INSTRUCTOR GUIDE

SESSION TWELVE

STUDENT LEARNING GOALS

- Understand the importance of pattern concepts as foundational for all mathematical understanding.
- Recognize types of patterns most accessible to young children.
- Use science process skills to investigate seeds.
- Generate ideas for children to explore and learn about seeds and plant growth in ongoing ways.

Materials List

General

- Computer with internet access/speakers
- PowerPoint slides for Session 12 (downloaded from website)
- Data projector
- Sign-in sheet (customizable printable)
- Course Reader
- Big Ideas of Early Mathematics textbook

For the Math Focus

- Unifix® cubes (each student will need a total of 9 cubes – 3 cubes each of 3 different colors)
- Containers for Unifix® cubes, such as tubs or bowls (1 per group)
- Dry mixed beans with 3 or more different kinds of beans (such as lima, pinto, and black), enough for students to use to make patterns
- Paper bowls (several per group for holding beans)
- White or colored paper for background for bean patterns (1 per student)
- Recommended: The Napping House by Audrey Wood

For the Arrival Activity

- Plastic sealable bags, sandwich or quart-sized (1 per student)
- Paper towels (2 per student)
- Small bottle or cup of water (1 per table)
- Permanent markers (1 per table)

For the Science Focus

- Discovering Seeds exemplar activity guide
- Paper plates (1 per student plus extras for collecting seeds and pieces of fruits for tasting)
- Plastic knives (1 per student)
- Plastic spoons for removing seeds (several per table)
- Napkins for tasting fruits (1 per student)
- Magnifying lenses
- Optional: a few unusual fruits such as fig, persimmon, star fruit, dragon fruit, tamarind, passion fruit, lychee
- Students provide: assorted fruits

Additional Copies/Handouts

- Reflective Essay assignment
### Session at a Glance

<table>
<thead>
<tr>
<th>Topic</th>
<th>Description</th>
<th>Estimated Time (In Minutes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arrival Activity</td>
<td>Students follow directions on the “Germinating Seeds with Children” handout in their Course Reader to set up their own seed germination experiment in a plastic bag to observe the growth of a seedling over the coming weeks.</td>
<td>15</td>
</tr>
<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>Discussion: Sharing responses from previous session’s homework assignment</td>
<td>Students discuss the scenario from the homework assignment about a father who wants his child to do math worksheets in preschool. They share ideas for strategies to support families in understanding their children’s learning and development.</td>
<td>15</td>
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<tr>
<td>Math Focus: Patterns</td>
<td>Students explore the big ideas about pattern and are introduced to the different types of patterns (visual, auditory, movement, temporal, and numerical). They differentiate between repeating and growing patterns and linear and non-linear patterns. They watch and discuss an Erikson video about a classroom activity based on the book <em>The Napping House</em>.</td>
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<tr>
<td>Science Focus: Discovering Seeds</td>
<td>Students participate in the exemplar activity: Discovering Seeds. They cut open different fruits and compare the seeds inside. They make observations about the size, shapes, colors, and numbers of the different seeds. They watch a PBS Learning Media video showing children engaged in various activities with seeds and planting.</td>
<td>45</td>
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<tr>
<td>Looking Ahead to Next Session</td>
<td>Assign and introduce the Reflective Essay. 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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</tr>
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**Total Estimated Time:** 2 hr 30 min

### Before Session
- Review the materials relevant to this session:
  - Chapter 5: Pattern in *Big Ideas of Early Mathematics*
  - Exemplar activity guide: Discovering Seeds
  - PowerPoint for Session 12 (downloaded from website)
  - Reader Section: Session 12
  - Reflective Essay Assignment
- Make copies of any printables and/or handouts.
- Set up materials:
  - Place the materials for the Seed Germination Arrival Activity on the tables. For each student: 1 sealable plastic bag and 2 paper towels. For each table: bowl of mixed beans, 1 cup or bottle of water, one permanent marker for writing names on bags.
  - Prepare a container of Unifix® cubes for each table containing 3 different colors of cubes. Ideally, each student will have 9 cubes (3 of each of the 3 colors), but they can also work in pairs.
  - Have a tray nearby the area where you will model the Engage part of the exemplar activity with a paper plate, plastic knife, and plastic spoon.

### As Students Arrive
- Have students sign in on attendance sheet and check off if they brought their fruit to class.
- Have students turn in their homework **at the end of class** since they will be referring to it in class discussion.
Arrival Activity: Students follow the directions on the “Germinating Seeds with Children” handout (in their Course Reader) to set up their seed germination experiment in plastic bags. They will take their bags home, observe them, and then bring them back to the next session.

Note: No soil is needed because a seed has its own food needed to sprout.

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. Have students discuss the scenario from the homework assignment about a father who wants his child to do math worksheets in preschool.
   - Ask students to talk in small groups about their ideas for helping the father reconceptualize how to help his child prepare for kindergarten math.
     - How can the teacher present their perspective while respecting the parent’s concerns?
     - What activities would they suggest he do at home with his child that would be more developmentally appropriate than a worksheet with arithmetic equations?
   - Have groups share out highlights from their discussion, good ideas that were shared, and any questions that arose.
   - Building on what comes up in the discussion, stress the importance of approaching this situation from a strengths-based perspective. Both the father and the teacher are concerned with the child’s school readiness. Starting with this shared interest helps the teacher/parent relationship to stay positive and create an attitude of partnership rather than defensiveness. Review the key elements of a strengths-based approach:
     - Family-centered
     - Values the capacities, skills, knowledge, and potential of individuals, families, and communities
     - Focuses on assets and shared goals, instead of deficits and obstacles
     - Builds on opportunities that already exist
Math Focus

4. Introduce Pattern as described in Chapter 5 in the Big Ideas of Early Mathematics textbook.
   - Ask students what words and phrases come to mind when they think of patterns.
   - Display the slide with the definition from the textbook: “A pattern constitutes a predictable sequence of objects or numbers in which all the members are related with each other by a specific rule or rules.”
   - Ask students to look at the pattern examples on the slide. For each example, ask a volunteer to describe what the predictable sequence is and what rule each pattern follows.
   - Emphasize that children innately look for patterns in their world. Since patterns are all around us, there are many opportunities to explore patterns with children through everyday play and experiences as well as through more structured math-focused activities.
   - Use the next 6 slides to illustrate that patterns exist in many forms. Challenge students to think of more examples for each category below:
     - Visual patterns (two slides): those we see in common objects, in buildings, and in nature.
     - Auditory patterns: those we hear in musical rhythms, bird songs, clock ticking, sound of footsteps. Ask students to close their eyes. Make a pattern with your footsteps for them to listen to.
     - Movement patterns: those found in dance and walking. Have the students stand up and do some movement patterns such as skipping in place, “Head, Shoulders, Knees, and Toes” or a dance move such as a salsa step. Ask students for suggestions.
     - Temporal patterns: include hours and minutes, days of the week, or the seasons.
     - Numerical patterns: those found in the sequence of odd and even numbers, as exist in the progression of square numbers, and in the predictability of base-10 number system as seen in the 100s chart.
   - Ask students to look around the room and notice patterns. Ask them to explain the pattern; i.e. what is predictable and what specific rule or rules does the pattern follow?

5. Engage students in making repeating patterns with Unifix® cubes.
   - Give each table of tub of Unifix® cubes. Direct students to make a pattern with 3 repeating colors, such as blue, red, yellow and repeat until they have 9 cubes altogether. (If you don’t have enough multiples of the same three colors for all students, they can use any three colors of cubes as long as they follow the given structure: ABCABCABC.)
   - Tell them to think of the mathematical relationship between the color pattern and number. Challenge them to try to figure out what color will be in the 27th position. What about the 301st position? Tell them to first think about it themselves, and then talk at tables. Some will find it easier than
others - that’s fine. It’s not a test, but an opportunity to understand a mathematical relationship.

- Have different students explain how they figured out the answers. It’s the structure of the pattern that allows us to make these predictions.

**Answers:** The answers are animated to appear on click. In the example on the slide, the 27th cube would be yellow or C; the 301st cube would be blue or A.
- Show the slide that explains one way to figure out the answers, and allow time for them to solidify their understanding.

6. **Differentiate between repeating and growing patterns.**
   - Remind students that patterns are predictable and follow a certain rule (or rules). Patterns can be “repeating” or “growing.” Explain the difference.
   - **Repeating patterns:** always have a unit of repeat. With the Unifix® cube activity, the unit of repeat was blue, red, yellow (or whichever three colors were used). Have students follow a clap, clap, snap, snap pattern and ask them to identify the unit of repeat. Repeating patterns are everywhere – in visual, auditory, movement, temporal, and numerical patterns.
     - Ask students to identify the unit of repeat in the examples of repeating patterns on the slide.
     - Ask them to think of other repeating patterns. Some examples of repeating patterns are:
       - Day, night, day, night, etc.
       - 5 days of school, 2 days off, etc.
       - Breakfast, lunch, dinner, etc.
       - Life cycle patterns (for example, egg to frog)
       - Songs like “Head, Shoulders, Knees, and Toes,” “Hokey Pokey,” “Wheels on the Bus,” etc.
   - **Growing patterns:** Children can also work with growing patterns. Growing patterns increase or decrease by a constant amount. The most basic is our counting system: 1, 2, 3, 4, 5… The pattern is ‘plus one’.
     - Ask students to identify the rule for each of the growing patterns illustrated on the slides (second slide is animated to show rules on click).

7. **Show the book The Napping House by Audrey Wood as an example of a literature connection to learning about patterns.** If you don’t have the book, show the sample pages on the PowerPoint slides.
   - Read the story or ask a volunteer to read it. The story has a rhythmic and repetitive text and is based on a simple growing pattern. On each page, one more character piles onto the bed. Then when a flea bites the mouse, the characters fall out of the bed one by one.

8. **Watch and discuss the Erikson math video: Who is Napping?**
   - The video shows how a teacher uses the story to engage children in thinking about growing patterns.
• After watching the video, ask students for their reaction to the activity. You might point out how the context of the story helps children to understand how a growing pattern works. You might also mention that it would be important to make sure that children are familiar with the story prior to the activity.

10. Provide free exploration time for students to make patterns with beans.
• Let students know that they are going to have some exploration time to make patterns with beans. They can make simple or more complicated patterns. This is time to explore, be creative, and have fun.
• Give each table a bowl of dry mixed beans containing at least 3 different kinds of beans and white or colored paper to use as a background.
• Go over the directions for sharing and discussing their pattern with a partner.

11. Introduce the Big Ideas about Pattern from the Big Ideas of Early Mathematics textbook.

#1. Patterns are sequences governed by a rule.
  o In all the examples we have seen, there was a rule. Teachers can build on children’s natural tendency to find patterns everywhere in order to make children’s knowledge more precise and mathematical.

#2. Identifying the rule of a pattern brings predictability and allows us to make generalizations.
  o Knowing the rule of a pattern allows one to predict what comes next.
  o Once children identify the rule, they can extend the pattern. However, children can sometimes copy a pattern without identifying its rule.

#3. The same pattern structure can be found in many different forms.
  o This understanding develops over time and enables children to see connections and think about relationships apart from their physical form.
  o For example, we could represent the ABABABAB pattern structure through a visual, auditory, movement, temporal, or numerical pattern.

Science Focus

Note: You may want to take a break at this time so students can wash their hands before cutting open the fruits.

• 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

- Point out that when doing this activity with children, the teacher would normally bring in an assortment of 4-6 types of fruits, ideally some that are less familiar to children so they will be more surprised by what they find inside.
- Have the students each hold up the fruit they brought for everyone to see. Identify any that are unfamiliar and give students an opportunity to talk about their prior knowledge and experiences. Some students may have brought fruits that are connected to cultural or family traditions.
- Ask, “What do you notice about these fruits?”
- Ask them where they think fruits come from. (Children often say “the store.”) Continue the discussion to establish that they all grew on plants.
- Tell the students that they are going to explore the fruits by cutting them open with plastic knives to see what they look like on the inside.
- Explain that before cutting open the fruits at their tables, they should pass around the fruits and talk about their different characteristics (colors, shapes, textures, smells, etc.).
- Next they can cut them open with plastic knives to see what they look like on the inside. (Mention that with children, it is important to demonstrate how to safely use a plastic knife.)
- Ask for predictions:
  - What do you think we will find inside?
  - Will they all look the same on the inside? What do you think will be different about the insides of the fruits?
- Explain that there will be extra paper plates on the tables where they can place the seeds. They can also cut the fruits up into small pieces for tasting.
- Suggest that students may want to trade the fruit they brought with someone else from the class.

Explore

- Encourage students to use their senses (except taste, for now) to observe the assortment of fruits at their tables.
- Before opening the fruits, encourage them to make predictions about what the seeds will look like.
- Pass out paper plates, plastic knives, plastic spoons, paper towels, and magnifying lenses. They can use the plastic spoons to help remove seeds if needed.
- When seeds are discovered, have the students remove them and place them on a paper plate. Label the plate with the name of the fruit the seeds came from.
- Engage them in making comparisons about the sizes, shapes, and numbers of seeds they discover.
Note: Suggest that students visit the other tables to get a closer look at the variety of fruits and seeds being explored.

- Place the pieces of cut up fruit for tasting on separate plates.
- As the students finish the exploration, share the cut up pieces of fruit for tasting.

Reflect

- As an adult learner, what aspects of the Discovering Seeds experience were most meaningful and why? Encourage the students to talk about their discoveries. Ask questions such as:
  - What surprised you?
  - Are the seeds the same? How are they different?
  - Which kind of seed is your favorite? Why?
  - Where else have you seen seeds?
  - Why are seeds important?
- What are your thoughts on doing this activity with children?

Clean up: Direct students to clean up the fruit and seeds and wipe down the tables.

13. Show photos of children engaged in the Discovering Seeds activity. Ask for students’ ideas on modifications for different ages and developmental levels.

14. Song: Have everyone stand up and sing along.

   I’m a Little Seed
   (Sung to the tune of “I’m a Little Teapot”)  
   I’m a little seed in the dark, dark ground.
   Out comes the bright sun, big and round.
   Down comes the cool rain, soft and slow.
   Up comes the little plant, grow, grow, grow!

15. Show “Peep and the Big Wide World” educators video.


- Reiterate that the exemplar activities are “snapshots” of experiences that would ideally be part of a larger exploration of a certain topic. For example, if doing the Discovering Seeds exemplar activity with children, a teacher would probably provide many other opportunities for children to explore and learn about seeds and plant growth.
- Watch the video that shows how one childcare center incorporated exploring seeds and planting over a sustained period of time to provide children with connected learning experiences.
- After watching the video, ask students for their reactions to the activities featured in the video, the teacher’s facilitation, and children’s engagement.
- Let students know that “Peep and the Big Wide World” is a public television show that teaches preschool science and math through a cartoon.
The “Peep and the Big Wide World” website has curriculum, videos, and other teacher resources for parents and educators that students may be interested in further exploring. The “Peep” curriculum includes 6 units: Plants, Water, Shadows, Ramps, Sound, and Color.

Wrapping Up

16. Looking ahead to next week.
   • Assign Reflective Essay and go over questions on the assignment sheet.
   • 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 Seed germination bag (made during Arrival Activity)
     o Start collecting paper tubes (from paper towels and wrapping paper) and small boxes for Session 14. Each person will need to bring a bag full of these items.