Purpose and Materials Needed

“The whole of science is nothing more than the refinement of everyday thinking” - Albert Einstein

Our science ideas come from our everyday experiences starting when we are very young. Part of teaching and learning science both in and out of school is being aware of how people develop science understanding. In NextGen PET you will have specific opportunities for you to think about how people learn science and to practice skills related to teaching. The lessons in which you will learn about teaching and learning are in the Teaching and Learning Module.

In this activity, we will introduce the Next Generation Science Standards (NGSS) and consider how to elicit children’s ideas.

What does successful science instruction look like?

Predictions, Observations and Making Sense

Part 1: Your ideas about how children should learn science.

Think back on your own science learning experiences, both in this class and your experiences in elementary school, high school and college through now. Consider what you think makes good science teaching. You may consider an activity or lesson that you think was successful at helping you learn something. Write some of your ideas down.

Share your experiences with your group members.
In science classes, children learn many things. They learn about science ideas and they learn how science is done. They also learn ways of thinking and may develop attitudes toward science. That is, they may decide that they like or do not like science. What types of things do you think are most important for children to learn in their science classes?

Answer the clicker question about what you think is most important for children to learn in their science classes.

CQ 1-1: Of the following possibilities, choose the one you feel is most important that children learn in science classes?

A. Skills for conducting scientific research like conducting careful observations.
B. Scientific facts and vocabulary.
C. Science knowledge that will help students understand current events such as information about nuclear power plants and genetic modifications.
D. An understanding of how new science knowledge is developed.
E. That science is fun.

Part 2: The Next Generation Science Standards (NGSS)

You should have read The Next Generation Science Standards (NGSS) and NextGen PET as homework. It is also included at the end of this activity for your reference. Recall that the NGSS are a set of standards that describe what children in grades K-12 should be able to do at specific grade levels. The NGSS has been adopted by many states.

The NGSS were informed by research on how children learn science and on the knowledge and skills they need to be successful after leaving school.

The standards draw on three types of knowledge (called dimensions):

1) Disciplinary core ideas
2) Science and engineering practices
3) Crosscutting concepts
Activity 1: Teaching and Learning Science

The type of instruction and goals of science learning described in the NGSS may look very different than science instruction you had as a student in elementary school.

!? In what ways do you think that your learning in science has been similar to the type of instruction described in the NGSS?

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Share your ideas with your group members.

In Unit M (Developing a Model of Magnetism) of NextGen PET you have been working with all three dimensions. Below we show an example of the types of ideas from each dimension included in Unit M.

<table>
<thead>
<tr>
<th>Disciplinary Core Idea (DCI)</th>
<th>Magnetic forces can be attractive or repulsive, and their strengths depend on the strengths of magnets involved and on the distances between the magnets.</th>
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<tbody>
<tr>
<td>Science and Engineering Practices</td>
<td>Developing and using models.</td>
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<tr>
<td>Crosscutting Concepts</td>
<td>Systems and system models. Defining the system under study — specifying its boundaries and making explicit a model of that system — provides tools for understanding and testing ideas that are applicable throughout science and engineering.</td>
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<td></td>
<td>Cause and Effect: Mechanism and explanation. For example, in Unit M your model showed that when a magnet is brought near (or slid over) a nail, there are attractions and repulsions between poles (cause) that result in the little magnets in the nail to become aligned (effect), making the nail magnetized.</td>
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Read the following activity summaries from the three teachers below.

<table>
<thead>
<tr>
<th>Teacher</th>
<th>Activity Summary</th>
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<tbody>
<tr>
<td>Ms. Rouge</td>
<td>My third grade students observed a diagram of how magnets work, showing that like poles attract and opposite poles repel. I asked them what they noticed about the diagram and to read aloud the definitions for the words “attract” and “repel.” The students used this diagram to write a predication for what would happen if the north side of a magnet touched the north side of another magnet. They tested their hypothesis to see if their prediction was correct and wrote conclusions in their journals.</td>
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<tr>
<td>Ms. Celeste</td>
<td>I asked my third grade students to tell me what they thought would happen if two magnets came near each other. One student said that they would always come together. Another said that she had seen them push apart. I had the students try bringing two magnets together several times to explore what happens. Then, I asked the students what happened when they brought different ends of the magnets near each other. I asked them to do what scientists do and make a table of their findings. Then, they wrote in their journal about when magnets attracted and when they repelled and we came up with a rule for how two magnets interact as a class.</td>
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<tr>
<td>Ms. Naranja</td>
<td>First, I asked my third grade students to talk to their neighbor about where they had seen magnets before. Then, I had my students play with magnets. They had a great time sticking them together and pushing them apart. The students even took their magnets out to the sand box in the yard and collected magnetic dirt. They love playing with magnets now. Then, they wrote in their journal about their experience.</td>
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</table>

All three of the teachers describe instruction about magnetism. However, they describe different experiences and scientific practices that the students engage in and practice.

Review the practices listed in the attached document *The Next Generation Science Standards (NGSS) and NextGen PET*. Which practices, if any, do the
Activity 1: Teaching and Learning Science

students engage in in the three classrooms described by Ms. Rouge, Ms. Celeste, and Ms. Naranja?

Ms. Rouge

Ms. Celeste

Ms. Naranja

Which teacher’s activity do you think best reflects the NGSS goals for integrating disciplinary core ideas, science and engineering practices, and crosscutting concepts?

Why?

Respond to the following clicker question.

CQ 1-3: Which of the teachers do you think taught in ways that was most like the intention of the NGSS?

A. Ms. Rouge
B. Ms. Celeste
C. Ms. Naranja

An important part of planning instruction is knowing what the students in your class already think about the science topics. In a NextGenPET class
your instructor and the curriculum developers rely on research on how undergraduate students think about physics and chemistry topics as well as their own experience.

To give you some practice in identifying children’s ideas, you will be completing an out-of-class interview of children about their ideas about magnetism and trying to identify the models of magnetism that students are using.

**Summarizing Questions**

**S1:** Think about the type of instruction described by the NGSS. What about the NGSS is most surprising to you?

**S2.** What aspects of the NGSS do you think will be challenging for teachers?
Unit TL
Reading: The Next Generation Science Standards and NextGen PET