowledge, their theories are often incorrect. It is generally better not to correct their misconceptions by giving them an "adult explanation" unless you feel they are really ready. A concept may take years to develop and there is no hurry. Instead, continue to encourage children to share their explanations. Provide additional learning experiences to scaffold the child's growing understanding and development of the concept.

Communicating

Communication requires a child to gather information, process it, and then present it so that others can understand his or her meaning. Children can communicate their observations, ideas, and conclusions by talking or writing, visually in drawings and other art media, or through dramatic representations.

Using and Creating Models

Scientists use models in many ways to help them communicate their ideas, and to understand processes. A model makes something simpler or easier to see that cannot be observed firsthand. For example, a globe is a model of the earth. Every model is like the real thing in some ways and different from the real thing in some ways. Models can help children study something that cannot be observed directly. Children can also build their own models of things such as a tree, a rocket, a bee, or a flower.

Note: There is no definitive list of science process skills for early childhood. Depending on the source, process skills are listed and described differently according to how they are interpreted. Some sources combine skills into broader categories with subsets, whereas others list them in more narrowly defined terms. This list was compiled using the following resources:

- Lind, K.L. (1999). *Exploring science in early childhood education: A developmental approach* (3rd ed.) Africa: Delmar Thomson Learning
- Martin, David et al. (2005). Process-Oriented Inquiry – A Constructivist Approach to Early Childhood Science Education: Teaching Teachers to Do Science. *Journal of Elementary Science Education*, Vol.17, No. 2 (Fall 2005) pp. 13-26.
- Worth, Karen. (2010). *Science in Early Childhood Classrooms: Content and Process*. <http://ecrp.uiuc.edu/beyond/seed/worth.html>