INSTRUCTOR GUIDE

SESSION FIVE

STUDENT LEARNING GOALS

- Articulate the value of sensory play.
- Gain knowledge of different aspects of measurement concepts in early childhood.
- Apply principles of constructivist learning to mixing solid and liquid ingredients.
- Distinguish between convergent and divergent questions and cite advantages or disadvantages of each type.

Materials List

General
- Computer with internet access/speakers
- PowerPoint slides for Session 5 (downloaded from website)
- Data projector
- Sign-in sheet (customizable printable)
- Course Reader
- Big Ideas of Early Mathematics textbook
- Easel paper (1 sheet per group)

Other Printables and Handouts
- Midterm Project assignment sheets

For the Science Focus*
- Solids and Liquids exemplar activity guide

Explore
- Trays (1 per group)
- Small containers for liquids (6 per group, 4-6 oz. clear plastic cups are recommended)
- Liquids - water, juice, milk (approximately ½ cup each per group)
- Small plastic spoons (3 per group)
- Eyedroppers (3 per group)
- Craft sticks or coffee stirrers (1 per student)
- Magnifying lenses (1 per student)
- Paper towels
- Optional: extra mixing trays for students who forgot to bring one
- Students provide: flour, salt, and powdered gelatin. One mixing tray, such as an ice cube tray, muffin tin, or Styrofoam® egg carton

*To reduce clean up, you may wish to use disposable materials
# Session at a Glance

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<th>Description</th>
<th>Estimated Time (In Minutes)</th>
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<td>Arrival Activity</td>
<td>Students do a measurement brainteaser to start thinking about how young children build a foundation for understanding volume.</td>
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<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>Discussion: The Value of Sensory Play</td>
<td>Students discuss why sensory exploration is a valuable experience for young children. Students brainstorm different sensory play activities to do in the classroom, and share about their own experiences.</td>
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<td>Math Focus: Measurement</td>
<td>Students discuss how sensory materials can help build math skills. Students explore the big ideas about measurement, and watch and discuss an Erikson video of preschoolers theorizing about volume.</td>
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<td>Science Focus: Solids and Liquids</td>
<td>Students participate in the exemplar activity: Solids and Liquids.</td>
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<td>Discussion: Questioning Strategies</td>
<td>Students brainstorm examples of convergent and divergent questions in the context of the Solids and Liquids activity.</td>
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<td>Introduce Midterm Project / Looking Ahead to Next Session</td>
<td>Introduce the Midterm Project. 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

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**Before Session**
- Review the materials relevant to this session:
  - Chapter 6: Measurement in *Big Ideas of Early Mathematics*
  - Exemplar activity guide: Solids and Liquids
  - PowerPoint for Session 5 (downloaded from website)
  - Reader Section: Session 5
- Make copies of any printables and/or handouts.
- Set up materials: for each group of 4-6 students, prepare one tray of ingredients for the *Explore* part of the exemplar activity as follows:
  - Place 6 cups or small bowls on each tray.
  - On each tray, fill 3 cups about halfway full with the liquids you brought: 1 with water, 1 milk, and 1 juice.
  - Place three eyedroppers on the tray.
  - Place 3 small spoons on the tray (students will fill the remaining 3 empty cups with the solid ingredients they bring from home).
  - Place magnifying lenses on trays.
  - Place the trays nearby until needed for the exemplar activity.
  - Have ready the materials you will need to model the *Engage* part of the exemplar activity: one of the trays with ingredients (use some of the solids brought by students), droppers, and spoons; ice cube tray; popsicle stick; magnifying lens.

**As Students Arrive**
- Have students sign in on attendance sheet and mark if they brought their assigned ingredient and ice cube tray, muffin tin, or Styrofoam® egg carton to class.
- Have students turn in homework in at the **end** of class since they will be discussing the assignment during class.
Getting Started

Arrival Activity: Have students refer to the brainteaser on the slide and talk with each other about their best guesses/answers. Let them know the brainteaser is a fun way to “warm them up” for the math focus on measurement. It’s not a quiz! Encourage students to share their answers and briefly talk about their methods for figuring them out. Reveal the answers (slide is animated so answers appear on click).

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.

2. Review agenda.

Early Childhood Topic

3. Lead a discussion on the value of sensory play.
   - To get students thinking about sensory play, ask them to share their ideas about why they think sensory play is important for young children.
   - You may want to have them talk at their tables or with a partner and write down a few ideas before sharing out with the whole group.
   - Some ideas they may mention are:
     - Fun, play-based, child-directed exploration through which they construct their own knowledge. Focus is on process, not product.
     - Supports the whole child - language development, cognitive growth, fine and gross motor skills, problem solving skills, and social interaction.
     - Great for calming an anxious or frustrated child and for improving focus and concentration.
     - Helps children learn about the physical properties of different materials (hard, soft, hot, cold, wet, slimy, sticky, dry etc.).
     - Helps foster brain development.
   - Ask students to share kinds of sensory materials they have used with young children.
   - Emphasize that sensory play is really part of the scientific process. Whether out loud or within the internal dialogue of the mind, children have developed a question, leading them to investigate – by grabbing, pounding, squeezing, smelling, listening, what have you! They are using their senses to collect data and from that, they attempt to answer their own questions. Whether or not young children are always able to verbally communicate this process, it is still a valid exercise in scientific inquiry. They investigate their own questions and use many science process skills.
4. Discuss how sensory experiences can help build math skills.
   - Point out that sensory play is also very important for developing math skills. Ask students what kinds of mathematical thinking and skills children might be using in the photos (measuring, counting, comparing, estimating).
   - Explain that today’s class focuses on measurement (Chapter 6 in the textbook).
   - Define measurement as a process that produces a quantitative description of an attribute such as length, circumference, weight, temperature, volume or number.
   - Ask student to think of some ways they’ve used measurement today. (telling time, money, cooking, speedometer in car, etc.).
   - Make the following points:
     - Measurement for young children starts with comparisons - big/little, bigger/smaller, more/most, tall/short, etc.
     - For young children, the most appropriate focus for measurement activities is on length and capacity.
     - With young children, it is often best to use non-standard units of measure. They are generally not ready for standard units of measurement that adults use because they do not yet fully understand the number system.
   - Ask students to identify standard and non-standard units listed on the slide.

5. Introduce the Big Ideas about Measurement from the Big Ideas of Early Mathematics textbook.
   - Many different attributes can be measured, even when using a single object. For example, looking at the image of the two containers, ask the students what different attributes can be measured? We can measure the height, or the width of the opening, the circumference around, or how much they hold (volume).
   - All measurement involves a “fair” comparison. For example, with the containers in the picture, a fair comparison would be to measure the same attribute of both containers. We can’t measure the height of one, but the width of another in comparing their measurement. You need to measure the same attribute in order for it to be fair.
   - Quantifying a measurement helps us describe and compare more precisely. We can use numbers to make comparisons more precise. For example, we can find out that the big container is not only bigger than the smaller one, but we can be precise and find out that it holds 2 cups more than the smaller one. Measuring can tell us “How much more or less.”

(Note: The video clip shows two different teaching episodes. We recommend watching the second one, which is about 5 minutes long.)

Debrief the video with questions such as:
• What is your reaction to the lesson?
• How was this activity designed around an authentic reason to measure?
• Capacity (how much a container holds) is a difficult idea to describe with language. What did you notice about children’s receptive and expressive language abilities?
• What do you think was the teacher’s reason for incorporating graphing into the activity?
• Is a teacher-led activity like that modeled in the video consistent with a constructivist learning approach?

Science Focus

7. Introduce the Solids and Liquids exemplar activity.
Children also enjoy sensory exploration when they mix substances together to find out what happens. Let students know that you are going to model the Engage part of the activity as if you were doing it with children in order to help them experience the activity more through a child’s eyes and to demonstrate the teaching strategies as written in the exemplar.

Engage:
• Ask if anyone has ever mixed ingredients together. As they share, encourage them to describe what they used and what happened when they were mixed. If they don’t have ideas, you might lead them with questions about mixing ingredients in the kitchen, at the beach, or in the bathtub. Summarize their responses by saying something like, “Julie mixed together shampoo, conditioner, and water. She used 3 ingredients in her mixture.”
• Tell them that when we mix different ingredients together, it is called a mixture.
• Let the students know that they are going to use ingredients to make mixtures. Like scientists, they will experiment, make observations, and notice what happens when they combine different ingredients together.
• Show them a tray with the cups of ingredients that they will be using. Explain that the ingredients are all things you might have in your kitchen, but we won’t be eating or drinking them today. We’ll be using them for science experiments.
Optional: Discuss Solids and Liquids
The goal is not for children to learn the definitions of liquids and solids, but this activity can be a good way to introduce these terms and concepts, depending on the readiness of the children.

- Tell them that some of the ingredients are called LIQUIDS. Ask if anyone has heard of “liquids” before or has an idea about which ingredients are liquids. Encourage them to share their ideas.
- Depending on the children’s prior knowledge, give them clues to help them figure out which ingredients are liquids. For example, you could say, “If I put my finger in a liquid, it will get wet.” Then test the ingredients by placing your finger (or a child volunteer’s finger) into each cup. Or you could say, “Liquids make a puddle when they spill,” and then demonstrate which ingredients make a puddle and which do not (the solid ingredients can make a pile, but not a puddle).
- If children say that liquids are things that we drink, affirm that we do drink some liquids, but challenge them to think of liquids that are not for drinking.
- Once you have established which ingredients are liquids, tell the children that the other ingredients are called SOLIDS. Let them share their ideas about what solids are.
- Ask them how the solid ingredients are different from the liquid ingredients. Establish that the solid ingredients are dry, they do not make a puddle when spilled, and that you can pick up a tiny little piece of the solids, (but you can’t pick up a piece of a liquid.)

• Tell the children they can experiment to find out what happens when they mix the different ingredients together. Show the additional materials they will be using and give the following tips:
  - To pick up the dry ingredients (solids), we will use small spoons. Emphasize that they only need to use a little bit at a time.
  - To pick up the liquids, we will use droppers (demonstrate how to use a dropper).
  - We will use stir sticks for stirring.
  - Your job is to mix the different ingredients together in the ice cube tray and to observe what happens. What kind of mixtures can you make?
  - Use magnifying lens to see more closely.

Explore
(Have students fill the 3 empty cups on their trays with the flour, salt and powdered gelatin they brought from home.)

• Allow students to make their own choices about which ingredients to mix together. Let their curiosity lead the way!
• As they combine the different solids and liquids, remind them to:
  - Use small amounts.
  - Put the spoons and droppers back into the cups they belong in.
  - Take their time! Add a little of this and a little of that. Stir them together. Observe what happened. Predict what will happen if they add another ingredient.)
o Notice how their mixtures change as they add different solids and liquids.
  o Compare their mixtures with others in their group.

• As they are working, circulate among the groups. Model asking questions such as:
  o What do you notice?
  o What do you think will happen when you add ___?
  o How did it change?
  o Which ingredients did you use?
  o How does it feel?
  o What does it remind you of?

**Reflect**

Ask questions such as:

• Did you like experimenting with the solids and liquids? Why or why not?
• What other kinds of solids and liquids would you like to try mixing together?
• What are your thoughts about doing this activity with children?

**Clean up:** Direct students to clean up the trays and materials.

8. **Show photos of children engaged in the Solids and Liquids exemplar activity.** Ask for students’ ideas on modifications for different ages and developmental levels.

9. **Present background information on solids, liquids, and gases.**

Let students know that you are providing this scientific information in order for them to gain some content knowledge at an adult level and to illustrate how children’s early experiences with solids and liquids lay the foundation for learning more complex concepts later on.

**Solids, liquids and gases** are the 3 main physical states of matter.

• **Solids** have a definite shape, do not flow, and are virtually impossible to compress. Their particles are strongly bonded together.
• **Liquids** have no definite shape, can flow to take the shape of the bottom of a container, and are very difficult to compress (virtually incompressible). Their particles are weakly bonded to each other and can break their bonds easily.
• **Gases** have no fixed shape, spread (or diffuse) to completely fill a container, and are easily compressed. Their particles are “free,” having no bonds between them. They have much more energy than those of a solid or liquid and fly around, bouncing off each other and the walls of their container.

Review the basic principles of solids and liquids that are appropriate for young children. Reiterate that curiosity, exploration, and discovery are at the heart of the mixing activity, not memorization of facts and definitions. Through hands-on experiential learning, each child builds conceptual understanding over time.
10. Engage students in brainstorming examples of convergent and divergent questions in the context of the Solids and Liquids activity.

- Have students refer to their homework assignment on the “Timely Questions” reading. Review the difference between divergent and convergent questions.
- Give each table a sheet of easel paper. Have them divide the paper in half and write the headings “Divergent” and “Convergent” at the top of each side of the paper.
- Direct the groups to brainstorm a list of both types of questions that a teacher might ask children while they were doing the solids and liquids mixing activity. Ask them to come up with at least 3 examples of each. Ask them designate someone with good handwriting to be the recorder.
- After they’ve had enough time, have groups share out. This can be done in several ways: either by having groups post their easel paper around the room and having everyone take a tour around the room to read them, by having each group come up front and reading off some of the examples from their list, or by having tables trade their lists of questions with each other.
- Reiterate that the questions a teacher asks should be intentional, the importance of really listening to children’s responses, and emphasize that there are also times when it’s better to give children uninterrupted time to be absorbed in an activity.

11. Go over the Midterm Project.

- Explain that students will do one of the exemplar activities as part of their midterm. As assigned in the homework, they should be reading the activities each week after experiencing them in class.
- Give out the Midterm Project assignment sheets. Go over directions, expectations, and due date.

12. 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.
  - 2-3 “non-traditional” bubble blowers. Look around your kitchen, office, or recycle bin - be creative!
  - Make a discovery bottle and bring it to class for show and tell. Note: specific directions are given on the handout in the Course Reader.