Utilizing Purposeful Play to Foster an Inclusive Mathematics Classroom for Early Learners

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ORIGO STEPPING STONES PREK

Guided Play Benefits

- Demonstrated positive outcomes for learning and development
- Active, engaged, meaningful, socially interactive (interactions between children and adults may be essential for social/emotional development)

Hassinger-Das, Hirsh-Pasek, Golinkolff. (2017).

- Maintains joy, while adding a focus on learning goals through adult scaffolding
- Enhanced discovery with immediate feedback
- Prevents frustration allowing students to engage longer
- Combines:
  - Child agency
  - Adult guidance

What Does Gentle Guidance Entail?

- Infused vocabulary
- Thoughtful questioning that
  - Encourages discourse
  - Helps children retrieve previous learning
  - Extends children's thinking

- What do you notice/wonder?
- What do you think?
- Why do you think that?
- How do you know?
- What does that remind you of?
- Remember when we…

Hassinger-Das, Hirsh-Pasek, Golinkolff. (2017).

Guided Play: Summing It Up

A study with preschoolers (Fisher et al. 2013) compared children's ability to learn about geometry and shapes through guided play, free play, and direct instruction.

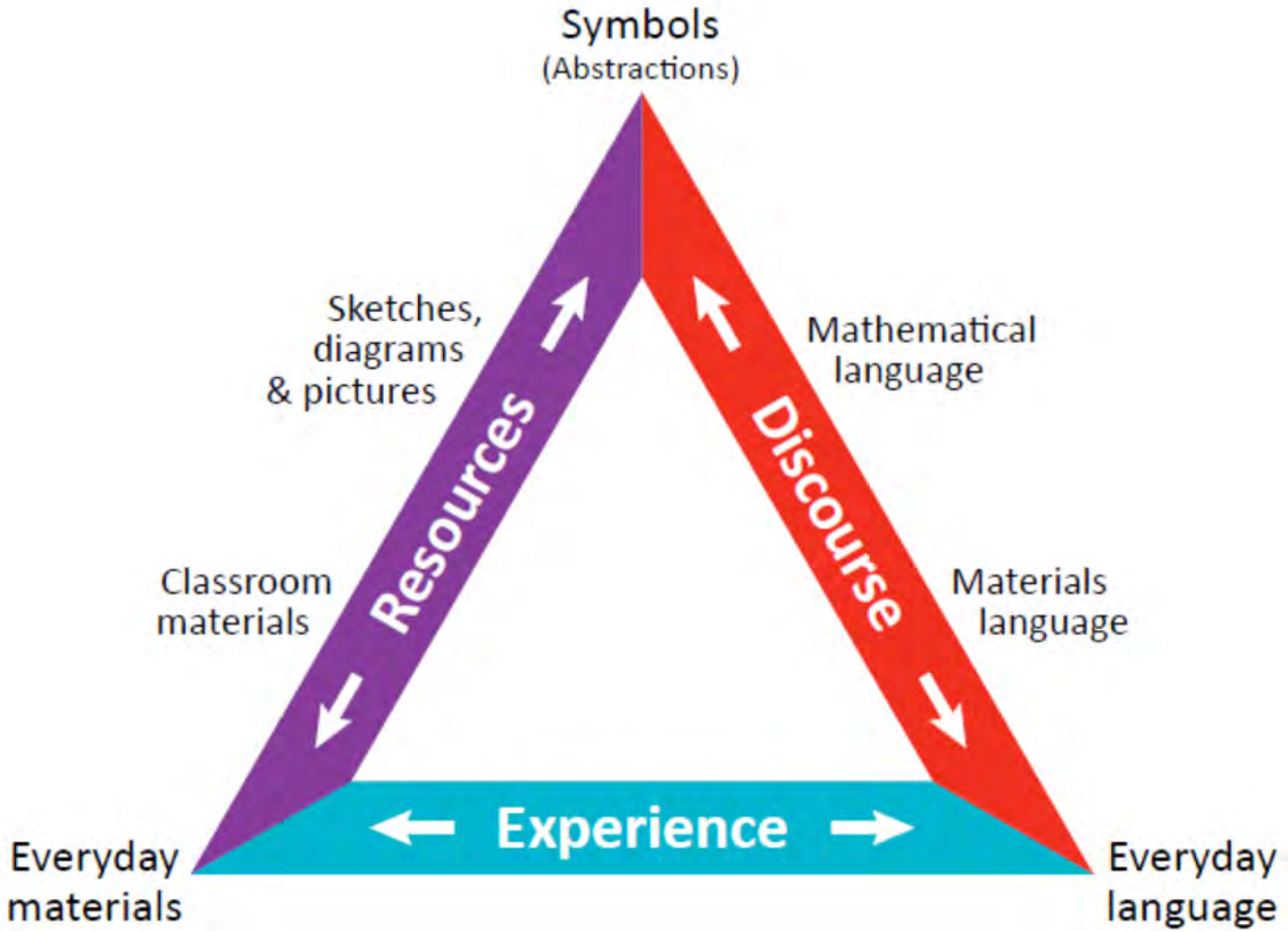
- Guided play: adult followed the children's lead and scaffolded the interaction.
- Direct instruction: children listened passively
- Free play: children interacted with shapes any way they wished
- Children learned more about geometry and shapes in the guided play condition

Hassinger-Das, Hirsh-Pasek, Golinkolff. (2017).

What Else Matters in Mathematics Instruction?

Developing Skills and Concepts

- Rich experiences that support oral language development
- Participation in engaging activities in a developmentally appropriate progression
- Interactions with a variety of concrete and visual materials

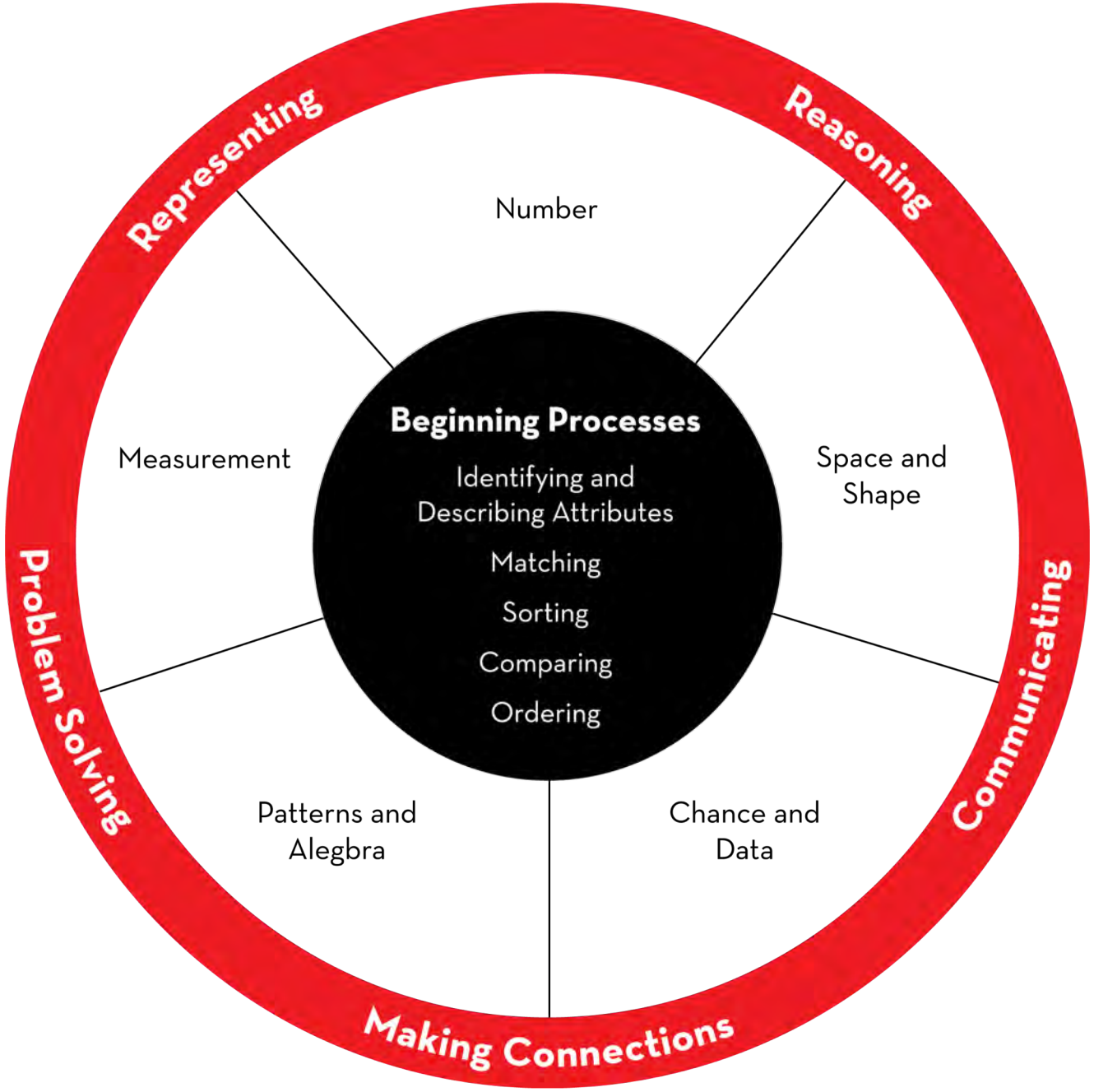

Symbols
(Abstractions)
Sketches, diagrams & pictures
Mathematical language
Resources
Discourse
Classroom materials
Materials language
Experience
Everyday materials
Everyday language

Beginning Processes

Early Childhood Mathematics Framework

Develop as students strengthen their abilities to represent, reason, communicate, problem solve, and connect mathematical ideas.

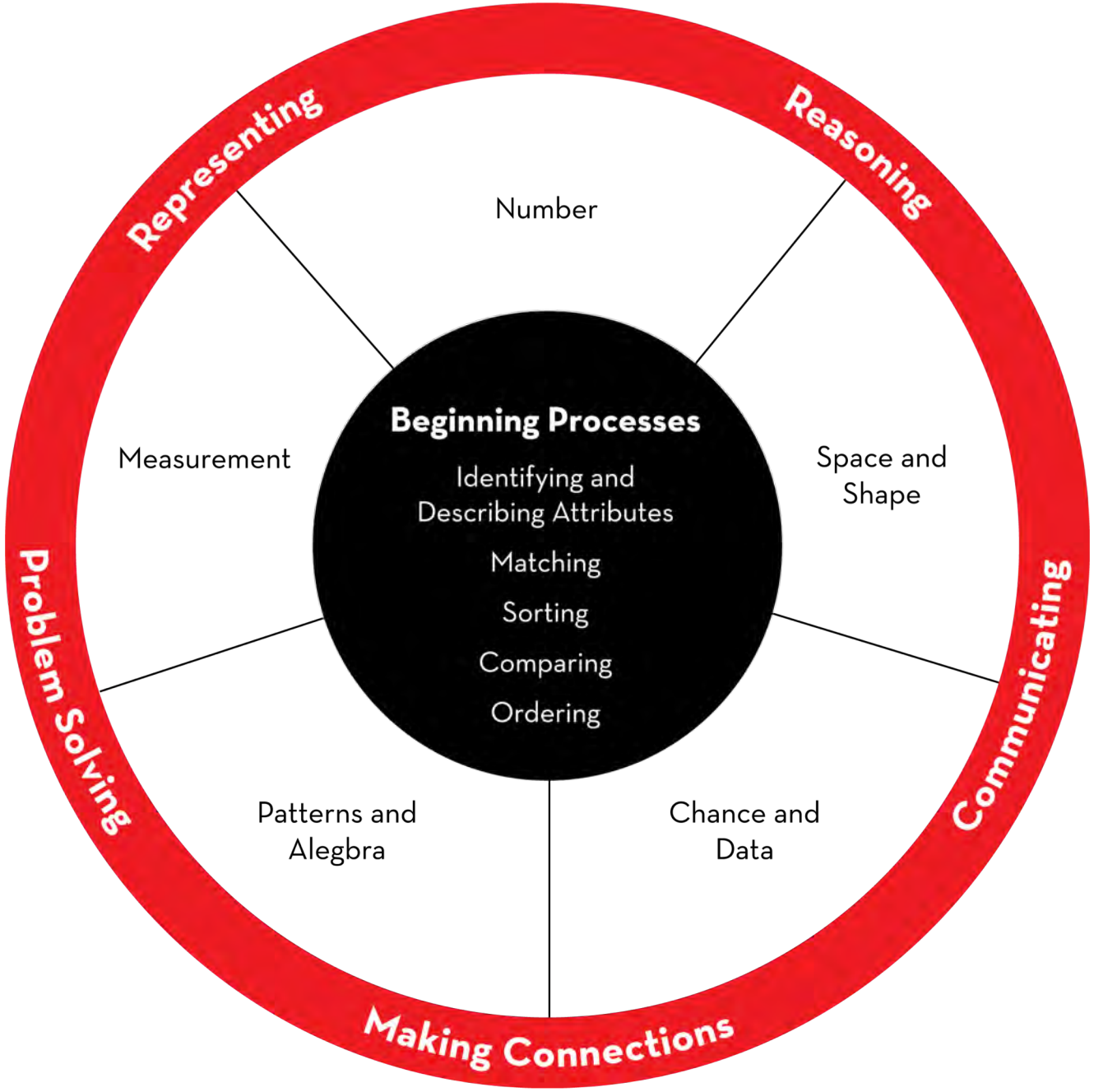
Irons, 2007



Beginning Processes

Early Childhood Mathematics Framework

Consider that students who struggle with concepts across strands (Number, Geometry, etc.), may need experiences with describing, matching, sorting, comparing and ordering to help them to move forward.



Irons. (2007) *Beginning processes*.

Beginning Processes and Equity

- Equity for each child is a result of opportunities for thinking.
- Playing around with mathematics and the beginning processes provide opportunities for thinking.

Identifying and Describing Attributes

- Attributes are characteristics, features, qualities, properties, traits, or specifications of objects.
- An understanding of later mathematical processes, such as matching, sorting and comparing, and ordering depends on the children's confidence with attributes.
- Learning experiences in identifying and describing attributes support children to become observant and facilitate reasoning,

Beginning Processes, Irons 2007, p. 1

Identifying and Describing Attributes: Developing the Skill

- Begin simply
- Types of attributes
  - Shape
  - Size
  - Color
  - Mass
  - Sound
  - Taste
  - Texture
  - Function

Five + Function

- Vocabulary is important and ever-evolving
  - Encourage students to describe attributes in their own language
  - Model ”same” and ”different” language

Irons. (2007) *Beginning processes*.

Identifying and Describing Attributes

Find and Feel

Children feel and describe objects that are hidden in a box.
They then place the objects on their matching outlines.

Collection of different objects (e.g. plastic spoon, pencil, key, toothbrush, comb, coin, large buttons)
1 large sheet of light card (approx. 30 cm × 40 cm)
1 box
1 piece of opaque fabric to cover the box

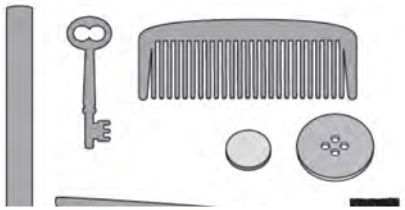
Preparation

- Trace each object onto the sheet of light card.
- Place the objects in the box and cover the box with the piece of fabric.

Activity

Invite a child to reach into the box and select and hold an object in their hand. Ask the child to describe what the object feels like and guess what materials were used to make the object. After some discussion, ask the child to remove the object from the box and describe any visible attributes. Then have the child place the object on its traced outline. Repeat with other children until the box is empty.

Later, have the children work individually with the objects. A child describes each object's color and the materials used to make it, and then matches each object to its outline. Encourage the children to show their work to a friend when they have finished.



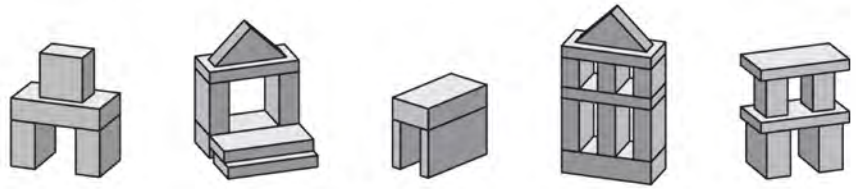
Building Blocks

Children construct buildings with blocks.
They then compare the shapes of the buildings.

2 baskets for each pair of children
15 to 20 building blocks for each basket

Activity

Show the baskets of blocks to a pair of children. Instruct them to take a basket each and make a building using only the blocks from their own basket. When the children have finished, say, Tell me about the buildings. What is the same about the buildings? What is different? Encourage a variety of responses. Note the language that the children use to describe the shapes of the buildings. Some children will compare the number of blocks used in each building.



Extension

Identifying and Describing Attributes

Activity

- Say, We are going to use our sense of hearing to decide if the sounds we create are the same or different. Show the children the sound cards on each face of the *Big Cube*. Demonstrate the sound of singing and clapping, and the sounds of the instruments pictured. Show the children the same/different cards on the other *Big Cube*. Roll the cubes and ask, What did I roll? (Same. Rhythm sticks.) What do I need to do to create the same sound as the rhythm sticks? (Play the rhythm sticks.) What sound would I need to create if I had rolled the word different? (Singing, clapping, or a different instrument.)
- Repeat the activity with children taking turns to roll the *Big Cubes*. Encourage the children to explain their reasoning.

Identifying and Describing Attributes

- Finger puppets encourage children to describe attributes.
- Animals have many characteristics that children are eager to describe.

Identifying and Describing Attributes with Dominoes

Meet and Greet

Exploring the features of dominoes

Activity

- Have each student select one domino and ask individuals to describe their tile.
- Discuss different types of tiles so students use and understand the various descriptive terms within the set: blanks; dots; doubles; singles; ends; and so on. Examine mathematical aspects such as the dot arrangements to show how these help identify numbers, and "odd", or "even".
- Have each student select a second domino. Ask them to look at the two tiles and think of how they are the same and different. Invite individuals to describe their thinking.
- Ask the students to select a new pair of dominoes, draw a picture of each, and write or describe similarities and differences between the two.

Note

A glossary of domino terms can be found on page 38.

Yes/No

Using mathematical language to describe features of dominoes

Note

Repeat this activity over a period of time to consolidate the new mathematical language students are learning.

Activity

- Move the students into groups. Invite one student from each group to select a domino from the double-six set and keep it hidden. Have the other students ask "yes" or "no" questions to identify the domino. For example, "Are the numbers on the two ends different?", "Are both numbers odd?", "Is one number less than four?".
- Repeat for dominoes selected by other members of the group. Involve individuals that do not usually contribute to the discussion.
- Repeat the activity for dominoes selected from the double-nine set.

Extension

Ask each student to select a domino and write clues about it. Each student reads their clues to other members of the group for them to identify the domino. This activity will help with logical reasoning as the students discover that more clues may be needed.

Matching: Developing the Skill

- Focus on “sameness” of attributes
- Ask, “Why do these match?”

Irons. (2007) *Beginning processes*. p. 17

- Carefully sequence matching activities
  - Visual – emphasize color, size, shape
  - Other senses – touch, hearing, smell, taste
  - Objects to objects
  - Objects to outlines
  - Pictures to pictures
  - Pictures to outlines

Let's do the number dance!
Stomp your feet with me.

Stomp your feet up high,
one, two, three, four, five.

Stomp your feet again,
six, seven, eight, nine, ten.

Our number dance is done.
It was so much fun.

Matching: Playing Copycat

- Everyone stands up
- One person will roll the cube
- Everyone will match the picture
- Look around. Do we all match? How can we tell?

Matching: Domino Drag

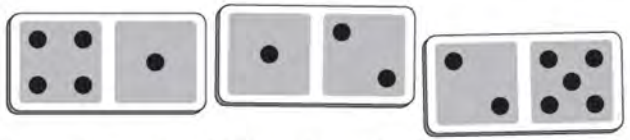
Domino Drag

Children match dot pictures using dominoes.

1 box of dominoes for each group of children

Activity

Show the dominoes and point out the dot pictures on each end. Demonstrate how to match the dot pictures by placing the matching ends of the dominoes together. Place one domino in the middle of the group. Deal the remaining dominoes and ask the children to place their dominoes facedown. Have one child flip one of their dominoes and decide if it matches either end of the face-up domino. If they find a match, they move their domino to its match. If they do not find a match, the next child has a turn. Continue to play until all dominoes are matched in a straight line, or until no further matches can be made.



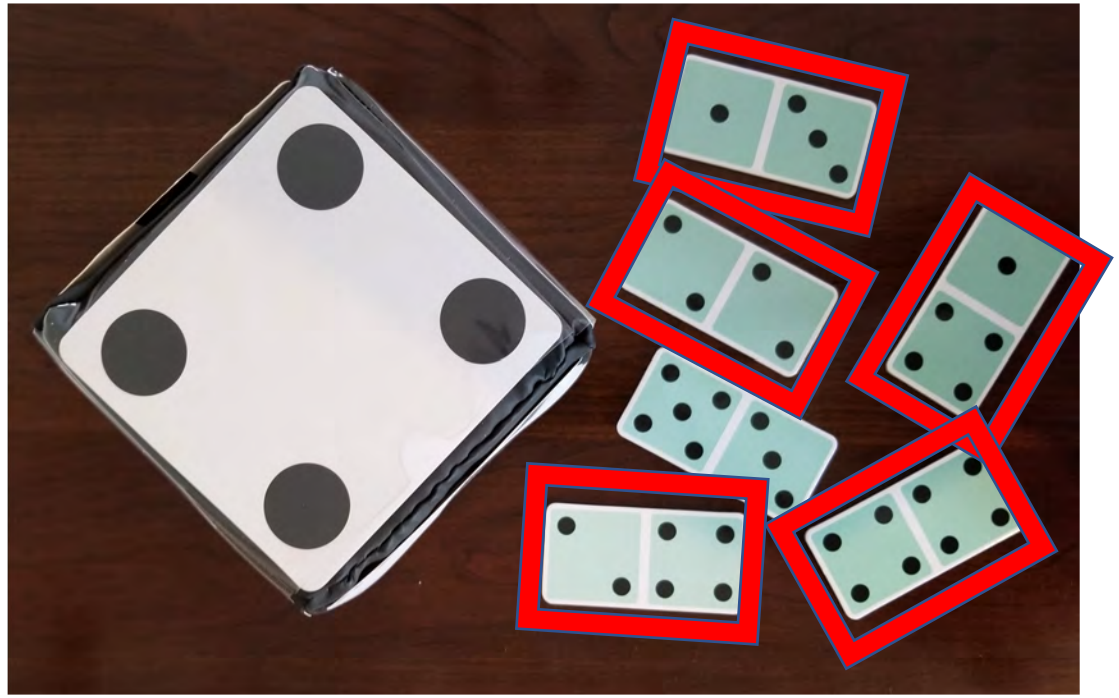
Alternatively, have individual children make rows of matching dominoes.

Extension

Repeat the activity, and this time, the children can match the dominoes in any direction.

Alternatively, have the children take turns to select a domino, draw the dot groups, and then record the numeral for each of the groups. Continue to play until each child has recorded five dominoes.

Matching: Do You Have a Match?



- Distribute dominoes
- One person will roll the cube
- Students with a match will stand and explain how they know they have a match
- Roll again and repeat or have students match “the other end” of a friend’s matching domino

Matching Puppets

Matching puppets

In this activity, children match their puppets by the attribute of color to other items found in the classroom.

Preparation

Each child will need:

- 1 color paper circle (*Note:* Use the colors from *ORIGO Big Poster Book 1*: yellow, blue, gray, white, brown, pink, red, purple, black, violet, green, orange.)
- 1 paper plate
- other materials to make a puppet (for example, yarn, cotton balls, eyes, and pipe cleaners)
- markers
- glue
- 1 craft stick

Activity

- Distribute the color circles and paper plates. Model how to paste the circle onto the paper plate. Allow a few minutes for the children use the available materials to create a face for their puppet. Help the children attach their plate to a craft stick.
- Lead the children with their puppets on a classroom walk. Model how to use the puppet to find a color match. For example, say, I am standing next to a locker. The locker is gray just like the face of my puppet. Have the children find a match for their puppet color. During the activity, ask questions such as, What object did you choose? Why? How does it match your puppet?

Sorting: Developing the Skill

- Begin by focusing on one attribute
- Group according to one or more attributes
- Involve the “three D’s”
  - Decide
  - Do
  - Describe
- Sort using two or more attributes after many first-level experiences

Beginning Processes, Irons 2007, p. 33

Station Sorts

- Have the children sort the kitchen utensils, food, or clothing in the home center
- Sort items from a nature walk in the science center
- Sort the blocks in the block center

Be sure that children explain their sorts to a friend.

Color Sorts

- Gather a collection of different colored objects
- Place two hula hoops in the center of the floor
- Say, “When I call your name, please choose an object and place it in the hoop I point to.”
- Call on different children to place objects in the hoop according to the rule: Red and Not Red
- After a few objects are placed have children guess the sorting rule

Your Turn

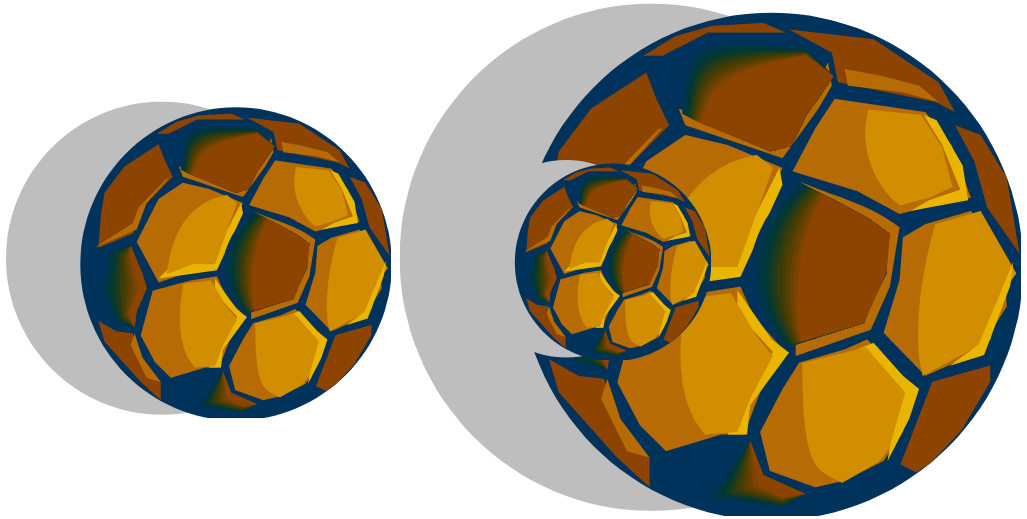
Play Guess My Rule

- Choose some items from your table
- Sort them according to one attribute
- See if your tablemates can guess your rule

Comparing: Developing the Skill

- Based on relations between how much of an attribute two objects possess – which one possesses more/less
- Model and provide opportunities to use comparison words
- Provide opportunities to understand that comparison is relative

Cognitive Conflict with Comparison



Comparing Toy Animals

In this activity, children compare the size and/or length of two toy animals.

Preparation

You will need:

- 1 *ORIGO Big Cube*
- *ORIGO Big Cubes Cards*: set H (includes one wildcard) inserted in the cube
- 1 box of toy animals (for example, jungle animals, farm animals, sea creatures, dinosaurs)

Activity

Say, Today we are going to match size words with toy animals. Read the size word card on each face of the cube and explain that for the wildcard the children can use a size word of their choice. Invite two children to collect an animal from the toy box. Roll the cube and read the word aloud. Say, I rolled (longer). Which animal is longer? Is the (tiger) longer than the (sheep)? How could we find out? Encourage the children to explain their thinking using a sentence frame such as "The sheep is long and the tiger is longer." Provide another example if necessary. Repeat the discussion with children taking turns to roll the cube.

Comparing: Same, More, Fewer?

- Say, “Today we are going to roll and compare the cubes.”
- Children roll and compare the quantity of dots with the quantity of animals. If they roll a smiley face, they get to roll again.
- Ask children to explain how they know the two quantities are more, fewer, or the same.

- You could play the game so that children receive a pre-determined amount of points for a rolling a match, rolling more, or rolling fewer animals than dots.

Your Turn: Playdough Partners

Playdough Partners

Children make shapes that are bigger, smaller, longer, taller, shorter, wider, and thinner than a picture model.

Blackline Masters 21, 22, 23, and 24 (pages 101–104)

At least 7 sheets of light card (approx. 20 cm × 30 cm)

Playdough

Rolling pins, dough cutters, plastic knives, and other playdough equipment

Crayons

Preparation

- Copy Blackline Masters 21, 22, 23, and 24 onto light card. Cut out the individual picture cards and, if possible, laminate them for durability.
- Cut the remaining sheets of light card in half for the children to create more picture cards.

Activity

Spread the picture cards around a table. Read the instruction on each card with the children. Invite the children to select a card they would like to use. Direct them to make the new shape with the playdough and place it on the picture card. When the children are finished, ask them to describe the shapes they made to the rest of the class. Highlight the comparison words that are used in the instructions. Have the children repeat the activity by selecting a different card.

Extension

Have the children make more picture cards to create shapes that are the same size, length, or width. For example, "make a circle the same size", "make a caterpillar the same length", or "make an apple the same width".

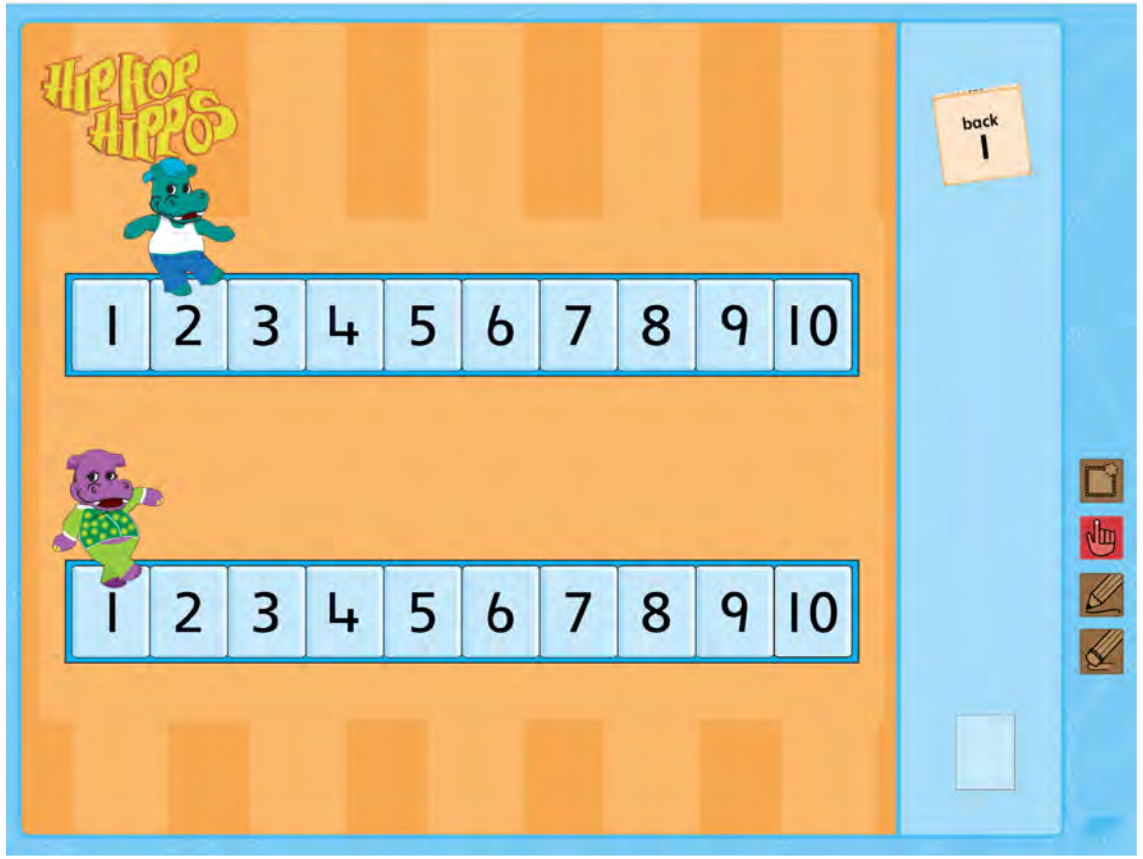
make a longer worm

make a bigger heart

Comparing Weight: Let's Go on Vacation

- In the home center have students pack 2 bags with various clothing items
- Students become human pan balances to compare the weight of each bag

Relative Position



Player 1	Player 2
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9
10	10

Ordering: Developing the Skill

- Involves arranging objects, pictures, groups, events according to increasing or decreasing amounts of an attribute
- Encourage use of “est” words during real-world ordering activities
- Provide initial experiences involving only 3 objects

Ordering is important for later concepts such as ordering numbers.

Beginning Processes, Irons 2007, p. 65

Ordering: Bottle Line-Up

- Provide pairs or small groups of children with empty plastic bottles in various sizes, rice, scoops, funnels, and a shallow tray
- Tell children to fill 3 or 4 bottles with different amounts of rice
- Have children order bottles by weight
- Encourage children to use correct vocabulary and share their thinking
- To vary the activity have children close their eyes to compare the weights

Footprint Cover-Up

Children work in groups of three or more to arrange their footprints in order of size.

- Blackline Master 6 (page 78)
- Poster paper
- Markers
- Scissors
- Glue

Preparation

- Cut the poster paper into smaller rectangular pieces, approximately the size of a child's foot. Provide the groups with smaller pieces of poster paper, markers, and scissors.

Activity

Direct the children to work in groups of three. Instruct the groups to take turns tracing around the right foot of each group member. Each child should then carefully cut out their footprint and label it with their name. Help the children as required. As the groups are working, ask, What do you notice about the footprints? Who has the biggest (smallest) footprint? How do you know?

As a whole group, discuss the foot sizes of each group. Encourage the children to estimate and then show how they would place one footprint on top of another to decide the order. After the groups have shared their findings, they can paste their footprints in order on a larger sheet of paper.

If time allows, rearrange the whole group into groups of four and repeat the activity.

Extension

Provide each pair of children with a copy of Blackline Master 6. Ask the children to cut out the paw prints and arrange them in order of size.