Patterns (and Relationships)

What are the patterning skills of a young child?

Recognizing patterns is an important component of a child's intellectual development. Children learn to organize their world through their understanding of patterns. They recognize patterns of all sorts in their surroundings and gradually begin to use this as a strategy for problem solving and as a tool for developing understandings (often initially over-generalizing or under-generalizing). For young children, patterns are the first step in their development of algebraic thinking.

Some believe that patterns and relations are the essence of mathematics. Mathematics is about structures (number structures, geometric structures, algebraic structures,…). Uncovering patterns and relationships gives us clues to underlying structures and helps us predict what might come next, before it happens. Instruction that focuses on patterns and relationships appears to be more effective than drill in promoting retention and transfer of knowledge.

The word pattern is used in several ways in the English language. Patterns extend and therefore can lead to predictions and generalizations. For young children, mathematical patterns can be chunks that repeat (ABABAB…) or grow (ABAAABAAAB…). Relations reveal the reasons particular things are connected or linked. A function is a special relation for which there is only one link associated with an object. They are
often visualized as machines that if you put one thing in, you get one consistent output.

For more information about theories behind developing patterning for young children, see Children's Thinking about Making Connections and the Teacher's Role in Instruction from TEXTEAMS Mathematics Institute Pre-Kindergarten/Kindergarten.

**From the Texas Prekindergarten Curriculum Guidelines**

The child:

- Imitates pattern sounds and physical movements (e.g., clap, stomp, clap, stomp,…).
- Recognizes and reproduces simple patterns of concrete objects (e.g., a string of beads that are yellow, blue, blue, yellow, blue, blue)
- Begins to recognize patterns in their environment (e.g., day follows night, repeated phrases in storybooks, patterns in carpeting or clothing)
- Begins to predict what comes next when patterns are extended.

**Clarifying Activities:**

**Sample Activities with ongoing observation tips for patterns and relationships:**

It is vital that mathematical content and teaching methods for young children be child-centered and developmentally appropriate. That is, the children's thoughts, words, actions, interests, and needs are the basis for instructional activities. Young children need opportunities to explore their world and experience mathematics through their play. While children need always to be at the center directing their mathematics development, the following contains examples of child-tested instructional activities suitable for home, preschool, Prekindergarten classrooms, and other informal learning environments.

**Activity for Patterning:**

Children have a sound parade by imitating musical patterns with child-made instruments while marching around the classroom, hallway, or playground. Children can create and decorate oatmeal box drums, Paper Mache maracas, tongue depressors with bells, or plastic plate guitar. To extend into creating physical patterns, encourage the children to use patterns to decorate their instruments by using patterning in models you may prepare and by providing materials that can be easily used to create patterns.

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**Questions to ask:**
Start with:

- Can you imitate the sounds I make?

Probe further with:

- What do you notice about the sounds I am making?
- Do you hear a pattern?
- How do you know what comes next?

Examples of what to listen and look for:
(NOTE: This is not meant as checklist of expected skills to be mastered by students. There are no right or wrong answers. The intent for the questions and what to look and listen for is to provide adults with some guidance to help them observe children's mathematical thinking.)

Listen for:

- Children are imitating the sound pattern as they march.

Look for:

- Does the child seem to understand what a pattern is?
- How does the child begin to reproduce the pattern?
- Is there an apparent organized plan to the child's work?

If the child uses patterns to decorate:

Start with:

- Tell me about how you have decorated your instrument.

Probe further with:

- Tell me about your pattern.
- What shapes did you use?
- What sizes did you use?
- Did you use different sizes of the same shapes?
- How did you know what comes next?
- If you wanted to add a decoration here, what would you add? Why?

Activity for Patterning:

Children play a game of copying patterns made from pattern blocks or other manipulatives that the teacher introduces in large group, then in small group, and finally at the manipulative center.
Questions to ask:

Start with:

- Tell me about your pattern.

Probe further with:

- Can you "read" the pattern for me?
- How did you decide use this here?
- How did you know what comes next?

Examples of what to listen and look for:

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What to listen for:

- How well is the child able to describe the pattern?
- Is the child able to describe the pattern with ease?
- Can the child describe the pattern with some prompting?
- Does the child "read" from left to right and top to bottom?

What to look for:

- Does the child seem to understand what a pattern is?
- How does the child begin to reproduce the pattern?
- Is there an apparent organized plan to the child's work?
- Does the child match the pattern item by item or seem to look at larger unit repeats?
- Is the child able to reproduce many different kinds of Patterns (AB, AABB, ABC, AAB, ABB, etc.) over time?
- How many different kinds of patterns can the child reproduce?

Activity for Patterning:

String a bead necklace, eg. yellow, blue, blue, yellow, blue, blueÉ. Ask the children to make a necklace that has the same pattern as this one? Questions to ask:

Start with:

- Can you make a necklace that has the same pattern as this one?
Probe further with:

- Tell me about the pattern.
- What is the color of the first bead?
- Can you "read" the necklace pattern for me?
- How do you know what color comes next?
- Can you create your own necklace pattern?

Examples of what to listen and look for:
(NOTE: This is not meant as a checklist of expected skills to be mastered by students. There are no right or wrong answers. The intent for the questions and what to look and listen for is to provide adults with some guidance to help them observe children's mathematical thinking.)

What to listen for:

- How well is the child able to describe the pattern?
- Does the child "read" from left to right and top to bottom?

What to look for:

- Does the child seem to understand what a pattern is?
- How does the child begin to reproduce the pattern?
- Is there an apparent organized plan to the child's work?
- Does the child match the pattern item by item or seem to apply larger unit repeats?
- Does the child create her/his own patterns?
- Does the child notice patterns in their environment?

Activity for Patterning:  
*Candy Cane patterns*

Bring in a variety of candy canes with different stripe patterns for children to explore. Notice all of the patterns on the canes, discuss how they repeat, and as a whole group or small group, record the patterns on candy cane-shaped paper (cut manila paper into candy cane shapes. Each cane should be about 11/2 inches wide and 8-9 inches tall.) As a follow-up in a separate activity, provide children with crayons and blank candy cane papers and encourage them to create their own candy cane patterns. Hang finished canes on your classroom tree or use for decorations.

Questions to ask:

**Start with:**

- Tell me about this pattern.
- Can you show me the repeating part? Where does it stop? Where does it come again?
Probe further with:

- Oh, I see you have yellow, green, blue and now you are making another yellow. What will come next?
- Can you "read" this pattern?
- Will your candy cane have three stripes all the way down?
- How do you know what will come next?

Examples of what to listen and look for:
(NOTE: This is not meant as checklist of expected skills to be mastered by students. There are no right or wrong answers. The intent for the questions and what to look and listen for is to provide adults with some guidance to help them observe children's mathematical thinking.)

What to look and listen for:

- Can the child describe the pattern?
- Does the child carry the pattern all the way to the end?
- Does the child "read" the patterns made by other classmates?
- Can the child tell you what will come next?
- Does the child self-correct if the wrong crayon is picked up?
- Does the child organize his crayons systematically to facilitate the repeats? Does she have to hunt for the right one each time?
Math All Day: Centers and other Times

The mathematical content that is described in the Prekindergarten Curriculum Guidelines is integrally tied to the ways the classroom is structured and the types of experiences children encounter. Young children need opportunities to explore their world and experience mathematics through their play. Most mathematics learning in the early years does not require sitting down for group lessons. However, although learning is often informal, it is intentional and deliberate. Careful planning is required to build upon and extend the informal knowledge of the child. In Preschool and Prekindergarten classrooms, management techniques and room arrangements are of utmost importance. See books by Jean Feltman (For example, A Survival Guide for the Preschool Teacher) for classroom management ideas.

Well-placed discovery centers provide hands-on learning experiences that can engage children in mathematical thinking. All centers should all be equipped with writing tools so children can represent their mathematical thinking. You may rotate if you do not have room for all of the following centers in your classroom all year. Suggested centers include:

- **An Arts and Crafts Center** with plenty of markers, crayons, stamps, glues, watercolors, buttons, shells, clay, and other items for exploring, representing, and communicating. The materials should be easily accessible in sorted containers that the children are responsible for maintaining.
- **A Manipulative Center** with pegs and peg boards, interlocking blocks, beads, puzzles, and other items to sort, match, pattern, count, put together, and take apart.
- **A Sensory Table** filled with sand, rice, beans, leaves, water, ice, or other items. Include a variety of containers for pouring and measuring or small toys and other items for exploring other mathematical ideas such as patterning.
- **A Block Area** with blocks of various sizes and shapes for constructing and exploring.
- **A Dramatic Play Center** with number rich props such as an imaginary class phone directory, old phone books, play money, price tags, cash registers, bathroom scale, scales to weigh plastic fruit and vegetables, measuring cups and other items to recreate settings children experience in their lives.
- **A Literacy Center** with a chalkboard, felt-board, listening center, puppets and stage, and word display (that includes alphabet and numerals) for exploring and communicating mathematical ideas.
- **A Construction Center** with non-retracting measuring tools, empty boxes, straws, PVC, pulleys, hardhats, safety goggles, large nuts and bolts, aluminum foil, clay twine, blocks with holes, brads, dowel rods, paint stir sticks and other items to explore structures, measurement, spatial reasoning, and other mathematical ideas.
A Music and Creative Movement Center that has a large open area with a tape player, various musical instruments (store bought and child created), story props, scarves, streamers, pompoms and a wide variety of tapes with a wide variety of music styles for developing patterning, one-to-one correspondence, number sense, and communication skills.

Patterning at the Block center:

Let's Build a Beautiful Pattern Wall

Challenge a small group of children to build a pattern wall together in the block area. Start with: Begin the wall by laying rectangular prism blocks flat, on end, flat, on end, … Ask: Can you work together to continue the wall? Encourage the children to work together and communicate with each other about what blocks come next.

Tower Patterns

Watch as children work in the block center. Many times children will create structures with repeating patterns in a tower. Seize the opportunity to direct their attention to the patterns and have them continue to build, extending the pattern they have begun. For example, one of the simplest patterns in tower building involves two uprights topped with a crosspiece. Layered on top of that are two more uprights and another crosspiece. Children can go up several layers using a simple uprights-and-crosspiece repeating pattern. By simply being alert to what is already being done, you can provide children with vocabulary and bring their awareness to the repeating nature of their constructions. Use this new awareness to help them create even more elaborate repeating pattern towers. Reward creativity by capturing the towers with video or photographs.

A sample activity for Patterning at the Sensory Table:

Idea: Can you make patterns in the sand?

Show the children how to make holes, shapes, and imprints in the sand to get them started. Encourage them to make their own sand patterns.

Patterning at the Manipulative Center:

Use manipulatives of all kinds to make patterns. Give the children cards with patterns on them to copy and extend. Then encourage the children to create their own patterns. Encourage them to record their patterns (perhaps drawing them on paper and using the computer to stamp the pattern) so that others can copy them.

Circular Patterns
Patterns are not always linear. Introduce circular patterns using pattern blocks. Start with a yellow octagon in the center. Place green triangles around the octagon, base-to-edge. Note with child how the triangle placement repeats all the way around the octagon until you are back to the beginning and then keeps going around and around and around without interruption. Add another shape in between the green triangles. Again, note how the circular pattern completes itself and continues on in unending repetition. Encourage children to make their own circular patterns. You can use any regular polygon as the center for a circular pattern but beware the irregular polygons (no red trapezoids!)

**Patterning at the Art and Crafts Center:**

*What a Pretty Border*

Encourage the children to make stamp sponge patterns around the border of a paper to frame their art.

*More Pattern than Plain*

Ask children to make game pieces by creating pattern stampings on one face (one side) of five tongue depressors. Children then drop game pieces and count how many pretty faces show and how many are plain.

Winners have more pretty faces than plain.

*Colored Paper Patterns*

A variety of colored-paper is placed on the art center table. The children choose whatever colors they want to make their pattern and they glue the pieces together either in a tower pattern fashion or side-by-side fashion or a creative fashion of their own. Then the children can make a special picture on their colored paper pattern created by them.

*Bear Clothes*

After spending time in large or small group discussion of clothing patterns, put a stencil of a large bear (fits on an 8X11 paper) in the art center. Put in stencils for clothing (simple shirt and pants) or cutouts of shirts and pants to fit the bear. Students trace the bear shape onto paper and make clothes to dress the bear. Encourage students to make patterned clothing using stripes, polka dots, zigzags, or other repeating patterns and glue them onto their bears.

**Patterning at the Snack center:**

*Goldfish/Goldfish/Pretzel*

Make snack time a station. Children can gather their own snacks. Ask them to place on their napkin a pattern on display at the station then take the snack back to their seats. For
example, the pattern might be
Goldfish/Goldfish/pretzel/Goldfish/Goldfish/pretzel/Goldfish/Goldfish/pretzel,
so that each child's snack consists of 6 goldfish and 3 pretzels.

*Fruit-Kabobs*

Display a rebus with 3 picks, showing a grape, strawberry, and pineapple on each pick. (shows part, whole) The children take 3 picks and put a grape, strawberry, pineapple on each pick. They check each other to see if they are making the pattern. They then lay their picks of fruit on the paper towel to form the pattern of grape, strawberry, pineapple, grape, strawberry, pineapple, grape, strawberry, pineapple, pineapple.

How many strawberries are in the pattern? How many grapes? Pineapple pieces?

They may then eat their pattern of fruit for a snack.

*Patterns on a Log*

For this activity you will need pre-cut and pre-cleaned celery stalk (the leaf end off), a large jar of peanut butter, spoon and different small foods such as raisins, grapes, M&M, peanuts, etc. Each child gets a stalk of celery and with a spoon fills the entire insides of the celery stalk. The child then can take the small food and create a pattern such as: M&M, raisin, M&M, raisin, etc. After creating his/her pattern he/she can eat their pattern on a log.

Make sure to discuss proper health issues such as washing their hands, not putting their hands in their mouths, what to do if food falls on the floor.

*Patterning at the Technology center:*

*Pattern Stamps*

Use a stamping program to create pattern pictures.

*Patterning at the Music and Creative Movement Center:*

*Musical Patterns*

At the first part of the year I have different types of real world instruments such as tambourines, drums, maracas, guitar, etc. The children as a class create a symbol to represent each individual instrument then label a bucket with the appropriate symbol to go with each instrument. Throughout the year, in arts and craft center, children create instruments. I then place the child made instrument in the bucket with the real world instrument. Children then create their own musical pattern scores. The children get sentence strips and either draw the symbol or glue Xerox copies of the symbols that have been pre-cut and placed in bins. For instance, the child may have a musical pattern score:
guitar, drum, guitar, drum, etc. or maraca, maraca, tambourine, maraca, maraca, tambourine, etc. or any combination of instruments to create a musical pattern score. The children then hang their musical pattern score and play their music.

Another instrument that the children play with is a xylophone. The xylophone is has color-coded keys. The children make musical pattern scores with colored rectangular construction paper. For instance, red, blue, red, blue, etc. The children hit the appropriate color-coded keys. For more complex patterns, I then add different length of colored rectangular paper to the area so now the children have to work with two attributes. For instance, long blue, short red, long blue, short blue, short red, etc. The children then hit the appropriate keys by color and length.

For other musical pattern scores, I also add Xerox copies of different sound cards such as: stomp, clap, slap, snap, etc and different motion cards such as: jump, hop, skip, etc.

The children can now create sound and motion patterns.

**Animal Patterns**

Provide cutouts of farm animals, zoo animals, or pets. Provide some way for the cutouts to be displayed (felt board, magnet board, craft sticks in styrofoam, etc). Children create patterns using the animal shapes. For example, they may make a rabbit-bird, rabbit-bird pattern or cow-horse-pig, cow-horse-pig pattern. Children then use the pattern to direct themselves in a chorus (barnyard chorus, zoo cage chorus, etc.) As one child uses a pointer to follow the pattern left to right, the other children "read" the pattern by making the appropriate animal noises and actions (hop-flap, hop-flap or moo-neigh-oink, moo-neigh-oink.)

**Patterning in the Literacy Center:**

**Three Billy Goats Gruff**

After several readings of the story of the Three Goats Gruff, as a whole group or small group activity, retell the story using a pattern format to illustrate. For this story, you will need three goat shapes, three bridge shapes, and three troll shapes. As you retell the story, place or draw a goat shape, a bridge shape, and a troll shape for the first goat. Repeat for the next two goats. Your finished story pattern will look like this:

Goat-bridge-troll, goat-bridge-troll, goat-bridge-troll

Place this story pattern in the literacy center along with felt figures, finger puppets, or other props for story retelling. Children use the story pattern strip to help them in their story retelling. There are several books and stories that will fit well into this pattern format.

**Patterns in Our World**
Bring in photos or magazine pictures of buildings or patterns in architecture and have a classroom discussion. Go on a school tour and have the children discover patterns in the school architecture. Then take photos. Place the developed photos in the construction center and the children reconstruct the patterns from the photo with different construction manipulatives. Place architecture blue print paper if possible or plain paper so that the children can record by making architectural blue prints.

**Walking Tours for Patterns:**

*Playground Patterns*

The children take a walking tour of their playground and find all kinds of patterns. They see patterns of light, dark, light, dark, bark on the trees. They see big rocks, little rocks, big rocks, little rocks. They see blue swings, red swings, blue swings, red swings. After they have spent time finding all the different patterns give the children large butcher paper to record the patterns they have discovered on the playground. Also, the children can draw the patterns with sidewalk chalk on black butcher paper.

**Teacher Tips**

**How do you Instruct?**

I make patterns with large cardboard blocks or color paper on the floor (eg., red, yellow, red, yellow...) The children walk on the blocks and call out the pattern.

To teach the pattern of the order of our day, I write out and post your daily classroom schedule for the children to see. I also use pictures so that the children can easily read the classroom schedule. I have a digital clock and a clock with hands on the classroom calendar next to the class schedule at child level for the children to observe. On the classroom schedule I write the time in front of activity such as: read-a-loud time, calendar time, etc. so that the children can get the routine (pattern) of our school day. On the clock with the hands, place color coded dots around the clock on one-inch rings and the same color coded dots on the schedule next to the time. Every hour, an hour timer goes off on every hour and the clock monitor adds a ring around the clock with the hands so the children know what rotation we are on. For instance the first ring around the clock signifies 8 am-8:59 am, the second ring indicates 9 am-9:59, the third ring indicates 10 am-10:59 am and the fourth ring indicates 11 am-11:59 am. (I teach half days). So if we are about to go centers at 10:15, the third ring is around the clock with the hands and a color-coded dot is on the third ring next to the number 3 indicating 15 minutes. With this activity done daily the children begin to understand the sequential order of our school day, (patterning) and begin to understand time. We play sound pattern games using sounds like Moo, Woof, Moo, Woof.
We put the animals on a felt board to represent our sound pattern. This is a traveling center.

We use a felt board and colorful felt shapes to create a pattern station. I mix some manipulatives in other centers such as the block center or the sensory table once in awhile and encourage 3-D patterning.

**How do you use technology?**

Use a disposable camera to take pictures of patterns around the school with the children. We make a "Patterns in Our World Wall" and verbalize all the patterns we post there many times.

**Book Corner**


*Greg and Steve's Boogie Walk Kids in Motion CD*


Murphy, Stuart J., illustrated by Lois Ehlert. *A Pair of Socks.* Harper Collins.

Myers, Maggie, illustrated by Keli Frates. *Too Many Thanks.* The University of Texas, Dana Center.


Rosen, Michael, illustrated by Helen Oxenbury. *We're Going on a Bear Hunt.* Little Simon.

Williams, Rozanne L. illustrated by Kathleen Dunne. *Mr. Noisy's Book of Patterns.* Creative Teaching Press.