Experiencing Inquiry

By Cindy Hoisington and Peggy Ashbrook

When it comes to "teaching" science, many early-childhood educators express uncertainty about their role. Sometimes they view teaching science *concepts* (e.g., characteristics and needs of living things) separately from children's self-motivated *inquiry*. As science teacher educators, we often hear questions such as "How can I teach children concepts without taking the fun out of science?"

Childhood experiences may be one reason for this uncertainty. Educators may have negative memories of "school science," with teachers explaining facts and concepts or being expected to learn them from books. Fewer remember their teachers engaging them in inquiry. In some cases, this led to them "not liking science very much" or "never feeling like I was good at science." These teachers need and want guidance in supporting children's conceptual learning and inquiry simultaneously, the approach advocated in *A Framework for K–12 Science Education* (NRC 2011) and applied in the *Next Generation Science Standards* (NGSS Lead States 2013). In some cases, this means learning to teach science differently than how they remember it being taught to them.

The NSTA Position Statement on Early Childhood Science Education (NSTA 2014) states that teachers must have opportunities and time to *experience* inquiry before being expected to apply it in the classroom. Teachers benefit from professional development that immerses them in the science and engineering practices; promotes their own learning of science concepts through inquiry; and builds on their own science experiences, observations, and ideas. Teachers also benefit from having a concrete framework that makes the inquiry process visible. One such framework is the Engage-Explore-Reflect cycle (EER) (adapted from Chalufour et al. 2004).

FIGURE 1.

The EER cycle.

The EER cycle diagram (Figure 1) shows how the inquiry process might unfold during a single exploration. It incorporates foundational inquiry skills into three distinct phases. The arrows in the EER diagram emphasize the cyclical nature of authentic inquiry. Claims and conclusions generate new questions for investigation that provide further opportunities for deepening conceptual understanding.

Teachers can use the EER cycle as a guide for experiencing inquiry at an adult level and as a structure for planning and facilitating their students' inquiry-based learning. The EER is especially useful for helping teachers generate productive questions and comments that promote children's inquiry while maintaining a focus on the relevant concepts. ■

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Using the EER Cycle

Objective

To experience physical science inquiry with colleagues while investigating properties of matter using the EER cycle, and to use inquiry to promote conceptual learning.

Materials

- classroom blocks and other objects to build with that include different materials (e.g., wood, cardboard, plastic, foam), sizes, weights, and shapes

As adults, we have built with blocks (or watched children do so), worked with water, and watched seasons turn for many years. But how often have we investigated these topics ourselves in a scientific way? Carrying out a science investigation with colleagues will give you new insight into science and how inquiry promotes conceptual learning. It will also help you promote children's inquiry in ways that support their understanding of concepts while maintaining a focus on their experiences, observations, and ideas.

1. Engage—notice, wonder: Observe the objects with your colleagues and talk about their characteristics, including properties of the materials: Are they rigid or smooth, and what's their weight, size, and shape? How have you observed children using these materials? What do you think you might be able to build with them? How do you think their properties might influence what you are able to build?
2. Engage—question, predict: Identify a question or challenge to investigate in pairs such as building the tallest tower. Make some predictions about which blocks and building materials will work best to build up.
3. Explore—investigate, observe, record: Build towers in pairs using a selection of materials. As you and your partner build, ask yourselves:

- Which blocks are you choosing, and why?
- How are you placing them?
- Where in the tower are you placing the heavy and light or smooth and rough blocks?
- Are any patterns beginning to emerge?

Investigate different ways of placing the blocks. Draw your tower, and notice how that helps you look more closely at the individual blocks and their placement. Do a "walk-a-bout" so building teams can compare one another's towers.

4. Reflect—discuss, make claims, draw conclusions: Come back into a large group and discuss your observations. Share your ideas about how the properties of the blocks or building materials influenced how you were able to build. Try making a claim such as *wood blocks work better at the bottom of the tower than the top*. Take it a step further and share a conclusion such as *….because they are heavy and can hold the other blocks up*. Try raising new questions for investigation—for example, *how strong is the tallest tower? How might you build a tall tower that is also strong and stable?*

Wrap up this part of the PLC exploration by using the EER cycle diagram to analyze your own inquiry. Give specific examples of how collaboration promoted your inquiry or your use of the practices. Read more about developing science inquiry and engineering design in block-building. Consider additional productive prompts to use to promote inquiry and think about the properties of the materials as you implement a tower-building investigation with children (see NSTA Connection).

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A Hartford, Connecticut, Kindergarten teacher and her coach participate in EDC's LASErS project.

NSTA Connection

Download the tower-building investigation at *www.nsta.org/SC1709.*