

## SESSION ONE THINKING IN PATTERNS

### Outcomes

- To begin to develop a community of learners who are actively involved in learning
- To identify relationships in real life context
- To investigate patterns and relationships
- To use a table to record patterns and relationships

### Overview

The first session of Thinking in Patterns focuses on developing a climate for learning, and introducing participants to patterns, relationships and tables. Participants use manipulatives, pictures and/or numerical strategies to describe relationships and make predictions.

### Time

- 10-15 minutes** As participants arrive there are pattern activities for them to complete on the tables. The session formally begins with participants introducing themselves and sharing their reasons for attending this class.
- 10-15 minutes** Patterns and relationships expressed with an in/out table are introduced using non-mathematical relationships. Participants complete in/out tables, discuss the relationships and think of a new relationship to share with another group.
- 20-25 minutes** Participants use tables to study patterns in piles of cubes and record the number of cubes needed as the piles get taller.
- 25-30 minutes** Participants choose activities to do from **A Menu of Pattern Activities**.
- 20-25 minutes** After working on the activities, participants present their processes and solutions.
- 5-10 minutes** The session ends with participants reflecting on the mathematics of the session. Assignments for home are given.

### Materials

Facilitator	Transparencies (Eng. & Spanish)
<ul style="list-style-type: none"> <li>• Poster size copies of activities 1-4 in <b>A Menu of Pattern Activities</b></li> </ul>	<i>BLM 1: Patterns and Relationships</i> <i>BLM 2: Piles of Cubes I (optional)</i>
Participant	Handouts (English & Spanish)
<ul style="list-style-type: none"> <li>• Index Cards, 5 x 8 or Cardstock, 1 per participant</li> <li>• Markers, 2-3 per table</li> <li>• Pattern Blocks, 20-30 per table (optional)</li> <li>• Colored cubes (any type), 20-30 per table</li> <li>• Tiles or similar objects, 20-30 per table</li> <li>• Scissors, 2 per table (optional)</li> <li>• Flat toothpicks, 1 small box per group</li> </ul>	<p><b>One per participant for class</b></p> <i>BLM 1: Patterns and Relationships</i> <i>BLM 2: Piles of Cubes I</i> <i>BLM 3: A Menu of Pattern Activities</i> <p><b>One per participant for home</b></p> <i>BLM 1: Patterns and Relationships</i> <i>BLM 3: A Menu of Pattern Activities</i> <i>BLM 4: At Home With Patterns</i>

## Activities

Preparation of Classroom	Notes
<ol style="list-style-type: none"> <li>1. Have sets of pattern blocks or colored cubes on each table. As participants arrive, talk to them individually and have them begin to form patterns with the manipulatives.</li> <li>2. Have materials to make name tents on the tables.</li> <li>3. Prepare a sample of a name card with your name on it.</li> <li>4. Prepare posters of each of the problems in <b>A Menu of Pattern Activities</b> on large construction paper.</li> </ol>	<p>It is helpful to begin to know the participants as quickly as possible. Initial conversations should help them feel more comfortable. Making patterns with the materials is a non-threatening activity. Initial conversations will also help you be aware of the language preference of the participants.</p>
Getting to Know Each Other (10-15 minutes)	
<ol style="list-style-type: none"> <li>1. Introduce yourself and tell a little bit about your professional and personal background. If you have children be sure to talk about them. Parents will feel comfortable relating to you as a fellow parent.</li> <li>2. Give the participants information about this course and tell them that it is designed to: <ul style="list-style-type: none"> <li>• Increase their understanding of mathematics</li> <li>• Help them help their children learn mathematics</li> <li>• Give them an understanding of how mathematics is taught in today's classrooms</li> <li>• Provide an enjoyable learning experience with other adults</li> </ul> </li> <li>3. Have participants make a name tent card for themselves. Share a sample. Make sure to emphasize the use of large lettering that can be seen from afar.</li> <li>4. If the group is relatively small, less than 20 people, participants can introduce themselves and share some things about their children (number of children, schools attending). They can also share why they are attending this class and one thing they noticed about the patterns they made at their tables.</li> </ol> <p>If the class is large, having individual introductions can be very time consuming. An alternative approach is to have introductions at the tables. This can be followed by each table sharing some commonalities they found among themselves.</p>	<div data-bbox="971 1066 1360 1184" style="text-align: center;">  <p>Monica</p> </div> <p>Name tent cards can be made from large index cards or card stock. Using this material rather than paper is preferable as they will be used for each session.</p> <p>These introductions can have a positive impact on the comfort level of the participants while developing a community of learners. They engage participants in getting to know one another, give the instructor an opportunity to get to know the participants, and require the participants to take beginning steps in being active and communicating in the class.</p> <p>Encourage participants to share using their most comfortable language. Be prepared to have someone translate.</p>

## Activities

Patterns and Relationships (10-15 minutes)	Notes
<p>1. Discuss the concept of a pattern by asking participants when and how patterns are used in life. A good process to use is a think, pair, share process. Ask each person to think about patterns in their life, pair-up with another person and share their thoughts. Follow this by asking for ideas to be shared with the whole group.</p> <p>2. Discuss when and why patterns are taught in school and their importance in learning mathematics.</p> <p>3. Use the <b>Chart It!</b> to record words and definitions. Start with the word patterns. Define it or draw a non-verbal representation of it.</p> <p>4. Let participants know that they will be studying patterns throughout this course. Say: <i>In order to find a pattern in a group of items, we study the relationship between the items. We will start by looking at relationships.</i></p> <p>5. Display <b>Patterns and Relationships</b>. Show and discuss the first table before discussing the others. Require participants to describe the relationship of the pattern by asking:</p> <ul style="list-style-type: none"> <li>• <i>How did you decide on what to replace the questions mark with?</i></li> <li>• <i>What is the relationship between the words in the first column and the second column?</i></li> </ul> <p>6. Record answers as they are shared.</p> <p>7. Distribute a copy of <b>Patterns and Relationships</b> to each participant. Ask them to find the relationship by looking for patterns in the tables and then decide on the missing information. After completing the tables, they can compare with others at their table.</p> <p>8. Have volunteers share the missing information and describe the relationship.</p> <p>9. Use the overhead projector to record answers on the transparency of <b>Patterns and Relationships</b>.</p> <p>10. Introduce other examples if desired.</p>	<p>This approach engages all and helps those who may be intimidated to be more actively involved. Ideas such as quilting and tiling usually are shared.</p> <p>It is particularly helpful to share some basic information about how and when patterns are taught in the local schools.</p> <div data-bbox="1133 632 1334 947" data-label="Image"> </div> <p>Be aware that using the word “algebra” may be intimidating for some at this early stage of the course.</p> <p>Recording responses on chart paper is helpful for all learners but especially for English Language Learners (ELLs).</p> <p>If there are ELL participants, use pointing or other gestures to indicate what you mean by column.</p> <p>Think ahead about whether the contexts in <b>Patterns and Relationships</b> will work for your group. Change them if necessary. It is sometimes best to make tables with relationships that fit a local context (local sports teams and types of team, business names and types of business, schools and mascots, etc.)</p>

**Activities**

**Mathematical Patterns and Relationships  
(20-25 minutes)**

1. Let participants know that they will now work with patterns and relationships that are more mathematical in nature.

2. Distribute **Piles of Cubes I**. Displaying the transparency is optional.

3. Using cubes build Pile 1. Display the structure so that everyone can see it. Ask:

*How many cubes are there in this pile?*

4. Build Pile 2. Ask:

*How many cubes are there in this pile?*

5. Begin a table that shows the relationship between the pile number and the number of cubes by asking:

*So, pile 1 has how many cubes? Pile 2 has how many cubes?*

6. Ask:

*If this is the 3<sup>rd</sup> pile, what should we write in the table?*

Record 3 and 10 in the appropriate columns.

7. First have the participants build the 4<sup>th</sup> and 5<sup>th</sup> piles and complete the table. Ask for a volunteer or two to share the number of cubes for piles four and five. Ask questions such as:

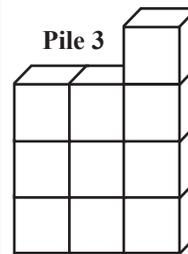
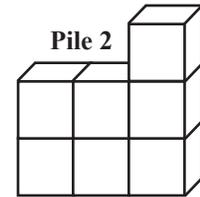
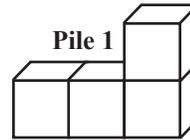
- *What kind of patterns do you see?*
- *How did you know that there are 16 cubes in pile 5?*
- *Is there another way to find that number?*

8. Then ask:

- *Could you build pile 10?*
- *What would it look like?*
- *How many cubes would it have?*

Walk around observing and answering questions as participants work. This will get you familiar with the types of strategies being used.

Have participants share various ways to find the number of cubes in pile 10. It is important to share as many different ways as possible. Invite them to share their thinking using chart paper or the overhead projector. If they are uncomfortable in doing so, you can record their thinking for them.



Pile Number	Number of Cubes
1	4
2	7
3	10
4	
5	
10	

It is important to distribute **Piles of Cubes I** after the participants have manipulated the cubes. The focus should first be on examining the patterns using objects. Encourage them to take notes of the thinking of others.

Participants see patterns in the table or see patterns using the cubes. Using the table some notice that the number of cubes for a pile is 3 more than those in the previous pile. Others use the cubes to determine that the pile number tells the number of groups of three and that one needs to be added to this.

Some methods which have been used to find the number of cubes in pile 10 are:

- Completing the table to pile 10;
- Using the fact that the 5<sup>th</sup> pile has 16 cubes so there must be 15 (3cubes for each of the next 5 rows) more cubes in the 10<sup>th</sup> pile;

## Activities

### Mathematical Patterns and Relationships (continued)

Emphasize that there is not just one correct method to solve this problem.

9. To lay a foundation for writing equations lead a discussion using the following questions:

- *Where do you see the 3 in the piles?*
- *Where do you see the 3 in the table?*
- *Where do you see the 1 in the piles?*
- *Where do you see the 1 in the table?*

Try to get them to express that the 1 is always there no matter how many 3s there are.

10. Give participants individual time to reflect on what they know or what questions they have about the cube problem.

11. Have them pair up with another person at their table and take turns sharing one thing they understand or one question they have. Give them about 5 minutes to do this.

12. Ask if there are comments or questions from their discussion that they would like to share. Take time to clarify any questions. Record any main ideas on **Chart It!**.

13. Have participants record any ideas they want to remember on their sheets.

14. Tell them that they will be spending the rest of the session with tables and patterns.

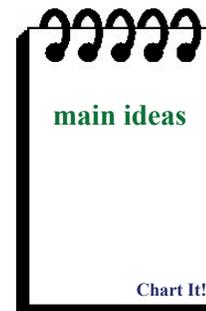
### Notes

- Multiplying 3 by 5 and adding 1;
- Using a variation of the expression  $3p + 1$ . If this occurs, let others know that they will be learning about this later in the course but do not dwell on it at this time.

Since this is the first session, it may be premature for some of the participants enough to come up and write their answers. It sometimes, but not always, takes time to develop the culture in the classroom where all of the participants are comfortable in doing that. Participants will usually have difficulty “seeing” the 1 in the table. There are a few ways to bring this out. One method is to rewrite the number of cubes using 3s.

A second method is to get them to think about the following question: if it was possible to have a zero pile, how many cubes would it have?

Pile Number	Number of Cubes	
1	4	$3 + 1$
2	7	$3 + 3 + 1$
3	10	$3 + 3 + 3 + 1$
4		
5		
10		



## Activities

A Menu of Pattern Activities (25-30 minutes)	Notes
<p>1. Ask participants to think about a menu and what one does when they are given a menu. Have one or two people share their thoughts. Tell them that they will be given a menu of activities. They will choose an activity. When they complete an activity and they are still hungry for more mathematics they can choose another activity.</p> <p>2. Around the room display the poster size copies of each problem in <b>A Menu of Pattern Activities</b>. Have the appropriate materials next to the displayed poster. Let them know that they will now be looking at patterns and relationships similar to the previous piles and cubes problem.</p> <p>3. Read the instructions for each activity. Clarify any questions that they have about the activities. Share the kinds of materials that are available for their use. Let them know that they should work in pairs or threes and choose any activity as a starting point. When they finish one activity, they can try another one. For this first exploration, encourage them to use the materials.</p> <p>4. Distribute copies of <b>A Menu of Pattern Activities</b> at this time.</p> <p>5. As they work spend a little time with each group to answer questions, ask questions, and become familiar with the successes and struggles of each group. Make decisions about which activity each group should present as you walk around.</p>	<p>Posters of each problem allow the instructor to point out specific items about each problem. Having participants move about encourages the “doing” of math in a relaxing manner. The posters will be used in a later session.</p> <p>This gives them freedom of choice and time to complete as many activities as possible.</p> <p>It is helpful to have the participants work in groups of no more than three since larger groups often result in less participation of some of the participants, especially those with less experience. Groups of two that can merge into groups of four to discuss findings often function well.</p> <p>Using algebra: Finding an algebraic rule for the relationship is not necessary at this time. Some participants may write a formula. This can be intimidating for others so it is helpful to not encourage it. Ask those who know some algebra to:</p> <ul style="list-style-type: none"> <li>• Try and find another method that doesn't use algebra</li> <li>• To write the relationship in words, e.g., “For every story, I added three toothpicks to the house.”</li> <li>• To study the manipulatives and try to connect them to the expression/equation they wrote</li> </ul>

## Activities

Presentations (20-25 minutes)	Notes
<p>1. When there is about 40 minutes left in the session choose participants to share specific activities. Give them chart paper and markers or an overhead transparency and pens for preparing their presentation.</p> <p>2. Some participants will not be comfortable giving an oral presentation at this time. If this occurs the facilitator can present the group's findings while asking questions such as:</p> <ul style="list-style-type: none"> <li>• <i>How did you figure this out?</i></li> <li>• <i>What pattern(s) do you see?</i></li> <li>• <i>Can you describe the relationship between the first column and the second column?</i></li> <li>• <i>Does anyone have a different way to explain it?</i></li> <li>• <i>Can you use what you learned about the flying V's to help you decide on the number of planes in the Flying W's?</i></li> </ul>	<p>If any participants have used an algebraic method, have them share last. Avoid getting into a deep discussion about variables, expressions or equations at this time. Tell participants that they will be learning about this later.</p>
Closure (5 minutes)	
<p>1. Ask the participants to discuss the following questions in their groups:</p> <ul style="list-style-type: none"> <li>• <i>What mathematics did you work with tonight?</i></li> <li>• <i>What are some of the terms we used? [table, pattern, relationship, names of polygons(if pattern blocks were used), diagonal]</i></li> <li>• <i>What can you do at home with your children to develop their understanding and recognition of patterns?</i></li> </ul> <p>2. Record comments as they are shared in the large group, making sure to add any new terms to <b>Chart It!</b>.</p> <p>3. Have participants place their name tent cards in their notebooks or collect them for use in the next session.</p>	
Take Home Activities (5 minutes)	
<p>1. Copies of <b>Relationships and Patterns</b> and <b>A Menu of Activities</b> should have been handed out previously but if not, they should be available for all to take home.</p> <p>2. Briefly discuss the <b>At Home with Patterns</b> handout letting everyone know that they should be ready to discuss any one of the three activities at the next class.</p>	

**Activities**

Preparation for the Next Session	Notes
<ol style="list-style-type: none"><li>1. Save the <b>Chart It!</b> and bring it to the next class.</li><li>2. Optional:<ul style="list-style-type: none"><li>• Type the notes on the <b>Chart It!</b> and distribute at the next session.</li><li>• Take digital pictures of each chart. Prepare handouts of these pictures.</li></ul></li></ol>	