STUDENT LEARNING GOALS

- Apply mathematical concept of sorting to a variety of real-life experiences.
- Apply scientific inquiry processes to exploration of sink and float activities.
- Understand the Engage/Explore/Reflect learning cycle format of the exemplar activity guides.

Materials List

**General**
- Computer with internet access/speakers
- PowerPoint slides for Session 3 (downloaded from website)
- Data projector
- Sign-in sheet (customizable printable)
- Course Reader
- Big Ideas of Early Mathematics textbook

**For the Math Focus**
- Recommended: Five Creatures by Emily Jenkins

**For the Science Focus**
- Sink and Float exemplar activity guide
- Access to sink
- Pitcher for filling tubs with water
- 1 deep tub for each group of 4-6, approximately 12”x18”, such as a plastic storage box (if available, clear tubs are preferable)
- Several towels or rags
- Large wooden block, small pebble, metal spoon, plastic spoon (for Reflect)
- Sink and Float sorting signs (printable)
- Wax-based clay (one large gumball-sized piece per student or pair of students). Recommended brand: Sculpey NDC53 EZ Shape Clay
- Paper plates, or trays, for sink and float sorting (2 per group)
- Optional: cart for transporting tubs of water
- Optional: additional interesting objects for sink and float, such as clothespins, pom-poms, candles, bar soap, old CDs, sponges, fruit (oranges and grapes are suggested)
- **Students provide:** objects to test
## Session at a Glance

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<th>Topic</th>
<th>Description</th>
<th>Estimated Time (In Minutes)</th>
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<tr>
<td>Arrival Activity</td>
<td>Students discuss at their tables the various ways that they can sort the dogs in the picture on the Arrival Activity slide.</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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<tr>
<td>Math Focus: Sets and Sorting</td>
<td>Students explore the big ideas about sets and sorting and consider classroom practices that support children’s understanding of these ideas. They watch and discuss an Erikson video of a classroom sorting activity and play “Guess My Rule” people sort.</td>
<td>30</td>
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<tr>
<td>Science Focus: Sink and Float</td>
<td>Students participate in the exemplar activity: Sink and Float. The concept of a Learning Cycle is introduced, and the Engage/Explore/Reflect format of the exemplar activity guides is explained.</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:
  - Introduction and Chapter 1: Sets in *Big Ideas of Early Mathematics*
  - Exemplar activity guide: Sink and Float
  - PowerPoint for Session 3 (downloaded from website)
  - Reader Section: Session 3
  - Video: People Sort: [http://earlymath.erikson.edu/?s=people+sort&submit=Search](http://earlymath.erikson.edu/?s=people+sort&submit=Search)
  - Video: Science Background: Density: [https://www.youtube.com/watch?v=y0SnFCs9z1g](https://www.youtube.com/watch?v=y0SnFCs9z1g)
  - Literature Connection: *Five Creatures* by Emily Jenkins
- Make copies of any printables and/or handouts.
  - Prepare Sink and Float sorting signs (printables). Print one set for each group. Optional: Laminate signs to make them re-usable.
- Set up materials:
  - For sink and float experiments: Fill tubs with water, deep enough so that floating objects will not touch the bottom of the tub, and set aside for later.
  - Place the following materials in the area where you will demonstrate the *Engage* part of the Sink and Float exemplar activity: one tub of water, several objects that float, several that sink, one set of sink and float signs, and two trays.

### As Students Arrive

- Have students sign in on attendance sheet and mark if they brought items for sink and float.
- Have students turn homework in at the end of class since they will be discussing the assignment during class.
- Students who were absent last session can make name cards.
Arrival Activity: Display the slide for the Arrival Activity and encourage students to talk with each other about the various ways that the dogs in the picture could be sorted. After a few minutes, invite each group to share one of the ways their group sorted the dogs.

1. Announcements and sharing.
   - If you have students who are working with children, ask if anyone tried any of the water play or people sorting activities from the previous session 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.

3. Homework sharing.
   - Give students some time to exchange their ideas about the benefits of sending home a family letter such as the sample letter from Exploring Water with Young Children by Ingrid Chalufour and Karen Worth.

   - Access students’ prior knowledge: The math activities done in this course are based on the Big Ideas of Early Mathematics textbook. Today’s class focuses on Chapter 1: Sets - Using Attributes to Make Collections. To engage students in this topic, have them turn and talk with a partner. Give the following directions:
     o Talk with your partner about how you would define “a set” and “attributes.”
     o Write down your best definitions.
   - After partners have had a few minutes to talk, ask for volunteers to share their definitions.
   - Project the slide with the definitions from the Erikson textbook:
     o A set is any collection that is grouped together in some meaningful way. Some examples: set of dogs, toys, colored beads.
     o An attribute is a characteristic or property used to describe an object. Attributes can be used to sort collections into sets. For example, the attributes of a bead might be small, red, round, shiny, plastic.
   - Ask students to think about the Arrival Activity. Ask, “What are some attributes of a dog?”
   - Ask students to brainstorm everyday ways that even very young children practice sorting.
5. Watch and discuss Erikson video: People Sort.
   http://earlymath.erikson.edu/?s=people+sort&submit=Search
   - Introduce the video by telling students that it shows preschoolers playing a sorting game based on attributes of the children themselves. These children are dual language learners.
   - After watching, debrief the video with a large or small group discussion. Questions you might ask:
     o How did the teacher involve the children in problem solving?
     o How did the teacher modify the activity to meet her students’ developmental levels?
     o What evidence did you see that children are developing better understanding of the idea of sets, sorting, and classifying?
   - Explain that the People Sort is a great activity because it involves the children themselves, using their whole bodies. Children who don’t yet grasp the concept get support from their peers.
   - Share a literature connection: Five Creatures by Emily Jenkins. This is the story referred to in the video. (Note: You can either read the book aloud or share the excerpt on the slide.) This book shows a variety of creative ways that five creatures (3 humans and 2 cats) can be sorted.

   - Playing this game gives students first hand experience with doing a people sort.
     1. Have 8 volunteers stand in front of the class. Make sure some are wearing jeans (but don’t let students know that this is the attribute you are using).
     2. Say, “I see 8 people in front of me. I am going to sort them into two groups using a ‘secret rule.’ Your job is to try to figure out my rule. If you think you’ve guessed it, don’t say it out loud because other people might still be trying to guess it.”
     3. One by one, sort most of the volunteers into two groups based on your rule (wearing jeans/not wearing jeans).
     4. When you have sorted all of the volunteers, ask students to guess your wheel.
     5. If time allows, let another person think of a way to sort the volunteers and have him or her take the role of the teacher and lead the sort. Remind them to make sure it is a rule that can be observed visually. (For example, glasses/no glasses; long sleeves/short sleeves; has red on clothes/no red).
   - Summarize that the goal of People Sorting activities is to develop children’s familiarity with the sorting process and how it produces sets.
   - Ask students for their ideas about how to modify People Sorting with younger and older age groups.

7. Introduce the Big Ideas about Sets from the Big Ideas of Early Mathematics textbook. Let students know that they will revisit these ideas when they read Chapter 1 for homework.
#1. Attributes can be used to sort collections into sets.
#2. The same collection can be sorted different ways.
#3. Sets can be compared and ordered.

- You can ask students to think about how these Big Ideas were incorporated in the People Sorting activities done in class.

Note: The Big Ideas are included in each chapter in the textbook. These are meant to give teachers a framework for planning early math teaching and are based on the most current research from the field. The Big Ideas map out the key math concepts young children should be developing between the ages of 3 and 6. The point is not to have children recite them, but for teachers to understand these concepts themselves so they can best provide appropriate experiences for children.

8. Highlight the following guidelines for teachers. Ask students to think about why these practices are important:

- Make sorting playful.
- Incorporate sorting in everyday routines, such as how materials are organized in the classroom, clean up time, and snack time.
- Comment on children’s spontaneous sorting. For example, “I see you put all the red beads on your necklace.” “You used all cylinder shaped blocks in your tower.”
- Recognize that over time, children’s ability to think flexibly about attributes will grow.

Science Focus

9. Introduce the Sink and Float exemplar activity.

- Have students refer to their Sink and Float exemplar activity guide.
- Whereas the water play activities from Session 1 were very open-ended, the Sink and Float activity requires more teacher guidance. Before doing a more structured sink and float activity, children should be given plenty of free exploration time with water play.
- Let students know that you will model the Engage part of the exemplar activity in much the same way you would do it with children. This is a purposeful way to help them experience the activity through a child’s eyes and to demonstrate how a teacher might engage and guide children, as well as other helpful teaching strategies.

Activity: Model the Engage part of the activity, as you would do it with young children. Ask the students to assume the role of the children.

Engage

If possible, gather students in a circle, sitting on the floor. Show a clear container of water filled at least halfway. Tell the students that they are going to be testing objects to find out if they sink or float.
• Ask them if they have heard the words “sink” and “float.” Have them share what they think those words mean. *(Remember, you are modeling how to do this with children.)*

• Agree on definitions of “float” (stays at the top of the water, does not touch the bottom) and “sink” (goes to the bottom of the water).

• Have the students brainstorm ideas of things that sink or float. You can have them think of objects they have used in the bathtub.

• Ask, “What are your ideas about why some things float and some things sink? (This is a time to share ideas. Do not correct their preconceptions or give explanations.)

• Select an object and ask them to predict whether it will float at the top of the water or sink to the bottom. One way to have them show their predictions is “thumbs up” if you think it will float; “thumbs down” if you think it will sink; “thumbs to the side” if you’re not sure.

• Demonstrate placing the object carefully into the water and observe what happens. Test one object that sinks and one object that floats, making predictions first.

• Using the Sink and Float sorting signs, establish one tray for the objects that sink and the other tray for objects that float. Model sorting the objects onto the appropriate tray after testing them.

• Explain that everyone will get to experiment with floating and sinking. Remind them to make their predictions first and to sort the objects after testing them.

**Explore**

• Direct students to work in their small groups to test the objects they brought to class.

• One at a time, the students should:
  o Choose an object
  o Pass it around the group for everyone to hold.
  o Make predictions about whether it will sink or float.
  o Test it in the water.
  o Place the object on the appropriate sink or float tray.

• As students are exploring, circulate around the room, actively engaging with the students to focus their observations and encouraging them to describe what happens to each object when placed in the tub.

**Going Further: Clay Activity** – After students have had time to test their group’s objects, give each student, or pair of students, a piece of clay (about the size of a large gumball). Challenge them to change the size and shape of the clay to make it float or sink.

**Clean up:** Direct students to remove the items from the water and ask for volunteers to spill the water into a sink or outside. Place items on towels to dry.

**Reflect**

• Ask questions to help students reflect on, and to articulate, their thinking such as:
  o What did you learn about sinking and floating?


○ “Do you have any new ideas about why some things float or why some things sink?” (Resist the temptation to give explanations.)

• Point out that a common misconception is that weight alone determines whether an object will sink or float. For example, a boat is very heavy but it floats.

• Ask students what other attributes besides weight, affect floating and sinking.

• To demonstrate that some light things sink, while some heavy things float, you can compare two objects such as a big piece of wood and a tiny pebble. Pass them around the circle. *Which is heavier? Which is bigger? What are they made of?* Make predictions about whether each one is a floater or a sinker and test them.

• Compare a metal and plastic spoon. Make predictions and test them in the tub. Focus their attention on the material the spoons are made from.

• **Note:** Emphasize that there is great value in encouraging children to verbalize, process, and communicate their ideas. The goal is to help children begin to understand that attributes contribute to whether an object sinks or floats, including: material, shape, size, and weight (all of these factors affect an object’s density). Through their explorations they will begin to build a foundation for later understanding of density, buoyancy, and water displacement.

10. **Show a video explaining sinking and floating.**

• Use the following video or find a relevant substitute that demonstrates the principles behind sinking and floating. [https://www.youtube.com/watch?v=y0SnFCs9z1g](https://www.youtube.com/watch?v=y0SnFCs9z1g)

• Make it clear that this information is being shared to build their own knowledge as adults, not as instructional material to be used with children.

• Use the science background slide explaining density to further build students’ understanding. While an object’s weight does play a role in why some things float, and others sink, it is not the only factor. An object’s density, the relationship between its volume and mass is a key factor. Density is defined as the mass of an object per unit volume \(D = \frac{m}{v}\). Therefore, the mass and volume of an object both affect whether it will sink or float, and changes to either of these variables might change the results of the sink/float test. Density explains why a ping pong ball floats and a large marble of equal size sinks.

11. **Song:** have everyone stand up and sing along.  

   **Will it Float**  
   [to the tune of: “When the Saints Go Marching In”]  
   Oh, will it float, or will it sink?  
   Which will it be; what do you think?  
   Will it stay on top of the water?  
   Or, like an anchor, will it sink?

12. **Show photos of children engaged in Sink and Float activities.** Discuss age modifications for younger and older children and other implementation ideas.
13. Show example of a recording sheet for Sink and Float activities.
   • Children can reflect on their learning and discoveries by recording their results.
   • Even four-year-olds can do a simple form of recording their findings.

   This video shows Sink and Float as part of a larger water investigation theme. Watch the video and have students share their thoughts and reactions.

15. Explain the exemplar activities and the Engage/Explore/Reflect format.
   • Have students read over the Sink and Float exemplar activity.
   • Explain that the exemplar activities were developed especially for this course. One of them will be featured almost every session of the course. They have two purposes:
     1. They are written for a teacher to use with preschool-first grade children.
     2. They are the same activities that you, as adult learners, will experience during the course.
   • It is important to understand that the exemplars are snapshots of a guided activity a teacher would do in a classroom. They are not meant to be one-shot activities, but would be part of a series of project-based or thematically connected experiences that would look different in every classroom. They are scripted to support the teacher, but are meant to be flexible and adaptable to different ages, settings, and teaching approaches. Each exemplar could branch out into many other areas of the curriculum depending on the interests, ages, and abilities of the children and the goals of the teacher.
   • Review the Exemplar format handout in the Course Reader. The format of all of the Exemplars is consistent. Go over the format while students follow along with the handout in the Course Reader. Explain the purpose of each stage of the Engage/Explore/Reflect Learning Cycle. As you describe the purpose of each stage of the Learning Cycle, use examples from the Sink and Float exemplar activity.

Wrapping Up

15. 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.
     o 5 rocks with interesting attributes
     o Old toothbrush