INSTRUCTOR GUIDE

SESSION FIFTEEN

STUDENT LEARNING GOALS

- Understand how gender bias impacts children’s attitudes towards science and math.
- Identify shape concepts that are most appropriate for focus in early childhood.
- Apply science, engineering, and math skills through building structures.

Materials List

General
- Computer with internet access/speakers
- PowerPoint slides for Session 15 (downloaded from website)
- Data projector
- Sign-in sheet (customizable printable)
- Course Reader
- *Big Ideas of Early Mathematics* textbook

Additional Copies/Handouts
- Materials list for what to bring for Invention Center Session 16 (printable)
- Extra copies of Final Assignment (customizable printable) for students absent previous session

For the Science Focus
- **Students provide:** materials for Structures Group Activity
### Session at a Glance

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<tr>
<th>Topic</th>
<th>Description</th>
<th>Estimated Time (In Minutes)</th>
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<td>Arrival Activity</td>
<td>Students take turns drawing shapes on each other’s back with their finger. Students try to guess what shape was drawn, and explain how they knew.</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. Answer any questions about the Final Assignment.</td>
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<tr>
<td>Discussion: Gender Equity and STEM</td>
<td>Students reflect on their own experiences with gender socialization and engage in a discussion about gender equity and STEM.</td>
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<tr>
<td>Math Focus: Shape</td>
<td>Students explore the big ideas about shape. They watch and discuss an Erikson video showing a child composing shapes using pattern blocks.</td>
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<tr>
<td>Science/Engineering Focus: Building Structures</td>
<td>Students discuss the rationale for creating a classroom environment that supports children’s building. They participate in the Structures Group Activity by rotating through each group’s station to explore different types of materials and challenges.</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 9: Shape in *Big Ideas of Early Mathematics*
  - PowerPoint for Session 15 (downloaded from website)
  - Reader Section: Session 15
  - Video: Composing Shapes with Child 12
- Make copies of any printables and/or handouts.

### As Students Arrive
- Have students sign in on attendance sheet and check off if they brought their materials for the Structures Group Activity to class.
- Have students turn in their homework.
Arrival Activity: Take turns drawing shapes on each other’s back with your finger. Guess what shape it is. How do you know?

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.
   - Answer any questions about the Final Assignment. Be sure all students have received the assignment sheet.

2. Review Agenda

3. Engage students in a discussion about their personal experiences with gender and STEM.
   - Ask students to reflect on the article “Block Play - It’s Not Just for Boys Anymore” that they read for homework and to discuss their personal experiences with a partner:
     - As a child, were you encouraged in science and math?
     - Do you think your gender made a difference in the messages you received?
   - Debrief by asking students to share what came up in their discussions.

4. Discuss gender socialization and STEM.
   - Ask students where they think the messages about gender roles come from. Based on their responses, point out that these messages can come from bias in the media, from family, or peers.
   - Show examples of society’s messages about gender roles in toys and clothing.
     - Clothing - Boys and girls are already being stereotyped starting at birth.
     - Baby rattles - One is for a girl and one is for a boy. How do we know which is which? It says right there on the packaging. One implies passivity and a life of leisure. The other implies activity and learning.
     - Even traditionally gender-neutral toys, such as Duplo blocks, come in “boy” and “girl” versions.
     - Boy/girl toy aisles in stores send the message that boys do not cuddle, and girls do not build. Notably, some stores, such as Target Corporation, have recently removed gender-specific labels and signage on toys.
• Ask students what effect they think this kind of marketing has on children.
• Emphasize that the hidden messages that girls receive about STEM shape their self-concept, confidence, and interest in those subjects.
• Ask for ideas about how teachers can decrease gender stereotyping and share the recommendations on the slide. (Slide is animated to show the following suggestions on click.)
  o Tune-in to your own biases.
  o Be aware of inadvertently reinforcing gender stereotypes.
  o Observe the ways children’s choices seem influenced by gender.
  o Encourage boys and girls to do the same activities.
  o Use gender-neutral labels, such as “police officer,” “mail carrier,” and “firefighter.”
  o Expose children to models of people in non-traditional gender roles.

### Math Focus

5. Introduce Shape as described in Chapter 9 in the Big Ideas of Early Mathematics textbook.

• Define shape as the form of an object. Everything in the material world has a shape. In mathematics, the focus is on regular 2-dimensional shapes and 3-dimensional shapes.
• Give students a minute to make a list of all the 2-dimensional and 3-dimensional shapes they can think of.
• Point out that each shape they have on their list can be defined by rules such as:
  o number of sides
  o lengths of sides
  o sizes of angles
  o number and shapes of faces (for 3-dimensional shapes)
• Present students with the classic mistakes that early childhood teachers often make when working with shape:
  o Limiting the learning objective to simply recognizing and naming shapes.
  o Presenting only typical, stereotyped versions of each shape.
• Ask students why these practices are called mistakes. Stress that shapes are often introduced to young children in very rigid ways. For example, if only exposed to a triangle with a horizontal base, they may not realize that there are different types of triangles. Stress that knowing the names of shapes is not the same thing as understanding the “rules” that govern shapes.
• To demonstrate the importance of focusing on understanding the “rules” that govern shapes, have students discuss the questions on the slide about what makes a triangle a triangle.
• Debrief the triangle activity by asking students to share their definitions of a triangle, one that is true for all triangles. Based on their responses, help
them construct a more precise definition, such as *A triangle is a closed shape with three straight sides that meet at three corners.*

- Reiterate the importance of going beyond the use of superficial shape labels to recognizing and specifying the defining attributes of shapes.
- Highlight key practices that help children more fully build understandings about shapes. (Slide is animated to show the following suggestions on click.)
  - Provide a diversity of shape examples beyond stereotyped versions.
  - Keep the focus on creative exploration of shapes.
  - Scaffold to help children make their own discoveries.
  - Engage children in rich discussion about shapes and their attributes and help them become more precise in their definitions.
  - Make connections to real world uses of shape – why some things are made in one shape for a particular purpose.

6. Introduce the Big Ideas about Shape from the *Big Ideas of Early Mathematics* textbook.

  **#1. Shapes can be defined and classified by their attributes.** As children sort and classify shapes, they become aware of rules about shapes. These distinctions are not immediately obvious to children; for this reason, it is important for teachers to be intentional and to design activities that show them that shapes can be defined and classified according to their attributes.

  **#2. The flat faces of solid (three-dimensional) shapes are two-dimensional shapes.** As they explore three-dimensional solids, children will discover that the faces (or sides) of these solids look like circles, rectangles, triangles, and other common two-dimensional shapes.

  **#3. Shapes can be combined and separated (composed and decomposed) to make new shapes.** Opportunities to combine, rotate, and compare shapes will help children develop understanding of part/whole relationships within and among shapes, as when two identical right triangles can be combined to make a rectangle. This is the idea that there are shapes within shapes.

7. Show the 3 slides of examples of classroom activities and materials that reinforce the Big Ideas about Shape.

8. Watch and discuss the Erikson video: “Composing Shapes with Child 12.”

   The video shows a child composing a 6-pointed star shape using pattern blocks in multiple ways.

   - After watching, ask students why they think the activity (composing a shape using pattern blocks in multiple ways) is a worthwhile activity for young children.
   - Building on their responses, make the following points:
     - It gives them opportunities to explore how shapes can be combined and separated (composed and decomposed) to make new shapes.
9. Discuss the rationale for including a variety of building materials in the early childhood classroom.
   • Ask, “Why is it important to create a classroom environment that supports children’s building?”
   • Emphasize that research shows that block play and other building and constructing activities promote development in the following areas:
     o Math
     o Science
     o Engineering
     o Language
     o Critical thinking
     o Social-emotional
     o Creativity
     o Art
     o Social Studies
   • Show the slide listing specific ways that building with blocks and other materials develops a wide range of early learning abilities in STEM.
   • Show the list of ideas for materials that offer children hands-on building experiences. Make the point that when children have experiences building with many different kinds of materials, they begin to notice how attributes such as shape, size, texture, and weight affect the design and stability of their constructions.

10. Give a definition for a structure.
   • Define a structure as a form that keeps its shape. Structures may be made of one or more parts that are arranged and connected together in a special way to provide support and stability.
   • You may want to give the example of a flat sheet of paper. Hold up a piece of paper. It has a shape, but could we say it is a good structure? A single, flat sheet of paper is not a good structure because it easily bends and flops. How can we make the same sheet of paper a rigid structure? We would need to experiment with different materials and support systems. We would need to be engineers and design, test, build, and improve our designs.

11. Structures Group Activity.
   • Tell students that they are going to have time to explore and build with the different materials each group brought to class. Go over the plan and timing for each part of the activity. Approximate times are suggested below:
• Groups build with materials they brought for their assigned activity (10 minutes)
• Groups introduce their activity and materials to whole class (3 minutes per group)
• Groups rotate through stations (5-7 minutes per station)
• Debrief activities (10 minutes)

• Reiterate the importance of adults having their own firsthand experiences in order to better appreciate the potential of these materials in children’s play and learning.
• Direct groups to explore and build with their materials. Give them several minutes warning before they need to stop.

Instructor Note:
This is a very open-ended exploration. While students are building, circulate around the room encouraging their trial and error, problem solving, creativity, and collaboration. Point out the science, math, and engineering aspects of what they are doing. Model scaffolding and rich use of language and vocabulary. Encourage students to pay attention to how they are using their spatial reasoning and problem solving skills and what theories they are formulating and testing.

• After about 10 minutes, get the students’ attention. Instruct them to pause in what they are doing, and to discuss the following questions at their tables:
  o How might a teacher introduce the materials to children to engage their interest?
  o What rules or guidelines for using the materials might be important to talk about with children?
• Ask each group to designate a spokesperson to give a quick introduction of their activity to the rest of the class based on the questions above. Have each group’s spokesperson briefly introduce their activity. Keep a close eye on the time.
• Rotate groups in an organized way through the stations so that all students have a chance to try out each of the activities. Use a signal, such as a clap pattern, to let students know when it is time to move to a new station.
• To debrief, use the reflection questions to prompt students to share their thoughts about each of the Structures activities.
  o What goal did you have in mind while building with the materials at this station?
  o What thoughts do you have about using these materials with children?
  o What science, engineering, and math thinking skills might children use while exploring these materials?

Clean up: Direct students to clean up the Structures activities.

12. Show photos of children doing Structures activities. Ask for students’ ideas on modifications for different ages and developmental levels.
13. **Share tips for teachers.** (Bullets are animated to appear on click.)

- **Do not build for children:** The learning comes from children experimenting on their own and discovering concepts instead of having someone tell or show them.
- **Do not show solutions:** Allow children to construct their own knowledge and learn from their mistakes by problem solving to “make things work.”
- **Ask questions to help children solve problems:** Pose questions such as, “What could you do to help your tower stay up instead of fall down?”
- **Narrate children’s actions:** When adults comment and describe what children are doing, it builds language and conceptual understanding.
- **Give children extended work time, do not rush them.**

14. **Looking ahead to next session.**

- **Review homework assignment due next session.**
- **Review materials to bring for next session:** Give out the list of materials to bring for the Invention Center exemplar activity. Depending on your class, you might want to have people sign up for what they will bring, or leave it open. Emphasize that student-supplied materials are essential for the hands-on activities in each class.