

Using SYMBOLS to build math skills

“I think we need to add some math activities to our schedule,” says Ms. Hudson, after the last 3-year-old has left for the day.

“You mean counting?” asks Ms. Jennings, her new aide.

“No, I’m talking about something more basic,” Ms. Hudson says. “Children have to understand that the word five stands for five things and that numbers follow a sequence. They must understand how to compare things like shape and size, make estimates, and measure length and weight.”

“How do we teach that?” asks Ms. Jennings.

“By asking them to observe and classify things, like who’s wearing sandals and who’s wearing athletic shoes. By setting up activities where they match or sort things, like sorting keys by size or shape. By seeing patterns, like the blue, yellow, and white stripes in a towel.”

“I get it,” says Ms. Jennings. “I thought math was math—you know, sitting down with pencil and paper and counting, adding,

and subtracting. Now I can see that it’s more than that, and it’s everywhere.”



Early education teachers are often stymied when they try to develop math activities that don’t feel like drill-and-kill exercises. Too often they think math is paper-and-pencil number work and forget that opportunities for math experiences underlie activities in every area of the classroom.

A child as young as 2 years can generally identify the larger of two objects—the bigger block, doll, or piece of cake, for example. With experience and increasing cognitive skill, children are able to classify, order, rank, and evaluate relationships among objects.

With these expanding skills, we introduce *patterns*, *charts*, and *graphs*. By creating patterns and building charts, children enhance classification skills and one-to-one correspondences. In making charts and graphs, children use

symbols to represent real objects. In all these activities, children collect and organize information, record it symbolically, and describe the information in mathematical relationships.

Children’s math skills grow through planned experiences and meaningful adult-child interactions. Consider your classroom’s learning centers—art, blocks, cooking, movement and music, and discovery. Integrate patterns, charts, and graphs as routine activities. The following activities offer suggestions.

Tools for chart and graph activities

Keep these materials on hand for planned and spontaneous charting and graphing activities.

- large, lined chart tablets
- pencils
- rulers
- spinners
- rubber stamps and ink pads
- string
- scissors

Art

In the art center, children can use materials and activities to explore math concepts like *classification*, *sequence*, and *symbol*. A simple exercise in classification, for example, is to group similar items together, such as picking out all the yellow pencils from a pencil holder and putting them in a box.

An important math skill is *seriation*, the ability to arrange objects in order by size. A simple exercise in seriation is to line up crayons, pencils, or collage materials from longest to shortest, for example. A related skill, *gradation*, would be to arrange in gradual stages, as in sorting paint color chips from lightest to darkest.

Crayon sort

(ages 3 and older)

Here's what you need:

- crayons
- containers, such as recycled food cans, margarine tubs, or small cereal boxes

1. Decorate the outside of the containers with the crayon labels or construction paper that matches the crayon color, as desired.
2. Give children a pile of crayons and invite them to sort according to color.

Variations: Invite children to sort pencils, paintbrushes, or colored paper squares.

Mosaic art

(ages 3 and older)

Here's what you need:

- colored paper
- glue sticks
- mural paper
- scissors or paper cutter
- photographs of mosaics and square tile patterns

1. Cut hundreds of 2-inch squares out of colored paper. A paper cutter makes this quick work. You can also buy precut, adhesive-backed paper squares at craft stores. Cut a length of mural paper and attach it to a wall near the floor.

2. Introduce the activity by talking about *squares*. Show the children that each piece of paper has four sides and four corners and that each side is the same length. All the pieces are the same size; there are many different colors.
3. Invite them to contribute to the mural by creating designs with the paper tiles.
4. With older children, reinforce geometry and spatial relationships. Show how a drawn 4-inch square can be filled with four 2-inch paper tiles. Challenge the children with larger and larger squares: How many paper tiles does it take to fill a 16-inch square or a 24-inch square?



Bead trade

(ages 5 and older)

Here's what you need:

- flour
- cornstarch
- salt
- paste food coloring
- small pitcher of water
- measuring utensils
- spoons
- bowls
- index cards
- zip-top plastic bags
- toothpicks
- string
- fine-tipped markers

1. Put the flour, cornstarch, and salt into separate bowls with measuring spoons. Nine tablespoons of flour, 6 tablespoons of salt, and 6 tablespoons of cornstarch will make about one cup of bead clay when mixed with water. Adjust the quantity of ingredients to the number of children in the group. Make a rebus chart or recipe card for the children to follow. Label plastic bags with children's names.
2. Introduce the activity by telling children they will be able to wear a graph on their necks. They will make beads to represent themselves and then trade the beads with classmates. At the end of the project, every child will have a necklace with beads that represent all the members of the group.
3. Invite the children to consider the beads they will make. Ask about color, shape, and decoration.

4. Show and then encourage the children to measure the flour, cornstarch, and salt into a plastic bag. Close the bag to mix the ingredients.
5. Open the bag and add water, 1 tablespoon at a time. After each addition of water, close the bag and knead the dough. The resulting dough should feel like commercial play clay—not too wet but not crumbly.
6. When the consistency is satisfactory, show how the food coloring can be added by dipping a toothpick into the desired color and spreading it on the clay. A tiny bit will make an intense color. Knead again.
7. Invite the children to shape their beads. Talk about how the bead is a symbol of the child. Tina's beads may be in the shape of a ball, while Jeff's beads may look more like a rolling pin. Have children make enough beads to give every child in the group. Poke a toothpick through the center of the finished bead for stringing.
8. Let the beads dry for three or four days. Some children may want to make only a few beads at a time. Remind them to keep their plastic bags tightly zipped; the dough will keep for about a week.
9. When the beads have dried, talk again about the beads as symbols. Invite children to use markers to decorate them in a personal, distinctive pattern.
10. When all the beads are decorated, let the children trade beads and string them into a necklace.

Blocks

Unit blocks and other construction toys are perfect tools for investigating pattern, classification, sequence, and one-to-one correspondence.

Same or different?

(ages 3 and older)

Here's what you need:

- plastic locking bricks
- lengths of cord
- construction paper
- scissors
- black marker

1. Cut the cord into three 3-foot lengths. Tie each into a circle.
2. Gather a basket of construction bricks in a variety of colors and sizes.
3. Spread the cord circles on a work surface. Make three small signs designating the sorting attributes—yellow, red, and green, or bricks 1X1, bricks 3X3, and bricks 4X4, for example.
4. Invite children to separate the bricks according to specific attributes.

Variations: Challenge older children to identify more than one attribute at a time for their sort: red 1X1 bricks, green 4X4 bricks, and yellow 3X3 bricks, for example.



Chart towers

(ages 3 and older)

Here's what you need:

- same-sized blocks (unit blocks, homemade milk carton blocks, or plastic locking bricks)
- chart paper
- construction paper
- scissors or paper cutter
- glue sticks

1. To prepare for the activity, gather blocks of the same size. Cut construction paper into 2-inch squares.
2. Introduce the activity by telling children to make block towers and paper towers. The towers will have the same number of components but won't be the same size.
3. Ask children to divide into pairs. One child will build a block tower, and the other will construct a tower of paper in a one-to-one correspondence.
4. After the two towers are completed, reinforce the concept by counting (with the children) the number of components in each tower. Draw two columns on the chart paper and label them *paper* and *block*. As you count, make a tally mark in the appropriate column. Write the number at the bottom of the chart.

Block patterns

(ages 3 and older)

Here's what you need:

- unit blocks
- large open floor space

1. Introduce block patterns with a demonstration. Choose several blocks and arrange them in a pattern on the floor. Make sure the blocks are touching.
2. Talk with the children about the pattern: "Our pattern starts with a long block (double unit). Next to it is a half circle and then two short blocks (single units)." Encourage the children to name the blocks as you point.
3. Challenge the children to cooperate in continuing the pattern with more blocks.
4. Encourage the children to continue the activity on their own. Ask, "Can you think of other patters to make?" "Can you think of other materials we could use to make patterns?"

Deconstruct and chart

(ages 4 and older)

Here's what you need:

- unit blocks
- chart pad
- black marker

1. Invite children to construct a building with unit blocks. Make several block shapes available but avoid dictating the design.
2. Prepare the chart pad by drawing columns—one for each of the block shapes used in the construction. Draw an outline of each shape across the top of the pad.
3. At the end of the activity time, gather the group and talk about the difference between *destruct* and *deconstruct*.
4. Invite the children to deconstruct the building. As each block is removed, draw a tally mark in the appropriate column.
5. Ask the children to estimate the number of blocks used and then count the tally marks. Talk with the children about the results, using words like *more*, *less*, *equal*, *match*, *tally*, and *total*.



Manipulatives

Of all classroom materials, manipulatives offer the most options for classification and pattern work. Collections of buttons, keys, coins, marbles, balls, counting bears, postcards, jar lids, hardware, leaves, shells, playing cards, stones, feathers, and plastic animals invite sorting by one or more attributes. For example, children can sort a collection of balls by color, use, hardness, and size. They can also order the balls by size and hardness.

Place coins, counting bears, buttons, or other items in one side of a balance scale. Encourage children to estimate the amount to put in the other side of the scale. Use the terms *more than*, *less than*, and *equal to*.

Teach children how to sort materials before putting them away. Provide appropriate boxes, baskets, and bins to make this housekeeping chore easy, fun, and satisfying.



Picture sort

(ages 2 and older)

Here's what you need:

- tray or clean pizza box
- 6 plastic lids, 2-3 inches in diameter, from dairy product containers
- duplicate pictures of familiar objects, such as a chair, flower, cup, tree, shoe, and dog, cut from old magazines or catalogs
- glue
- scissors
- clear, adhesive-backed vinyl
- zip-top plastic bag for storing pictures

1. Glue a picture to the inside of each lid. Cover the picture with clear vinyl. Glue the outside of the lids to the tray.
2. Cover the duplicate pictures with clear vinyl.
3. Invite children to match the pictures to the ones in the lids.

Variation: Glue circles or squares to the inside of each lid: one in the first, two in the second, and so forth. Cut out other circles or squares and have children place the appropriate number in each lid. For older children, glue printed numerals in each lid. Have children place the appropriate number of beads, buttons, paper clips, washers, coins, marbles, or pebbles in each lid.



Music and movement

Music is a combination of patterns of notes put together in a particular rhythm or beat. Use music and body movement activities to reinforce repeated patterns and classification by attribute.

Streamer music

(ages 2 and older)

Here's what you need:

- cardboard tubes from paper towels or gift paper
- ribbon
- tape
- scissors
- two recordings of music each with a different tempo, such as a quick march and a soothing lullaby
- large open space

1. Make streamers by cutting 2-foot lengths of ribbon, and taping several to one end of a cardboard tube. Make less expensive and less durable streamers using crepe paper. Make one streamer for each child in the group.
2. Introduce the activity by inviting children to listen to two types of music. Ask them to move their bodies to show the tempo of the music.
3. Invite children to use a streamer as they dance to the music. Talk with the children about how the streamers dance to the rhythm just as they do.

Find the beat

(ages 4 and older)

Here's what you need:

- rhythm instruments in a basket

1. Gather children, and introduce the song "B-I-N-G-O." Tell the children you'll sing the song twice: once with just their voices and once with instruments.
2. Lead the children in singing once through.
3. Share the basket of rhythm instruments and ask each child to choose one.
4. Tell the children that they will change the usual way the song is performed. Typically, at the refrain, the singers substitute a clap for the letters B-I-N-G-O, adding one clap for each verse. Instead of clapping, the children will play their instruments. For example: first refrain: shake instrument, sing I-N-G-O; second refrain shake instrument, shake instrument, N-G-O; and so on.

Variations: Use the same technique in songs that have clear beats. For example, "Boom Boom, Ain't It Great to Be Crazy," "There Was a Man and He Was Mad," or "Fooba Wooba John" all in *The Silly Song Book*.

Conducting

(ages 4 and older)

Here's what you need:

- cardboard
- black marker
- scissors
- rhythm instruments

1. Prepare for the activity by making patterned direction cards for playing rhythm instruments. First inventory your instruments and make a shadow template of each kind. Trace the shape of the instrument on cardboard and cut it out.
2. Use the templates to draw patterns that direct children how to play particular instruments. For example, one card may indicate two drum beats, one tambourine shake, and two drum beats.
3. Invite children to take turns being the rhythm band conductor, showing the cards to the group and directing the playing.

Variation: Encourage the conductor to give additional directions like loud, quiet, fast, or slow.

Discovery

Like manipulatives, collections of found objects invite labeling and classifying. Encourage children to examine, discover, and chart the results of various comparisons such as leaf shapes, the weight of stones and feathers, and the weight of wet or dry sand. Have them chart which objects will sink or float and which will stick to a magnet, for example.

Leaf points

(ages 4 and older)

Here's what you need:

- collection of tree leaves
- construction paper
- glue stick
- clear, adhesive-backed vinyl or laminator
- scissors
- file folder
- black marker
- zip-top plastic bag
- tape

1. Collect a variety of leaves, making sure they are different in form and size.
2. Glue each leaf to a square of construction paper. Cover both sides of the paper with clear, adhesive-backed vinyl (or laminate). Trim the squares to a uniform size.
3. Divide the file folder into four areas. Label the areas with drawings that correspond to basic leaf shapes: smooth with an end point, shaped like an arrowhead, divided into lobes, and fan shaped, for example.
4. Tape a zip-top bag to the back of the folder.
5. Encourage children to match the leaf collection to the patterns on the folder.
6. Store the leaves in the zip-top bag.

Variation: Make similar folder games that encourage children to identify patterns and classify according to attribute.



Garden sort

(ages 3 and older)

Here's what you need:

- assorted objects related to gardening, such as a nut, a small pumpkin, leaves, a plastic bag of mulch, a container of garden soil, a rock
- assorted objects not related to gardening, such as buttons, a sponge, a bell, a doll dress, a plastic flower
- sheet of poster board
- black marker
- ruler
- storage basket

1. Divide the poster board in half. Label one side "From the garden" and the other "Not from the garden."
2. Place an assortment of materials in the storage basket.
3. Invite the children to sort and classify the objects.
4. Be prepared to discuss the placement of some objects like the rock and plastic flower.

Variation: Repeat the examination and charting activity with other familiar objects like cars, trees, and pets.

Measure trees

(ages 4 and older)

Here's what you need:

- tape measure
- zip-top plastic bags
- clipboard and paper
- heavy cord
- scissors
- chart pad
- black marker

1. Prepare for the activity by identifying several trees that your group can measure. If there are no appropriate trees on your program's property, take a neighborhood walk to identify

trees in public areas. Or make this activity a feature of a field trip to a community park.

2. Introduce the activity by telling the children they will measure the *circumference* (around the trunk) of several trees.
3. Using cord, help children measure the circumference of the first tree. Have one child hold one end of the cord and another child walk around the tree with the other end. Cut the cord where the two ends overlap. Place the cord in a bag labeled "Tree 1."
4. Ask the children to estimate the circumference of the tree in inches. Record their predictions. Encourage them to make non-standard measurements—arms around the tree, heel-to-heel footsteps around the base, or the number of found stick lengths, for example.
5. Use a tape measure and measure the circumference of the tree again. Record the size on the clipboard. Talk with the children about their predictions and offer clues to gaining more accuracy.
6. Repeat the measuring exercise with each tree. Ask the children questions like "Which tree has the smallest circumference?" "Is Tree 2 smaller or larger than Tree 3?"
7. Make a chart that represents the actual and predicted measurements of each tree.
8. Compare the cut-cord length from each tree with the tape-measured circumference. Lay the cord in a circle. Invite children to stand in the middle, measure the distance around their bodies, and compare this length against the length of the cord.

Cooking and meals

Cooking activities and conversations at meal time offer plentiful opportunities to explore correspondence, sorting, and sequence. Conversations introduce subjects children can explore and graph. Examples are number of siblings, grandparents living nearby or far away, nutrition facts, and favorite snack foods.

Be mindful that individual tastes vary widely. Conversations about food preferences are a solid introduction to broader diversity and inclusion discussions.



Set the table

(ages 3 and older)

Encourage orderly, pleasant meals by teaching children about setting a table, and reinforce one-to-one correspondence at the same time. Adjust this activity according to the way your program serves meals. For example, if the children in your group use only spoons, make placemats that reflect the practice. Encourage self-service and remember that children will always try to live up to your expectations.

Here's what you need:

- cardboard
- scissors
- copy paper, preferably 11-inch by 14-inch colored paper
- copier
- clear, adhesive-backed vinyl or laminator
- black marker

1. Trace the utensils commonly used at meal time—spoon, fork, plate, cup, and napkin—onto cardboard. Cut out the templates.
2. Using the templates, make a copy master of the proper placement of meal utensils.
3. Make copies of the placemat for each child in the group.
4. Cover the placemat with clear, adhesive-backed vinyl or laminate. Provide these for every meal.
5. Ask mealtime helpers to set the table placing the cup in the proper outlined space, the spoon in its place, and so on.

Variations: Older children may want to make permanent placemats from fabric. They can print templates with permanent paint or ink. Or they can trace the utensil outlines with pencil and then hand stitch over the outlines with heavy thread.

Foods I don't like

(ages 3 and older)

Here's what you need:

- chart pad
- black marker
- face stamps
- glue
- old magazines or catalogs
- scissors
- mural paper

1. Prepare for the activity by collecting magazines with pictures of food and people eating.
2. Gather a small group of children. Ask them to remember a time when they were served a food they really didn't like. Encourage conversation and introduce vocabulary like *disgusting*, *ghastly*, *excessive*, *nauseating*, *impolite*, and *repulsive*. Help children discern whether their response to the food had to do with its actual taste, its texture, or its color.
3. Help the children identify one food they don't like to eat. List the foods on the chart pad so children can copy the words if they wish.
4. Tape a length of mural paper to a wall. Invite children to find pictures of the unpopular foods in magazines, cut or tear them out, and make a collage.
5. Encourage children to vote on the most unpopular food. Draw columns on a chart pad. Have children place a face stamp in a column with their vote for an unpopular food.
6. Share the resulting graph with your program's cook and the children's parents.

Variations: Plan similar activities based on foods never tasted, food color preferences, favorite vegetables, bread styles, and food sources.

Correspondence waffles

Make this activity part of a routine snack. Or allow older children to prepare and eat this snack as part of center work. Remember that everyone must wash hands before preparing and eating food.

(ages 3 and older)

Here's what you need:

- toaster waffles
- toaster
- small berries, such as blueberries, blackberries, and raspberries
- plates and serving utensils

1. Prepare for the activity by placing clean, small berries in individual bowls.
2. Toast waffles, one for each child, and place on plates.
3. Invite children to explore the berry-to-waffle-hole correspondence. Encourage them to count the holes in each row and column of the waffle. Round waffles offer fun challenges. Invite children to fill the waffle holes with berries. They may choose to fill every hole or to create a pattern with the berries.

Caution: Food is not a toy. Ensure that children treat the food respectfully and eat what they serve themselves.



Large group circle activities

Conducting surveys and charting results can be a regular part of your day. Using a black marker, write a survey question at the top of a chart pad. Draw columns to correspond to likely answers. Let children post their face stamps (see instructions below) to indicate their responses.

Issues to survey can include eye color, shoe style, favorite finger play, shirt color, favorite picture book, number of pockets in clothing, bed time, number of siblings, and number of letters in children's names. Calendar activities invite charting. Use a chart pad and marker to track the numbers of sunny, cloudy, and rainy days in a month, for example.

All these activities reinforce one-to-one correspondence, a necessary prelude to counting and more complex math skills.

Face stamps

Here's what you need:

- digital camera
- adhesive-backed labels, several for each child

1. Use a digital camera to take pictures of each child.
2. Print the pictures on adhesive-backed labels.
3. Let children use these personal symbols in charting activities across the classroom. They are particularly useful in large group charting activities because children aren't forced to wait while others draw or tally a vote.

Tally sticks

Here's what you need:

- face stamps
- craft sticks
- 2 clean recycled food cans
- paint, fabric, glue, ribbon, adhesive-backed vinyl, or other decorative materials

1. Attach a face stamp to the end of a craft stick, one for each child in the group.
2. Decorate two cans. Designate one "Yes" and one "No."
3. Use these tally sticks for checking attendance, voting on preferences, or answering questions like, "Do you have a baby sister?"

Window streamers

(ages 4 and older)

Here's what you need:

- fabric ribbon of different colors
- scissors
- tape
- window or wall space

1. Use this activity for transitions from circle to the next activity. You can repeat it often with different results every time.
2. Prepare for this activity by cutting 24-inch lengths of ribbon. Make one streamer for each child in the group, ensuring that you have several streamers that match. Determine where you'd like the streamers to hang—in a window or on a low wall, for example.
3. Tell the children they will create a streamer pattern by taping ribbon to the designated space.
4. Dismiss one child at a time from the group. As you call the children's names, hand out ribbons with a piece of tape attached to one end.

5. Allow the children to build the pattern from either side or center out.

Variation: Use crepe paper streamers for this activity if you aren't concerned about durability and reuse.

Resources for teachers

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