INSTRUCTOR GUIDE

SESSION ELEVEN

STUDENT LEARNING GOALS

- Learn developmentally appropriate ways to help young children build their understanding of number operations.
- Become familiar with the three overlapping aspects of science learning - content, process skills, and dispositions.
- Appreciate the importance of an ecological perspective.
- Recognize the value of incorporating soil exploration into life science investigations.

Materials List

General

- Computer with internet access/speakers
- PowerPoint slides for Session 11 (downloaded from website)
- Data projector
- Sign-in sheet (customizable printable)
- Course Reader
- *Big Ideas of Early Mathematics* textbook

For the Math Focus

- Recommended: *Mouse Count* by Ellen Stoll Walsh
- Goldfish® crackers (at least 20 per student)
- Paper bowls (1 per table)
- 8.5” x 11” blue paper (1 per student)
- Small paper cups (1 per student)
- Paper towels or napkins (1 per student)

For the Science Focus

- Exploring Soil exemplar activity guide
- Tray containing a pile of soil (about 1 cup) for *Engage*
- White paper or white paper plates (1 per student)
- Craft sticks (1 per student)
- Magnifying lenses
- Plastic spoons (several per table)
- Several containers to use as bug boxes in case any worms, etc. are found in the soil
- Liter-sized bottle or container of water for each table or access to a sink
- Optional: extra soil for students to investigate, preferably healthy garden soil rich with organic material
- Optional: newspaper to cover tables
- Optional: wax coated disposable cups or bowls for making mud (1 per student)
- Students provide: soil and transparent jars with lids

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### Session at a Glance

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<th>Topic</th>
<th>Description</th>
<th>Estimated Time (In Minutes)</th>
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<td>Arrival Activity</td>
<td>Students use the jars and soil they brought to class to set up a “soil profile test.” After adding water to a small amount of soil in their jar, they shake the jar and then put it aside until later in the class. They make predictions about what will happen to the contents of the jar when left undisturbed for about an hour.</td>
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<tr>
<td>Welcome, Announcements, and Agenda</td>
<td>Give a general overview of the session and any relevant announcements, and provide time for sharing.</td>
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<td>Math Focus: Number Operations</td>
<td>Students explore the big ideas about number operations. Students use Goldfish® crackers in a “Snack Time Math” activity to act out number operations. They watch and discuss two Erikson videos.</td>
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<td>Discussion: Three Aspects of Science Learning/An Ecological Perspective</td>
<td>Students do an activity to learn about the three aspects of science learning (content, process skills, and dispositions). They learn the meaning of “an ecological perspective” and discuss how teachers can support an ecological perspective in young children.</td>
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<tr>
<td>Science Focus: Exploring Soil</td>
<td>Students participate in the exemplar activity: Exploring Soil. They make predictions about what they will find in the soil and compare and investigate the variety of soils brought to class. They observe and compare the results of the soil profiles they set up during the Arrival Activity.</td>
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<tr>
<td>Looking Ahead to Next Session</td>
<td>Discuss the homework and reading assignment to be completed before next session, and address the materials that the students will be responsible for bringing.</td>
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**Total Estimated Time:** 2 hr. 30 min

### Before Session

- Review the materials relevant to this session:
  - Chapter 4: Number Operations in *Big Ideas of Early Mathematics*
  - Exemplar activity guide: Exploring Soil
  - PowerPoint for Session 11 (downloaded from website)
  - Reader Section: Session 11
  - Video: Mouse Collections: [http://earlymath.erikson.edu/mouse-collections-preschool-storytime-game/](http://earlymath.erikson.edu/mouse-collections-preschool-storytime-game/)
- Make copies of any printables and/or handouts.
- Set up materials:
  - If there is not an easily accessible sink, fill a liter bottle or other container with water and place one bottle on each table for the Arrival Activity.
  - Fill bowls with Goldfish® crackers and have them ready to distribute to each table.
  - Place the tray containing a pile of soil, magnifying lens, craft stick, and plastic spoon in the area where you will do the *Engage* section of the Exploring Soil exemplar activity.
  - Set up a place to record students’ predictions about “What’s in the soil?” (either on easel paper or the whiteboard).
  - Optional: Cover tables with newspaper

### As Students Arrive

- Have students sign in on attendance sheet and check off if they brought their bag of soil and jar to class.
- Have students turn in their homework.
Arrival Activity: Direct students to the instructions on the slide to set up their soil profiles. After they have mixed the soil and water and set their jars aside, encourage them to make predictions about what will happen to the contents of their jar when left undisturbed for about an hour. Let students know that this is an activity designed to increase their own content knowledge about the components of soil and that they will revisit the jars later in class.

Note: The soil profile activity is intended to provide students with additional information at an adult level that may be helpful in teaching young children about soil. It is not meant to be done in this same way with children. However, young children are often interested in doing more open-ended soil and water mixing experiments.

1. Announcements and sharing.
   • If you have students who are working with children, ask if anyone tried any activities from previous sessions and to share their observations and insights.
   • Share any observations, clarifications, or notable comments that you feel should be mentioned related to the previous session’s homework. Some students may want to talk about their reaction to the critique of the traditional calendar routine that was described in their reading assignment (Chapter 3 reading in Big Ideas of Early Mathematics).

2. Review agenda.

Math Focus

3. Introduce Number Operations (Chapter 4 from the Big Ideas of Early Mathematics textbook).
   • Ask students what they think “number operations” means.
   • Define “number operations” as the processes we use to find out the answer to mathematical questions. The most common are adding, subtracting, multiplying, and dividing (+, −, ×, ÷), but there are many more, such as squaring, square root, etc.
   • Ask students to respond to the prompt: “What are some developmentally appropriate ways for young children to learn about number operations?” Give them a few minutes to talk at their tables before asking groups to share out with the whole class.
   • Go over the recommendations from the textbook. Relate the recommendations back to the ideas that came up in the class discussion.
     o Keep number operations firmly grounded in real world experiences.
     o Use concrete objects, act out stories, sing songs, and make drawings to demonstrate how number operations work.
     o Don’t focus on the symbols (+, -) used to represent addition and subtraction.
• Show the slide with the toddler and rubber ducks as an example of how very young children can engage with number operations.

4. **Explain the idea that “every operation tells a story.”** According to the *Big Ideas of Early Mathematics* textbook, young children need to understand the fundamental idea – that every operation tells a story – in order for number operations to make sense.
   • As you show the next five slides with examples of number operation “stories,” ask students to think of the equation that would be used to represent each of them. The slides are animated to show the equations on click.
   • Emphasize that with young children, they first need to build the foundation for understanding number operations. Later on, they will be able to understand the symbols.

5. **Show the book *Mouse Count* by Ellen Stoll Walsh as an example of a literature connection to learning about number operations.** If you don’t have the book, show the sample pages on the PowerPoint slides.
   • The story is about a snake that collects mice for dinner one by one. Children see how adding results in more mice, and taking away results in fewer mice.
   **Note:** Some students may be concerned that the story would be scary for children, but it is a favorite in many classrooms. The fact that snakes eat mice is a basic fact that children typically understand and the story has a good moral: Don't be greedy.

6. **Watch and discuss the Erikson video: Mouse Collections.** In the video, two teachers use *Mouse Count* to illustrate the concept of “less and more.”
   • **Debrief the video:** Ask students to share their reactions to the activities in the video.
     o How did having children act out number operation stories help build their conceptual understanding?
     o How did the teachers’ structure of the activities reflect appropriate learning goals?
     o How could English Language Learners demonstrate their understanding when they were not able to articulate them in words?

7. **Do the Snack Time Math activity with Goldfish® crackers as an example of a game that gives children practice with number operations.**
   • Have students refer to the “Snack Time Math” handout in their Course Reader. This activity gives children practice adding and taking away from a set and counting to find out “how many now?”
   • Give students about 10 minutes to read over the activity and to try the game at their tables. They can take turns playing the role of the teacher. Encourage them to use their imaginations to create their own stories.
• Give each table a bowl filled with Goldfish® crackers to share and one paper cup and a piece of blue paper for each student.
• After they have had some time to play the game, ask students to think about how they might adapt this activity with children of different ages/abilities.

8. Watch and discuss the Erikson video: Changing Quantity.
http://earlymath.erikson.edu/changing-quantity-with-child-13/
• The child in the video is acting out number operations similar to “Snack Time Math.” Ask students to think about how having a story helps her to make sense of number operations.
• Point out that having a story to think about helps children visualize the problem and may provide more motivation to persevere and find an answer.

9. Introduce the Big Ideas about Number Operations from the Big Ideas of Early Mathematics textbook.
#1. Sets can be changed by adding items or by taking some away (separating). In everyday life, the number of things we have or need often involves a change: we start with some and add more. Or we start with some and need to take some away. Children may not keep track of the specific count, but it is important for them to make the more foundational generalization that adding increases, and taking away decreases, the quantity in a set. (This is the idea in the “Mouse Collections” video watched earlier.)
#2. Sets can be compared using the attribute of numerosity, and ordered by more than, less than, and equal to. We use number operations to calculate how many more or fewer in one set than another. For example, the image of cars and trucks on the slide suggests number operations such as: How many trucks? How many cars? How many more cars than trucks? Young children can do this with real objects. Concrete experiences build the foundation for understanding the equation 7 - 5 = 2 using symbols when they get older.
#3. A quantity (whole) can be decomposed into equal or unequal parts; the parts can be composed to form the whole. An understanding of the parts-whole relationship within a set is a necessary foundation for number operations. Children need to recognize that smaller numbers are contained within larger numbers and be able to describe the parts of numbers. For example, a game with plastic bears and a paper bowl cave helps children think of 5 as a group of 4 and a group of 1.
10. Engage students in an activity about the three aspects of science learning for young children.
   - Display the slide showing the three aspects of science learning (circles are animated to appear on click). Fostering scientific learning in early childhood includes helping children to grow in these three areas. (Do not elaborate on these beyond the definitions given):
     - **Content** refers to scientific knowledge – the main ideas and concepts that represent what is known about the world.
     - **Process Skills** are the processes used to make discoveries about materials and phenomena.
     - **Dispositions** are a person’s attitudes towards doing and learning science.
   - Emphasize that these three components overlap with each other and are inseparable. All three areas are impacted simultaneously through children’s experiences.
   - Direct students to make a quick sketch of the three circles as shown on the slide, leaving room to write in each circle.
   - Show the next slide with the different words and phrases and ask students to write them into the circles where they think they belong.
   - When they finish, have them compare with a partner. Address any questions or confusion that may arise.
   - Ask them to brainstorm additional examples that could be added to each of the three areas.

11. Facilitate a discussion of how teachers can support an ecological perspective in young children.
   - Tell students that one of the most important dispositions and attitudes teachers can help children develop through life science activities is that of respecting living things. Children who come to appreciate living things and understand the importance of the relationships among them will be more likely to value and appreciate them. This view is called “an ecological perspective.”
   - Ask students to share ideas about the kinds of experiences that teachers can provide that build children's understanding of the interconnectedness and interdependence of living and non-living things in the natural world.
   - Lead into the Exploring Soil exemplar activity making the point that soil is a wonderful natural material for young children to investigate. Soil is the foundation of all life. It is important for children to feel a connectedness to this precious resource.
12. Introduce the Exploring Soil exemplar activity.
Let students know that you are going to model the Engage part of the activity in much the same way as if you were doing it with children in order to help them experience the activity through a child’s eyes and to demonstrate the teaching strategies as written in the exemplar activity guide.

Engage
- Show the students a pile of soil on a tray, and encourage them to share their prior knowledge and experiences by asking them questions such as:
  - What do you see on the tray?
  - Where have you seen soil before?
  - Why is soil important?
- Students will likely call it “dirt.” Introduce “soil” as the word that scientists use.
- Tell the students that they will be investigating the soils they brought from home. Ask them to make predictions about what they think they will find in the soil.
- Record their predictions on the whiteboard or chart paper.
- Demonstrate how to place a scoop of soil onto a piece of paper (or paper plate). Use your craft stick to slowly explore and look through the soil. Use your magnifying lens and model how to use it to get a closer look. Emphasize observing using your senses – look, touch, smell, and possibly listening (not taste).
- Show the paper cups or bug boxes and let students know that if any living creatures are found, they can gently place them in the cups to observe.

Explore
- Pass out the materials for exploring soil (white paper or paper plates, plastic spoons, craft sticks, magnifying lenses, and big boxes).
- Encourage students to compare the different soils at their tables and describe the differences.
- As students are exploring the soils, encourage them to describe their observations. What does it look like? How does it feel? What are you finding? How does it smell?
- If students find living creatures, place them in a small cup where they can be safely observed.

Reflect
- Share and discuss the students’ findings. Ask, “Did anyone find anything interesting while digging up their soil?”
- Revisit their list of predictions and compare them to their actual observations.
• By asking them questions and drawing on their responses, point out that soil contains living and non-living things. Refer back to the list to identify examples from both groups (Non-living: rocks, pebbles, sand; Living: roots, leaves, seeds, little animals).

Optional Extension Activity: Making Mud

• Give each table a container of water and a wax coated paper cup or bowl for each student. Students can mix small amounts of soil and water in the cups using craft sticks. What happens? Does adding water change the way the soil smells? Compare the textures of the muds from different cups. Which is smoothest or stickiest? If you were making a mud pie, what else would you like to add? What other experiments could you do with mud?

13. Have students observe their soil profiles and compare to others at their tables.

• Encourage them to discuss the following questions:
  o What happened after you let your soil profile settle?
  o How many layers do you see?
  o What do you think is at the bottom of the profile?
  o What is at the top of the water?
  o What do these layers tell us about soil?

• Show the slide identifying the different layers. Explain that the layers show how much of each component is in the soil. Most soils have two or three layers on the bottom and a small layer floating on top of the water. Some layers are heavier than others; some layers are larger. The bottom layer is sand. The middle layer is silt. The top layer is clay. The floating layer is the organic material.

• Suggest that students take their soil profiles home and set them on a shelf or windowsill and continue to observe them over the next day or several days. If they are left undisturbed, the layers should become even more pronounced.

Clean up: Direct students to clean up their materials and the tables.

14. Debrief the Exploring Soil activities.

• Ask students to debrief the soil exploration activities as an adult learner.
  o What aspects of the experience were most meaningful and why?
  o What did you enjoy most?
  o What ideas do you have for adapting the activities for different ages and developmental levels?

15. Show photos of children exploring soil. Ask for students’ ideas on modifications for different ages and developmental levels.
16. **Song:** Have everyone stand up and sing along. Marching is optional.

**Soil Song**  
* (Sung to the tune of “When the Saints Go Marching In”)  
Oh when you dig  
In the deep dark ground  
Oh when you dig in the deep dark ground  
You’ll find rocks and bugs and plants parts  
When you did in the deep dark ground.

Oh soil is home  
For lots of worms  
Oh soil is home for lots of worms  
Squishy, squirmy, soft and slimy  
Soil is home for lots of worms

Oh we need soil  
To grow our food  
Oh we need soil to grow our food  
Soil is life, we can’t live without it.  
We need soil to grow our food.

17. **Share background information about soil to build students’ content knowledge.** Remind students that this information is for their own knowledge as adult learners.

18. **Looking ahead to next session.**
- **Review homework assignment due next session.**
- **Review materials to bring for next session:** Emphasize that student-supplied materials are essential for the hands-on activities in each class.
  - A piece of fruit with interesting seeds that can be cut open with a plastic knife.
  - **Note:** Many foods commonly referred to as vegetables are actually fruits according to scientific definition. A fruit is a seed-bearing structure that develops from the ovary of a flowering plant. Vegetables are all other plant parts, such as roots, leaves, and stems.