Kindergarten

CONTENTS

The Learner at This Level

THE KINDERGARTEN CHILD:

- Learns best through play, direct experience and active exploration of concrete materials.
- Benefits most from routines and repetitive behavior and may be reluctant to try new activities.
- Thinks out loud and verbal answers may not equal cognitive understanding because they have more ideas than words.
- Needs a great deal of physical activity.

ALGEBRAIC REASONING

- Begins to realize patterns are everywhere through meaningful exploration at school and at home
- Identifies the core elements in a pattern.
- Focuses on repeating patterns, and can generate different types of repeating patterns (AB, AAB, ABB, etc).
- Describes the rules of simple patterns.
- Models situations of addition and subtraction and identifies quantities as equivalent or not equivalent.

NUMERICAL AND PROPORTIONAL REASONING

- Develops number sense by counting real world objects, sounds and physical movements and rote counts by reciting number names.
- Compares two sets of objects and identifies them as more than, less than or the same.
- Recognizes that the amount of objects in same-sized sets has the same number name (three-ness).
- Begins to recognize how many are in a small set without counting (subitizes).
- Counts a set of objects and learns that the last number stated in the sequence answers the question, “How many?” the rule of cardinality.
- Begins to use 10 as a benchmark.
- Determines whether parts of wholes are closer to very little, a half or a whole.
- Begins to describe the position of objects in a sequence by using ordinal numbers.
- Solves story problems by acting them out.

GEOMETRY AND MEASUREMENT

- Determines how things are alike and different by focusing on one attribute.
- Sorts objects and shapes by the presence or absence of a certain characteristic (round/not round).
- Uses nonstandard measurement as a way to systematically arrange or identify objects by size.
- Needs explorations of size, shape, length, and capacity.
- Explores patterns of minutes, days, hours, weeks, months and seasons.

WORKING WITH DATA

- Begins to organize data into categories during informal sorting experiences, such as putting away classroom materials.
- Explains the criteria used to sort and group objects.
- Connects numbers with real quantities of familiar objects by using graphic organizers, such as real graphs and non-intersecting Venn diagrams.
- Represents collections with written symbols or drawings on graphic organizers.

Mathematics Background for Teachers

MATHEMATICS BACKGROUND FOR KINDERGARTEN TEACHERS

ALGEBRAIC REASONING: PATTERNS AND FUNCTIONS

Patterns and functional relationships can be represented and analyzed using a variety of strategies, tools and technologies.

Central Understanding: Patterns can be described, generalized and extended based upon physical attributes or positions.

Background: The young child enters the formal school setting having observed patterns at home, in nature, at play and in stories. Understanding patterns, functions and algebra is a continual process of making connections between observations from the real-world environment and planned activities in a classroom. Meaningful experiences with patterns in contextual situations build a foundation from which children can begin to describe, generalize and extend patterns in geometry and number. Recognizing and working with patterns helps young children talk about relationships, predict what will happen and see the connections between mathematics concepts and their world (Copley, p. 83-84).

NUMERICAL AND PROPORTIONAL REASONING

Quantitative relationships can be expressed numerically in multiple ways in order to make connections and simplify calculations using a variety of strategies, tools and technologies.

Central Understanding: The relative numerical value of collections can be determined through comparison.

Background: Recognition of quantity emerges very early in life. To provide a strong foundation for number knowledge and the development of quantitative reasoning, children must be involved in numerous, engaging experiences in counting and comparing collections (Clements, p. 17). Through these experiences, children build their capacity to understand the relationships between and among quantities and extend their number knowledge as they begin to assign numerical value to quantity.

MATHEMATICS BACKGROUND FOR KINDERGARTEN TEACHERS

GEOMETRY AND MEASUREMENT

Shapes and structures can be analyzed, visualized, measured and transformed using a variety of strategies, tools and technologies.

Central Understanding: Objects can be described by attributes, properties, measurements, and location.

Background: Children at this level (van Hiele – Level 0) recognize and begin to learn the attributes of two-dimensional shapes and three-dimensional solids. The understanding of geometric figures expands when children are provided with numerous and varied experiences to manipulate them move them in space and discuss their attributes and characteristics (Copley, p. 106). Children should also have numerous opportunities to compare two things with respect to length (longer, shorter), area (covers more, covers less), and weight (heavier, lighter) because comparing objects lays the foundation for measurement. Children need to construct measurement concepts for themselves over an extended period of time, by being actively involved in comparisons using non-standard units of measure and by discussing and recording their observations about those comparisons. Measurement provides an ideal bridge between geometry and number, when numerical values are assigned to measurements (Copley, p. 131). In discussion, children will communicate using their own descriptions, which should be reinforced with formal mathematics language.

WORKING WITH DATA: PROBABILITY AND STATISTICS

Data can be analyzed to make informed decisions using a variety of strategies, tools and technologies.

Central Understanding: Objects can be classified and organized based on attributes

Background: The skill of classification rests on the ability to observe and identify characteristics and make comparisons. Classification, the first step in the organization of data (Van de Walle, p. 386), is the act of systematically arranging objects by their attributes. Children's descriptive language and names for objects and attributes reflect their observations and are acceptable ways of classification. Children refine their classification skills when they encounter challenges to the categories they have established. Young children need experiences with categorizing familiar things in different ways in order to learn to make sense of real-world data. Activities that involve sorting, grouping and categorizing must build on children's previous experiences and be explicitly designed to develop flexible thinking about the characteristics of data.

Correlated Grade-Level Expectations

Click here to access correlated grade-level expectations for kindergarten on the State Department of Education Web site.

Sequenced Grade-Level Expectations

KINDERGARTEN SEQUENCED GLES

Grade-Level Expectations	Fall	Winter	Spring
ALGEBRAIC REASONING			
1.1 Understand and describe patterns and functional relationships.			
1. Sort and classify objects by a variety of attributes (size, shape, color, texture, orientation, position and use), and explain the reason for each sort.			
2. Describe and make comparisons of qualitative and quantitative changes of a given pattern using terms such as warmer, softer, more, 1 more, less, 1 less, bigger, smaller, longer, and shorter.			
3. Recognize, reproduce, extend and create repeating patterns using movement, sounds, color, shapes, numbers and textures.			
4. Identify and extend visual, auditory and physical patterns in order to make predictions.			
NUMERICAL AND PROPORTIONAL REASONING			
2.1 Understand that a variety of numerical representations can be used to describe quantitative relationships.			
1. Represent quantities of up to 30 objects in a set.			
2. Compare sets of up to 30 objects and use the terms more, less or the same to compare the two sets and identify a set with one more or one less than a given set.			
3. Order sets of up to 30 objects from least to greatest.			
4. Identify the ordinal position of objects: first, second, third, fourth, fifth and last.			
5. Use a variety of models and familiar objects to compare two parts of a whole and describe the parts as being closer to a whole or closer to very little.			
6. Use a variety of models and familiar objects to: • Identify one whole and one half of an object. • Recognize a half and put two helves of an object together to make a whole. • Form a whole from two smaller sets that have equal amounts.			

Grade-Level Expectations	Fall	Winter	Spring
2.2 Use numbers and their properties to compute flexibly and fluently and to reasonably estimate measures and quantities.			
7. Count by rote to at least 30.			
8. Count and group up to 30 objects by tens.			
9. Identify the numerals 1-30 and match each numeral to an appropriate set of objects.			
10. Act out and solve addition and subtraction story problems that reflect real-world experiences and contextual problems using sets of up to 10 objects and describe the strategy or reasoning used to solve a problem. (Example: Put 2 crayons together with 4 crayons; then count to determine the number of crayons needed for all students at a table).			
11. Write the number sentences which correspond to story problems using addition, subtraction and equal symbols 12. (+, -, =) correctly.			
13. Estimate the amount of objects in a set using 10 as a benchmark, and then count to determine if the amount is more or less than 10.			
14. Identify and name pennies and dimes.			
15. Count pennies and trade pennies for objects.			
GEOMETRY AND MEASUREMENT			
3.1 Use properties and characteristics of two- and three-dimensional shapes and geometric theorems to describe relationships, communicate ideas and solve problems.			
1. Identify and describe familiar shapes (triangles, squares, rectangles and circles) and solids (cubes, spheres, cylinders, cones and prisms) in the environment.			
2. Compare and sort familiar shapes and solids in the environment and contextual situations.			
3. Construct small sets of shapes and solids using a variety of materials.			
3.2 Use spatial reasoning, location and geometric relationships to solve problems.			
4. Describe the location, direction, and position of objects or parts of objects, using terms such as under/over, inside/outside, next to/near, top/bottom, in front of, first and last.			

Grade-Level Expectations	Fall	Winter	Spring
5. Complete simple shape and jigsaw puzzles and explain the reasoning used to complete the puzzle and solve the problem.			
3.3 Develop and apply units, systems, formulas and appropriate tools to estimate and measure.			
6. Recognize events that reoccur (at specific times of the day or week).			
7. Locate yesterday, today, and tomorrow on a calendar to sequence events and use terms like before and after to compare events.			
8. Use non-standard units, physical referents (like a finger)or everyday object such as links, Unifix cubes, or blocks to compare ,estimate and order measures of length, area, capacity, weight, and temperature and describe the reasoning and strategies used.			
9. Describe and order small sets of familiar objects by size, length or area using comparative language such as more, bigger, longer, shorter and taller.			
10. Use a balance scale to compare the weight of two objects and identify which is heavier.			
WORKING WITH DATA			
4.1 Collect, organize and display data using appropriate statistical and graphical methods.			
1. Pose questions about objects and events in the environment that can be used to guide the collection of data.			
2. Collect data and record the results using real graphs and picture graphs.			
3. Arrange information in a systematic way using counting, sorting, lists, and graphic organizers.			
4.2 Analyze data sets to form hypotheses and make predictions			
4. Describe data using the terms more, less and the same.			
5. Identify and extend patterns from organized data to make predictions. For example: More boys than girls in our class watch television every day. We predict that the same will be true for another kindergarten class.			
4.3 Understand and apply basic concepts of probability			
6. Describe the likelihood of the future occurrence of events based on patterns and personal experiences using terms such as likely, unlikely or certainly.			
7. Engage in simple probability activities and discuss the results.			

Correlated GOALS 2000 Criterion Referenced Test

KINDERGARTEN CORRELATED GOALS 2000 CRT

The Goals 2000 Mathematics Curriculum was written as a companion to the 1998 Mathematics Framework. The Goals 2000 resources cited in this 2007 Model for Mathematics Curriculum are aligned to the 2005 Mathematics Curriculum Framework, 2007 Curriculum Standards and the fourth generation Connecticut Mastery Test.

The Kindergarten Criterion Referenced Test Part A from the Goals 2000 Mathematics Curriculum is aligned to the kindergarten sequenced GLEs and can be used for pre- and post-assessment. The Kindergarten Criterion Referenced Test Part B may also be used for pre- and post-assessment and integrated when appropriate. Student progress must be recorded by keeping a record of observations or a folder of student work samples. It is important to integrate items from Part B into the assessment process.

Please use the link below to access the electronic version of the complete document, which includes other activities, such as opportunities for open-ended and challenge experiences that must be examined for alignment prior to use.

http://www.sde.ct.gov/sde/cwp/view.asp?a=2618&q=321084

Standard	State Framework	Performance Activity	Performance Task
Algebraic Reasoning	**K.1.1.1** Describe the rule used to sort.	**What's my rule?** Give the student a set of objects, such as buttons, and ask the student to sort them and describe the sorting rule used. Then ask the student to sort the same objects in a different way and describe the new sorting rule. [Fall Winter]	**Multiple Sorts/Multiple Rules** Ask the student to sort a set of objects and describe the rule; then sort the same set of objects in a different way, and describe the second rule. [Nov.]
	K.1.1.3	**Pattern Making** In advance, prepare an AB pattern that repeats five times using two colors of Unifix cubes. For example: R Y R Y R Y R Y R Y Give the student a large collection of the Unifix cubes, including more than the two colors, (buttons, keys, leaves or different pattern block shapes would be good as well) and ask the student to copy and build the same pattern underneath yours. If the student successfully builds a copy that repeats the pattern five times, ask the student to make the pattern longer, perhaps to the edge of the table. [Winter Spring]	**Pattern Extensions** Start an ABBABB pattern with Pattern Blocks and have the student extend it. Include ABC.

Standard	State Framework	Performance Activity	Performance Task
Numerical and Proportional Reasoning	**K 2.1.1**	**Rote Counting** Ask the student to count out loud starting from 1. If the student counts beyond 100, ask the student to stop. Record the highest correct number. Successful performance is the ability to count correctly to 30 by the end of the year. [Fall] Assess rote counting three times during the year and enter the highest number on the record card each time. [Winter] Assess rote counting for a third time and enter the highest number on the record card. [Spring]	**Recording Highest Number** Observe the student rote count and record the highest number.
Numerical and Proportional Reasoning	**K 2.1.3**	**What's the Correct Order?** Give the student a set of button cards from 10-20 or from 20-30. Ask students to arrange them in order. [Winter Spring]	**Matching and Sequencing** Give the student a set of button cards 1-30 and a set of numeral cards. Ask the student to match each set with a card and arrange the sets in order. [Spring]

Standard	State Framework	Performance Activity	Performance Task
Numerical and Proportional Reasoning	**K 2.1.4**	**Recognize Ordinals** Make a row of five Unifix cubes, each a different color - such as red, yellow, blue, green, and white, when facing the student. Sit next to the student. Ask the student to tell you the color of the first cube; then ask for the color of the third cube. If successful, ask the student to tell the position of the green cube (fourth) and the white cube (fifth, or last). [Spring]	**Identifying Ordinals** Given a row of five Unifix cubes, each a different color, ask the student to name the color of the fourth cube, the first cube, the last cube, etc.
Numerical and Proportional Reasoning	**K 2.1.5**	**Making Halves** Fold a paper in 1/2. Color 1/2 of a shape. [Spring]	**Making Halves** Given 3 choices, point to item that represents 1/2. Given 3 shapes, fold them in half.
Numerical and Proportional Reasoning	**K 2.2.9**	**Match Making** In advance, put out four counting mats of 2, 5, 1, and 3 Unifix cubes. Give the student a shuffled set of numeral cards 1-20. Ask the student to place the matching numeral card next to each set. Observe how the student approaches the task. Successful performance is the correct matching for all four sets. [Winter] Repeat the task, but place 7, 5, 10 and 8 Unifix cubes on the mats. [Spring]	**Identifying Numerals** Ask the student to tell each number as you show a set of number cards.

Standard	State Framework	Performance Activity	Performance Task
Numerical and Proportional Reasoning	**K.2.2.9**	**I Can Write My Numerals** Show the student a mat with one Unifix cube on it. Ask the student to tell you how many and then write the same numeral. Then add a cube to the mat and again ask the student to tell how many and write the numeral. Repeat for up to ten cubes. [Winter] Ask the student to count aloud from 1 to 30 and write each numeral after it is said. [Spring]	**Recording Amounts of Objects** Ask the student to write the number on a small chalkboard that tells how many are in a small set or in picture of objects. Repeat for 2 or 3 different amounts.
Numerical and Proportional Reasoning	**K 2.2.10**	**Oral Story Problem** Give the student a handful of pennies. Tell the student you are going to read aloud a story problem about pennies - and that you will read it twice. Then read the problem. "Jimmy had three pennies. Maria gave him five more pennies. How many pennies does Jimmy have in all?" Read the problem again. Note whether the student solves the problem with or without counting out pennies. [Winter]	
Numerical and Proportional Reasoning	**K 2.2.12**	**Estimating** Show the students a transparent plastic bag that contains ten Unifix cubes. [Winter] Repeat the task, but use a bag of twenty cubes. [Spring]	**Estimating and Comparing** Ask the student to estimate which of two sets is more; (ask why they made that choice); then have the student count each set and tell which is more. Ask the student to name the number which is one more than the larger set.

Standard	State Framework	Performance Activity	Performance Task
Numerical and Proportional Reasoning	**K 2.2.13**	**How much money do I have?** Place a pile of 10 pennies in front of the student and ask the student to count them. [Spring]	**How many pennies?** Observe students as they engage in tasks that require counting and trading pennies.
Geometry and Measurement	**K 3.2.5**	**Position: Shape and Jigsaw Puzzles** Place a puzzle frame and pieces in front of a student. Ask the student complete the puzzle. If successful, continue to provide puzzles of increasingly complexity or increase the number of puzzle pieces. [Winter.]	**Geoboards: Shapes and Positions** Ask the student to build a square on the geoboard. Ask the student to place a Unifix cube inside the square; then place the cube, in turn, near the top, near the bottom, outside, to the left, and to the right of the square.
	K 3.3.8	**Estimating Lengths** In advance, precut two strips of oaktag - make one equal in length to 5 Unifix cubes snapped together, and the other 10 cubes. Give the student the two strips and ONE Unifix cube and ask the student to estimate the length of each strip. Record the estimates. Repeat, but use longer strips - 8 and 15, for example. [Spring] **Estimating Area** In advance, cut a 3-inch by 5-inch rectangle from a sheet of oaktag (or use a 3 x 5 index card). Give the student ONE Color Tile and ask the student to estimate how many tiles would cover the rectangle. Record the estimate. (Note: although to the adult the unit is a square inch - to a student, the Color Tile is nonstandard.) Repeat, but use a 4 x 6-inch rectangle or index card. [Spring]	**Estimate and Measure** Ask the student to estimate the length of an object, such as a pencil, in Unifix cubes, and then measure the object using the cubes. **Spatial Relationships 1** Place a red, a yellow, and a blue Pattern Block together to form a design. Ask the student to estimate how many green triangles will cover the design. Then have the student cover and count.

Standard	State Framework	Performance Activity	Performance Task
		Estimating Volume In advance, find a jar or other container that will hold from 8 to 12 Unifix cubes when filled. Show the jar and ONE cube to the student and ask the student to estimate how many cubes will fit in the jar. Record the estimate. Repeat, but select a jar that will hold from 12 to 20 Unifix cubes. [Spring] **Estimating Weight** In advance, find two objects, one of which is obviously heavier than the other. Place the objects in front of the student and ask the student, before picking them up, to guess which is heavier. Then ask the student to pick them up and describe them. [Spring]	**Estimating and Measuring Volume** Fill a small jar with walnut-sized objects (less than ten should fill the jar) and ask the student to estimate the number in the jar. Then count. Select a somewhat larger jar and ask the student to guess if all the walnuts in the first jar will fit in the second jar. Then transfer them. Next, ask the student to estimate how many more walnuts could be added to the jar and fill it. Then count and fill. **Estimating Weight** Ask the student to select two different small objects in the classroom, one which is heavier than the other. Ask the student to predict what will happen when the objects are each placed in a pan of the balance. Then place the objects in the pans and discuss.

Standard	State Framework	Performance Activity	Performance Task
Geometry and Measurement	**K 3.3.8**	**How long is that?** Continuing from Activity 21, give the student a handful of at least 12 Unifix cubes and ask the student to measure each strip. Record if successful. Repeat, but use longer strips - 8 and 15, for example. [Spring] **How big is that?** Continuing from Activity 23, give the student a pile of Color Tiles (at least 20), and ask the student to find the area of the rectangle. Record if successful. Repeat in Spring, but use a 4 x 6 rectangle or index card. [Spring] **How much will fit inside?** Continuing from Activity 25, give the student at least 30 more Unifix cubes and ask the student to find out how many will fill the jar. Record if successful. Repeat, but use a larger container that holds 15 to 25 cubes. [Spring]	**Non-Standard Measures** Ask the student to build a Unifix cube train with a length of eight. Then ask the student to find an object in the room that is shorter than the train, another that is about the same length, and a third object that is longer than the train. **Spatial Relationships 2** Ask the student to take a handful of Color Tiles and build a flat design. Have the student take a second handful and build another flat design. Ask the student which design is larger, then estimate the number of tiles in each design; and then count and compare the areas. **Estimating and Measuring Volume** Fill a small jar with walnut-sized objects (less than ten should fill the jar) and ask the student to estimate the number in the jar. Then count. Select a somewhat larger jar and ask the student to guess if all the walnuts in the first jar will fit in the second jar. Then transfer them. Next, ask the student to estimate how many more walnuts could be added to the jar and fill it. Then count and fill.

Kindergarten-Part B Mathematics CRT

Note: These problems are grouped by standard, not grade-level expectation. However, it is important for students to experience problems such as these, even if they cannot yet read them independently. To use any or all of the problems you may need to use concrete materials and create individual worksheets for recording student responses.

Algebraic Reasoning

Sidewalk Patterns

Suzie has yellow and green chalk. She makes 12 squares on the sidewalk using a yellow and green pattern. What will her pattern look like?

Dinosaurs

Give each child a cup of dinosaurs. Tell them that before they can play with the dinosaurs they need to show what they discovered about them.

Broken Necklace

My sister just broke Mom's necklace. She is putting it back together by putting red beads, green beads, and blue beads on the string in a pattern. What will the next 6 beads on the string look like?

Pattern Train

Using 3 pattern blocks make a train. Show which one is a car. Ask, "What would your train look like if your train had 3 cars?"

Rock Collecting

Pat loves to collect rocks and looks for rocks every day. On the first day she found a little rock. On the second day she found a big rock. On the third day she found a little rock. If this pattern continues, what size rock will Pat collect on the 10th day?

Flowers

You are planting flowers in a garden. You are planting in a pattern. The first is yellow, then red, then orange. If you continue this pattern what color will the 10th flower be?

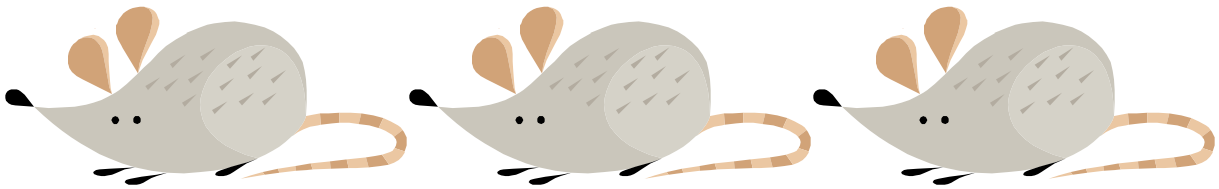
Farmer Fred

Farmer Fred wants to line up his 10 chicks and 10 ducks for a parade around the barnyard. He wants them to be in a pattern. What could the line look like?

Numerical and Proportional Reasoning

Example: Mice in the Meadow

Three mice are in the meadow. How many ears in all?



Cupcakes

There are 6 children in our class. If someone brings in 12 cupcakes to celebrate a birthday how many cupcakes will each child get?

Pumpkins

Five little pumpkins sitting on a gate. They each have 2  s for eyes and 1  for a nose. How many  s in all?

Gingerbread Men

I have 5 gingerbread men. I want to use raisins for the eyes. How many raisins do I need?

Favorite Sandwich

Mary's favorite sandwich is a peanut butter and jelly. She eats one everyday this week at school. How many sandwiches did Mary eat this week?

Goldilock's Next Adventure

Papa Bears always have large bowls. Mama Bears always have medium bowls. Baby Bears always have small bowls. When Goldilocks entered the house she saw 4 large bowls, 3 medium bowls, and 2 small bowls. How many bears lived at the house? Show the bears that lived there.

Rabbits

If there were 10 rabbits and 2 rabbits could share a carrot, how many carrots would we need?

Cookies to Share

Joey brought in 8 cookies to eat for snack. There are 16 kids in his class. How can they share the cookies equally?

Fair Share

Three dinosaurs were sharing 10 leaves. What would a fair share for each dinosaur be?

Eyes

Half of our Kindergartners have blue eyes. How many children have blue eyes?

Pizza for Two

Do you like pizza? Show how you and a friend could share a round pizza equally.

Pizza for Four

Do you like pizza? Show how you and 3 friends could share a square pizza equally.

Pizza for Six

Do you like pizza? Show how you and 5 friends could share a rectangular shaped pizza equally.

Hatching Chicks

It takes 21 days for our chicks to hatch. If today is day 11, how many more days until our chicks will hatch?

Mittens on a Line

We are going to hang some mittens on a line. The first mitten is red, the second mitten is green, the third mitten is yellow, and the fourth mitten is red. The mittens continue in this pattern. What color will the 6th mitten be?

Beanie Baby Beds

Anna has 10 Beanie Babies. She and her mom have decided to make beds for them. Each bed will hold 2 Beanie Babies. How many beds will Anna and her mom have to make?

Geometry and Measurement

Painting

I want to paint my wall with triangles and squares. I use more triangles than squares. What would my wall look like?

Popsicle-stick Shapes

Sue has 19 popsicle-sticks. She wants to make 5 square shapes. Can Sue make her 5 squares if she uses her 19 sticks?

Sorting with Blocks

Close your eyes and pick out 8 pattern blocks. Now, open your eyes and put the blocks in groups. Explain your answer.

Rods for Roads

The town road crew is going to build 2 roads of the same length. Use the Cuisinaire rods to show two different roads of the same length. Which road uses more rods?

Working with Data

Zoo

We went to the zoo and saw a tiger, a lion, and a giraffe. Which is your favorite animal? Ask 10 other children their favorite animal. How can you show the class's favorite animal?

Surveys

Mrs. Brown is allergic to cats. We need to find out how many kids have cats at home. How can we organize to do this? (Other survey questions to do with the class: How many brothers, sisters, like pizza, want juice or milk.)
*Provide clipboards and have 1 student per day do the survey.

Tom's Blocks

Tom has a big tub of pattern blocks. Each of you can grab a handful. I want to know what shapes are in your hand. How can you show which shapes you have?

Curriculum Standards Connections

ALGEBRAIC REASONING: PATTERNS AND FUNCTIONS. Patterns and functional relationships can be represented and analyzed using a variety of strategies, tools and technologies.

COMPONENT STATEMENT: 1.1. UNDERSTAND AND DESCRIBE PATTERNS AND FUNCTIONAL RELATIONSHIPS.

Grade Level Expectations

1. **Sort and classify objects by a variety of attributes (size, shape, color, texture, orientation, position and use), and explain the reason for each sort. (See also GLE 4.3.3.)**

Provide children with daily opportunities to sort and classify varied objects and explain their reasoning.

- Provide students with a collection of keys to sort according to one characteristic such as length, size or type of keyhole.
- Use any available collections such as shells, beans, rocks or buttons and have children glue the sorted objects to a large index card or piece of oak tag and place in a center so that other children can guess the reason for the sort.
- Encourage children to classify objects in the classroom such as old crayons or pencils by characteristics, e.g., color, length, and points or no points.
- Have children find all of the objects in the room that have a common attribute or use, such as all smooth objects or everything that can be used to make a picture.

2. **Describe and make comparisons of qualitative and quantitative changes of a given pattern using terms such as warmer, softer, more, one more, less, one less, bigger, smaller, longer and shorter. (See also GLEs 3.3.8, 3.3.9 and 3.3.10.)**

- When discussing the weather, ask children to compare daily temperatures using language such as, “Today is cooler than yesterday.”

- Have children monitor the growth of a plant or pet using comparative language.

- During calendar time, have children discuss what happens to the collection of counters for each day of the month/year. Ask them to explain how yesterday's collection differs from today's collection (one less) and predict what will happen to the number of counters tomorrow (one more).

3. Recognize, reproduce, extend and create repeating patterns using movement, sounds, color, shapes, numbers and textures. (See also GLE 3.3.6.)

4. Identify and extend visual, auditory and physical patterns in order to make predictions.

- Identify patterns in the environment such as floor tiles or windows.

- Recognize, copy, extend and create repeating patterns using objects, numbers and geometric figures, e.g., triangle, square, triangle.

- Recognize, copy, extend and create auditory repeating patterns (e.g., the patterns in songs, poems and/or rhymes).

- Have a group of five children stand in line in front of the class (audience). The child leading the activity should whisper instructions that follow a pattern to each person in line. At the leader's signal, the children in line silently carry out the whispered instructions, e.g., the first child smiles, the second frowns, the third smiles, etc. The audience should then be asked to silently repeat the pattern. The leader can choose an audience member to explain what the pattern was and then come up to the front with a new group to repeat the activity using a different pattern.

- Show cards that illustrate physical action (snapping, clapping, etc.). Have each child choose two or three different cards as elements for a repeating pattern. The child should then create a pattern and demonstrate it for the class to copy and extend.

- Have a child create a kinesthetic pattern, such as stomping and clapping or right arm raised then left arm raised, for classmates to copy and extend.

- Once children have identified, copied and extended patterns, give them opportunities to explain how they know what the next, or missing, element in a pattern will be. Example: clap, stomp, stomp, clap,_____, stomp

❖ **Possible Assessment Opportunities**

❖ Have each child individually create and demonstrate a repeating pattern using concrete objects, songs, rhymes and/or body movements.

Ask questions such as:

1. Explain how you made your pattern.
2. Why did you decide to make this particular pattern?
3. Where have you seen or heard a pattern that is similar to your pattern?
4. Can you make your pattern a different way (using shapes, colors, size, position, numbers or letters)?

Intervention: Provide visual or physical models for a two-element pattern for the child to copy and extend. Have the child then create a new pattern using the same models.

Challenge: Encourage children to create their own repeating patterns using four or five elements.

- Have children explore arranging a set of objects.

❖ **Possible Assessment Opportunities**

❖ Given a collection of objects, such as buttons, or trucks and cars, have children sort and classify the objects according to their own rules; use the sorted objects to create a pattern based on similarities and differences (e.g., car, truck, car…or according to the number of button holes).

Intervention: Use a small collection of objects and provide cues for sorting. Create AB patterns from the sorted objects.

Challenge: Include variations of ABC patterns.

A SAMPLE INTEGRATED LESSON – KINESTHETIC AND AUDITORY PATTERNS

Context: José really likes music time. He enjoys recognizing different patterns during finger-plays. What patterns do you notice in the finger plays such as, "Ten Little Monkeys" and "The Eensy Weensy Spider?" Is there more than one pattern?

Grade Level Expectations: 1.1.3, 1.1.4, 4.1.3

Time: One instructional period, which can be during music or physical education

Objective: The children will recognize and copy a kinesthetic or auditory pattern.

Procedure:

1. Select a child to copy and describe a teacher–made kinesthetic or auditory pattern from the songs in the context.
2. The children demonstrate auditory or kinesthetic patterns from familiar nursery rhymes.

❖ **Possible Assessment Opportunities**

❖ Children play "Simon Says" using kinesthetic patterns that they create. The class plays the game by copying the leader's patterns exactly. The winner becomes the new leader and demonstrates new patterns for the children to copy.

Intervention: Give a child cards illustrating physical actions from which to create a pattern.

Challenge: Create another pattern using the same cards and then translate the elements into another representation of the pattern.

Or use the following lesson:

MAKING A RECORD OF PATTERN CORES

This lesson focuses on elements that constitute a pattern core or unit. Identifying the core element or unit that is repeated is a necessary early concept that students must understand to recognize and create repeating patterns. Students will be able to identify repeating patterns; recognize and create core elements of repeating patterns; and record repeating patterns. http://illuminations.nctm.org/LessonDetail.aspx?ID=L495

Interdisciplinary Framework Connections				
Science	**English/Language Arts**	**Social Studies**	**Visual and Performing Arts**	**Physical Education**
A INQ. 3 Make predictions based on observed patterns (e.g., look for patterns in leaves, flowers, etc). **K.1 A.3** Count objects in a group and use mathematical terms to describe quantitative relationships such as same as, more than, less than, equal, etc. **K.3 A7.** Describe and record daily weather conditions. **K.3 A.8** Relate seasonal weather patterns to appropriate choices of clothing and activities (e.g., discuss patterns in calendar and day).	**2.1a** Recognize patterns in text (e.g., have children recite simple poems/ rhymes).	• Create timelines that sequence events and people, using days, weeks, months (e.g., explore the pattern of our day; identify patterns in our community).	**Music** • Perform easy rhythmic, melodic and choral patterns accurately (e.g., copy then create simple AB patterns). • Echo short rhythms and melodic patterns (e.g., sing songs). **Art** • Look for patterns in pictures.	• Demonstrate accuracy in memorizing and reproducing simple movement phrases. • Recognize and apply the concepts of body space, effort and relationships in developing movement sequences and game strategies (e.g., copy, extend, and create body patterns/dance).

Vocabulary: pattern, patterns, next, before, after, more, most, less, bigger, smaller, longer, one more, one less, over, under, size, shape, color, day, week, year, days of the week, few, fewer, fewest, month, hour, season, element, core elements, sort, classify, extend, texture

Resources:

Electronic Resources:

A to Z Teacher Stuff http://lessonplanz.com/Preschool/

Kinderplans.com http://www.kinderplans.com/content.cfm?pageid=132

Kinderart Littles http://www.kinderart.com/littles/dinosaur.shtml

SuperKids (Educational software Review) http://www.superkids.com/aweb/pages/reviews/multisub/preschoo/

Center for Distance and Online Learning http://teams.lacoe.edu/teachers/index.asp

Teach, Learn, Communicate http://www.alfy.com/teachers/teach/thematic_units/Patterns_Shapes/PS_1.asp

Internet4Classrooms http://www.internet4classrooms.com/kplus_subjects.htm

Gayle's Preschool Rainbow http://www.preschoolrainbow.org/counting-theme.htm

National Library of Virtual Manipulatives http://nlvm.usu.edu/en/nav/grade_g_1.html

Let's Size It Up – Goals 2000

Turkey – Goals 2000

Unifix Patterns – Goals 2000

Structured Observations: Pattern Assessment – Goals 2000

Pattern Questions - Goals 2000

Teacher References:

Picking Apart Patterns AIMS magazine. Volume 8 issue 5

Teddy Bears Go to the Movies and *Teddy Bears Go Hiking.* Primarily Bears, AIMS

Sorting and Patterning in Kindergarten: *From Activities to Assessment.* Elizabeth J Ziemba and Jo Hoffman, January 2006, Volume 12, Issue 5, Page 236

Algebra in the PreK-2 Curriculum? Teaching Children Mathematics, NCTM Sept. 2005

Children's Literature:

The Eensy Weensy Spider by Mary Ann Hoberman

A Pair of Socks, by Stuart J. Murphy

The Table of Phinneas Fable, by George Green

Pattern Bugs, by Trudy Harris

The Button Box, by Margarette Reid

What Comes in 2's, 3's, and 4's? by Suzanne Aker

Cookie's Week, by Cindy Ward

One Fish, Two Fish, Red Fish, Blue Fish by Dr. Seuss

The Boy and the Quilt, by Shirley Kurtz

Pattern Fish, by Trudy Harris

Elmer, by David McKee

Baby Rattlesnake, by Te Ata

Ten, Nine, Eight, by Molly Bang

Puppies in the Snow, by James Young

Classroom Materials: collections such as buttons, shells and colored cubes

Notes:

NUMERICAL AND PROPORTIONAL REASONING. Quantitative relationships can be expressed numerically in multiple ways in order to make connections and simplify calculations using a variety of strategies, tools and technologies.

≈ *COMPONENT STATEMENT: 2.1. UNDERSTAND THAT A VARIETY OF NUMERICAL REPRESENTATIONS CAN BE USED TO DESCRIBE QUANTITATIVE RELATIONSHIPS.*

Grade-Level Expectations *(Italics indicate links not evident in 2005 framework)*

1. ***Represent quantities of up to 30 objects in a set.***

2. ***Compare sets of up to 30 objects and use the terms more, less or the same to compare the two sets and identify a set with one more or one less than a given set.***

    - Provide numerous opportunities to count and use counting words when reciting poems or rhymes, singing songs, playing games and reading books.

    - Have children arrange sets of different amounts of objects in one-to-one correspondence. Ask questions such as:

        1. Which group has more?

        2. Which group has less?

        3. Do these have the same amount? How do you know?

    - Make a group of objects. Have the children count and create a group that is the same as the given group. Make another group that has more or less than the original group. Describe how your group is different from the original group. Ask questions such as:

1. Is your group a lot more or a lot less? A little more? A little less?

2. Can you tell how many more are in this group? How do you know?

3. Can you match the number of objects in a set to the number names?

4. What number comes after_____? Before_____?

- Using dominoes, dot cards, or a set of up to 10 objects, count the dots or objects and say the number name that tells the amount. Match that amount with the correct numeral or written symbol.

3. Order sets of up to 30 objects from least to greatest.

- Give children opportunities to count and compare quantities in familiar situations, beginning with 10 and moving to greater quantities, as the children are ready.

- Example: Some children are playing outside at school. Three of the children are on the playscape and four are playing catch in the field. Ask questions such as:

  1. How many children are on the playscape?

  2. How many children are playing catch?

  3. How many children are on the playground?

- During snack or lunchtime have the children compare their food or drink. Ask questions such as:

  1. How many children had milk? (Have the children count themselves.)

  2. How many children had juice?

  3. How many children had water?

  4. Give the milk, water and juice drinkers different colored counters to be placed in lines of one-to-one correspondence on a table for all to see and have the children decide which was the most, middle and least.

4. **Identify the ordinal position of objects: first, second, third, fourth, fifth and last.**

   - When children are in line, have a child chose who is first in line. Ask the child (the line leader) to identify the child who is second in line. Repeat this process for the children who are third through fifth and last in line.

   - Using familiar objects or a series of pictures of familiar objects ask the children to identify which object is first, second, third, fourth or last.

   - Give directions and discuss activities or events using the terms first, second, third … last.

5. **Use a variety of models and familiar objects to compare two parts of a whole and describe the parts as being closer to a whole or closer to very little**

   - Cut shapes such as squares, circles or triangles into two unequal parts. When comparing the pieces to a whole, ask questions such as:

     1. Which piece is closer to the whole square, circle or triangle?

     2. Which piece is closer to very little of the square, circle or triangle?

6. **Use a variety of models and familiar objects to:**

   - **Identify one whole and one half of an object.**

   - **Recognize a half and put two halves of an object together to make a whole.**

   - **Form a whole from two smaller sets that have equal amounts.**

   - Divide fruit or other edible snacks into two equal parts; give each child a half. Have children explain why the two halves would be a whole if they were put back together.

❖ **Possible Assessment Opportunities**

❖ Use shapes or pictures on colored papers, cut each paper into two equal parts.

Give each child a half of one paper and ask her or him to find the other half that to make the whole shape or picture. Ask the child to explain the thinking used to find the missing half.

Intervention: Place a rectangular piece of paper in front of the child with a line drawn to divide the paper into two equal parts. Give the child two more rectangular pieces of paper that are the same size (congruent), and different colors. Ask the child to use the second piece of paper to cover the whole rectangular piece in front of her and ask which is called one whole. Then have the child use the additional two pieces of paper to show one half of the rectangle by sliding one piece over the other until the top paper is aligned with the drawn line and shows only one half of the bottom rectangular piece. Have the child repeat finding one half by sliding the paper in the opposite direction. Once the child understands what one half of the rectangle looks like, have the child find one half of other pieces of rectangular paper. (This could be done on a computer as well.)

Challenge: Cut various shapes and pictures into three unequal parts. Have the child reassemble the wholes using the parts and identify each step of the assembly as yielding a shape or picture that is closer to very little, one half, or one whole.

≈ *COMPONENT STATEMENT: 2.2. USE NUMBERS AND THEIR PROPERTIES TO COMPUTE FLEXIBLY AND FLUENTLY AND TO REASONABLY ESTIMATE MEASURES AND QUANTITIES.*

Grade-Level Expectations *(Italics indicate links not evident in 2005 framework)*

7. **Count by rote to at least 30.**

8. **Count and group up to 30 objects by tens. (See also GLE 2.2.14.)**

❖ Possible Assessment Opportunities

- ❖ Have children count 20 familiar objects from their environment; place the counted items aside to keep track of them.

Intervention: Place counters in each grid of a 10-frame while counting. The grid can be made on a cookie sheet with masking tape and magnets used as counters. This approach provides auditory, visual and motor cues.

Challenge: Children can count as many objects as they are capable of and place the objects in groups of 10 and then count by tens.

9. **Identify the numerals 1-10 and match each numeral to appropriate sets of objects. (See Sample Integrated Lesson.)**

10. ***Act out and solve addition and subtraction story problems that reflect real-world experiences and practical problems using sets of up to 10 objects and describe the strategy or reasoning used to solve a problem. For example: Put two black crayons in the bin together with four black crayons; then count to determine the total number of black crayons.***

    - Use regular classroom opportunities such as the distribution of supplies or snacks and the organization and replacement of materials in the designated centers or storage places to have children solve contextual problems.

11. ***Write the number sentences that correspond to story problems using addition, subtraction and equal symbols (+, -, =) correctly.***

    - When children have developed to the point where they can use symbols correctly, record the situations from GLE 10 as number sentences.

12. **Estimate the amount of objects in a set using 10 as a benchmark, and then count to determine if the amount is more or less than 10. (Example: Ask students to estimate or make an *eye guess* of the number of pattern block triangles they can hold in two hands or the number of blocks in one scoop).**

13. **Recognize and name pennies and dimes.**

14. **Count pennies and trade pennies for objects.**

    - Give students a collection of pennies and dimes and ask them to organize or sort the coins into two piles; one pile of pennies and one pile of dimes.

    - Place up to 10 pennies in plastic bags and give one bag to each child. Have the children use the pennies to purchase objects from the storekeeper "one object per penny."

    - Once children can shop with 10 pennies in a bag. Ask them to count and organize pennies into bags of ten pennies each for further shopping and trading opportunities.

SAMPLE INTEGRATED LESSON – HAPPY FACES

Context: Many things make people happy. Some people feel happy when they eat good food — like pancakes. Sunny days make other people happy. A boy named David is happy on sunny days. How happy would David be if he had the same weather that we have had? Use your classroom calendar/weather chart to help David find the answer. The animals in this story were happy because they helped make pancakes.

Grade Level Expectations: 2.1.1, 2.1.2, 2.2.7, 2.2.8, 2.2.9, 2.2.10, 3.3.7

Time: Multiple days

Objectives: Children will determine how many objects are in a set.

Children will create corresponding sets.

Children will use the calendar/weather chart to identify and record weather conditions.

Materials: Pancakes for Breakfast by Tomie DePaola, numeral cards for the numbers 1-5, worksheet with 18-20 happy faces printed on it, enough round counters so that each child can have 20, musical instruments, the monthly class calendar/weather chart with the sunny days marked with a sun or a happy face, a blank calendar, and crayons.

Procedure: (for several sessions)

1. Read the picture book *Pancakes for Breakfast.*
2. Ask the children if the lady in the story had pancakes for breakfast. How do they know?
3. Sing this song to the tune of *If You're Happy and You Know It…* show the numeral card for the number you are using in the song.

   If you'd like to eat some pancakes, clap [two] times,

   If you'd like to eat some pancakes, clap [two] times,

   If you'd like to eat some pancakes, then your face (hands, head, feet…) will surely show it,

   If you'd like to eat some pancakes, clap [two] times,

(In subsequent verses, replace the number with one, three, four or five, and the action with other motions such as tap your head, stomp your feet, or with the sounds of musical instruments such as sticks, tambourines or maracas.)

4. Give each child a copy of the happy face worksheet and some counters. Ask the children, "How many different animals helped to make the pancakes in this story?" Reread the story and have each child place a counter on a happy face every time we see a different animal. Have children count the number of happy faces they have covered by touching the counters.

5. Look at the monthly calendar and count the happy faces, representing sunny days, for the current month.

❖ Possible Assessment Opportunities

- ❖ Have the children identify one thing that makes them happy. Give the children a blank calendar and have them put happy face stickers in the boxes for all the days when they participated in that activity. Once a week, have the children share their calendar, count their happy days and tell the number of cumulative days they were happy.

Intervention: Have the child count the happy days by putting a counter on each box with a sticker and then removing the counters while counting out loud.

Challenge: Provide the children with calendars with different numbers of happy faces on them. The children should compare the amounts on the calendars and then come up with a scenario of what that calendar could represent. For example, A little boy was happy when he could read. He read five days last week. A little girl loved gymnastics and was happy two days last week. The boy had more happy days.

6. Show children the numeral cards and have them identify each numeral by clapping the number of times represented by the numeral.

7. When all the cards have been used and the corresponding faces covered, show the numeral cards in random order again, and have the children remove from the faces the number of counters that you are showing on each card.

❖ Possible Assessment Opportunities

- ❖ Have a child or adult show a numeral card. Children should clap accordingly and then count out the correct number of counters by placing each counter on a different happy face. Show additional number cards in random order. As the children work, note which children can count out all the groups without hesitation and which cannot. Show the children numeral cards from 1-5.

Intervention: Give the child a paper with only six happy faces and use the numeral cards 1-6 in order. Once the child is successful, mix the order of the number cards.

Challenge: Ask the child to give a total number of faces covered.

8. Ask the children what season is shown in the story. Discuss the clues they used to answer the question.

9. Ask the children about the weather is in the story. Discuss the clues used to answer that question.

Interdisciplinary Framework Connections			
Science	**English/Language Arts**	**Visual and Performing Arts**	**Physical Education**
A.3 Count objects in a group and use mathematical terms to describe quantitative relationships such as same as, more than, less than, equal, etc. **A INQ 4** Reads, writes, listens and speaks about observations of the natural world. **A INQ 9** Count, order and sort objects by their properties. **A.7** Describe and record daily weather conditions. **A.8** Relate seasonal weather patterns to appropriate choices of clothing and activities.	• Identify current knowledge and awareness on a selected topic before a reading activity. • Draw conclusions and use evidence to substantiate them by using texts heard, read and viewed. • Select and organize visual and auditory information to answer a specific question.	**Music** • Sing a song from memory.	• Follow classroom rules, activity-specific rules, safety practices, procedures, etiquette and good sportsmanship in various physical activity settings. • Work cooperatively with peers of varying skill levels.

Vocabulary: more than, less than, same, equal, count, one more, one less, close to, closer to, near, very little, more, less, bigger, smaller, few, most, number, numeral, count, how many, counting mat, estimate

Resources:

Electronic Resources:

More Counting: http://math.rice.edu/~lanius/counting/index2.html

Let's Count to 5: http://illuminations.nctm.org/LessonDetail.aspx?id=U57

Building numbers to 10: http://illuminations.nctm.org/LessonDetail.aspx?id=U147

Preschool and Kindergarten Math: http://www.edhelper.com/

Counting and Skip Counting: http://wwws.aimsedu.org/aims_store/home.php?cat=126

Understanding a Child's Development of Number Sense: http://illuminations.nctm.org/Reflections_preK-2.html (text and video)

Chrysanthemum – Goals 2000

Elephants Play – Goals 2000

Counting Jar – Goals 2000

Mr. Mix-Up – Goals 2000

Number Assessment Interview – Goals 2000

Teacher References:

Elementary and Middle School Mathematics Teaching Developmentally, by J. Van de Walle, 5th Ed p. 116-121

The Young Child and Mathematics, by Juanita V. Copley

Research Ideas for the Classroom: Early Childhood Mathematics, edited by *Jensen*, p. 44

Children's Literature:

I Can Count the Petals on a Flower, by John and Stacy Wahl

The Very Hungry Caterpillar, by Eric Carle

What Do Plants Need? An AIMS Booklet for K.

How Many Snails? by Paul Giganti

Ten Black Dots, by Donald Crews

City by Numbers, by Stephen Johnson

Moon to Sun, by Sheila White Samton

Down in the Daisies, by L. Coats and E. Bolam

Quack and Count, by Keith Baker

One Gorilla, by Atsuko Motozumi

Annabell Swift, Kindergartener by Amy Schwartz

Mouse Count, by Ellen Stall Walsh

Benny's Pennies, by Pat Brisson

One White Sail, by S. T. Garne

Ten Flashing Fireflies, by Phileman Sturges

Pancakes for Breakfast, by Tomie dePaola

A Caribbean Counting Book by Faustin Charles and Roberto Arenson

Classroom Materials: snacks, toys, shoes, clothing, items from nature (shells, rocks, leaves, flowers), items from daily living (silverware, napkins, dishes, chairs, mats), books, markers, crayons, interlocking cubes, blocks

Notes:

GEOMETRY AND MEASUREMENT. Shapes and structures can be analyzed, visualized, measured and transformed using a variety of strategies, tools and technologies.

COMPONENT STATEMENT: 3.1. USE PROPERTIES AND CHARACTERISTICS OF TWO- AND THREE-DIMENSIONAL SHAPES AND GEOMETRIC THEOREMS TO DESCRIBE RELATIONSHIPS, COMMUNICATE IDEAS AND SOLVE PROBLEMS.

Grade-Level Expectations

1. **Identify and describe familiar shapes (triangles, squares, rectangles and circles) and solids (cubes, spheres, cylinders, cones and prisms) in the environment.**

   - Ask children to identify all the squares or circles that they can find in a particular location or situation.
   - Challenge the children by saying "I spy a rectangle or a triangle, who can see it as well?
   - Describe objects and shapes using descriptive language, such as round, pointed or straight, and geometric terms and names.

2. **Compare and sort familiar shapes and solids in the environment and contextual situations. (See also GLE 1.1.1.)**

   - Organizing objects into categories during informal sorting experiences at school focuses the children's attention on the attributes of objects to help develop an understanding of how things go together. Ask questions such as:

     1. How do we decide where to store new toys go in our classroom?
     2. Can you describe how I sorted _____?
     3. What is the same about this group of toys? What is different?

   - Provide opportunities to identify and sort collections of two- and three-dimensional shapes in the environment. Record data about the numbers of each shape found using tables and tallies.

- Sort and classify a set of objects by descriptive characteristics using graphic organizers such as a nonintersecting Venn diagram or two separate circles made out of yarn. Then identify the categories and have children place the objects in the correct category creating a real graph.

3. Construct small sets of shapes and solids using a variety of materials.

- Provide children with opportunities to make geometric shapes and objects out of materials such as clay or pipe cleaners. Children can sort the shapes they have created and describe how they sorted.

❖ Possible Assessment Opportunities

❖ Supply children with geometric shapes and figures objects that have been presorted according to size, shape or attributes such as roundness. Ask questions such as:

1. Can you think of a reason that these items are sorted this way?

2. Can you find other objects that could be placed in this group?

Intervention: Model by showing a group of different size rectangular objects such as writing paper, drawing paper, books and chart paper and ask the children to describe what each of the objects has in common.

Challenge: Ask the children to choose a way the items could be sorted differently and then re-sort accordingly.

~ *COMPONENT STATEMENT: 3.2. USE SPATIAL REASONING, LOCATION AND GEOMETRIC RELATIONSHIPS TO SOLVE PROBLEMS.*

Grade-Level Expectations *(Italics indicate links not evident in 2005 framework)*

4. Describe location, direction and position of objects or parts of objects, using terms such as under/over, inside/outside, next to/near, top/bottom, in front of, first and last.

- Give children opportunities to describe the location of familiar objects in the room. Ask questions such as: Where is the kitchen area? What or who is near the window?

- When the children line up, ask about their positions in line, requesting increasing detail as the year progresses. For example: a. Kim is next to or in front of Jason. b. José is in front of Chris and behind Kim and Jason. Chris is not first in line, he is last in line.

5. Complete simple shape and jigsaw puzzles and explain the reasoning used to solve the problem.

- Provide children with opportunities throughout the year to use *shape sorter* puzzles and activities.

- When children are completing puzzles, ask a child why he tried to place a piece in a certain space. Choose another piece and ask the child how she knew that it would not fit in that same space.

~ *COMPONENT STATEMENT: 3.3. DEVELOP AND APPLY UNITS, SYSTEMS, FORMULAS AND APPROPRIATE TOOLS TO ESTIMATE AND MEASURE.*

Grade-Level Expectations

6. Recognize events that reoccur (at specific times of the day or week).

- When discussing daily routines, ask the children about the first thing they usually do when they wake up in the morning, then the second thing that they usually do. Repeat the question for the evening routine asking about the last thing that they do before they go to bed.

- Ask when teeth are usually brushed.

- Discuss the time of day and sequence in which meals are usually eaten (breakfast, lunch, dinner or supper).

- Investigate patterns in the day, week, month and year.

- Talk about the class schedule for activities such as art, music, quiet time or circle time.

7. **Locate yesterday, today and tomorrow on a calendar to sequence events and use terms like before and after to compare events.**

   - Use a calendar to find today's date. Ask questions such as:

     1. Can you point to yesterday's date? Can you point to tomorrow's date?
     2. Does tomorrow come before or after today?

   - When talking about the day, ask questions such as:

     1. What did you do before you came to school today?
     2. What will you likely do before you come to school tomorrow? (Use terms such as definitely, probably and not likely.)
     3. What did you do when you went home after school yesterday?
     4. What are you likely to do when you get home after school today? (Use terms such as likely, maybe and not likely.)

8. **Use nonstandard units, physical referents (like a finger) or everyday objects such as links, Unifix cubes or blocks to compare, estimate and order measures of length, area, capacity, weight and temperature, and describe the reasoning and strategies used.**

   - Use different multiple nonstandard units to measure the same item. Ask questions such as:

     1. Why did we get different amounts of units?
     2. Which unit did we use the most of and why?
     3. Which units did we use the least number of pieces and why?

   - Give students numerous opportunities throughout the year to identify, place or line up objects from smallest to largest or from largest to smallest and explain how they made the decisions they did**.**

- Measure the attribute of size as it relates to the length, area and capacity. Use multiple nonstandard units such as paper clips, Unifix cubes, straws, etc., for the children to lay end-to-end for length, or cover a surface for area, or fill a container for capacity. Ask questions such as:

  1. Did it take the same number as you estimated?
  2. If not, was your estimate more or less?
  3. Why do you think there was a difference?

- Have the children compare the lengths or weights of two objects and identify which is longer, shorter, heavier or lighter. Ask questions such as:

  1. How do you know which object is longer or taller?
  2. Could we find another way to tell how much shorter an object is? (Use nonstandard units such as Unifix cubes.)
  3. Do our toys weigh the same or does one weigh more or less than another? How could we find out?
  4. Is there a way to find out how much more something weighs? (Use nonstandard units to compare the amount of weight.)

9. Describe and order small sets of familiar objects by size, length or area using comparative language such as more, bigger, longer, shorter and taller. (See also GLE 3.3.8.)

- Provide children with various objects and have them order them according to their length.

10. Use a balance scale to compare the weight of two objects and identify which is heavier.

- Have children hold two objects of obviously differing weights, one in each hand, to compare the weights.
- Once children determine which object is heavier, guide the children through how to use a balance scale to compare the same two objects, correlating the lower side of the scale with the heavier object.

SAMPLE INTEGRATED LESSON – THE ART SHOW

Context: The annual school art show will be next month. The art teacher wants to make sure that all types of art work are in the show. She would like your class to create designs using shapes.

Grade-Level Expectations: 3.1.1, 3.1.2, 3.1.4

Time: One instructional period

Objective: The children will be able to use shapes and spatial sense to create "Shape Designs."

Materials: art paper, a variety of cut out shapes in various colors, shape tracers (templates), pattern block shapes, glue, crayons, paint.

Procedure: (In the art or regular classroom)

1. Display art prints that were created using geometric shapes and designs and discuss them with the children.

    - Have the children identify the shapes that the artist used to create the work. The children should use terms such as above, below, next to, under/over, etc., to describe the location, direction and position of the shapes.

2. Using the art prints share with the children how real artists use space.

3. Hand out the art paper and have the children carefully look at its size to give a sense of the space needing to be covered and ask them to plan or think about the design they will create using the full space of the paper.

4. The design must have a minimum of three familiar shapes. (Some children may need to create a design using only two shapes.) The children can create different sizes and types of the shapes in the design.

5. Children may choose to use shape tracers, pattern blocks, cut out pattern block shapes, or draw or cut out their own shapes. The children can add color to their design using crayons, paint or colored paper.

6. Display the children's completed designs. Have each child choose a design (other than hers) and describe the shapes (including position, location and direction) while the other children try to identify the correct design from the class display.

❖ Possible Assessment Opportunity

❖ As children are working on their designs, circulate and ask them to identify and describe shapes and their positions, locations and directions.

Intervention: Arrange three different shapes (e.g. cut-outs, attribute or pattern blocks) in front of the child. Ask questions such as:

1. Which shape is to the left of the square? Can you make a picture of this design?

2. Can you point to the shapes or blocks that match the shapes in your picture and tell me their names? Describe where they are in the picture you created.

3. Using three-dimensional blocks from the play area, ask the child to create a design that looks like a house. Have the child copy the design on art paper by drawing, tracing or using cut-outs. What shape could you use to finish the house in your design? If you wanted to make a tall building what shapes would you use? How would you place the shapes?

Challenge: Have the children examine art work to find familiar shapes in the work. Ask the children to write or tell a story about the shapes that they see and why they think they are included in the design. The story should include identifying the shapes as well as their position, location, and direction. (For example: There is a picture of an amusement park. There was a ride that was shaped like an orange triangle on top of a purple rectangle. It looked scary. On the left of that ride was a huge circle Ferris wheel.) Have the children use the shapes they saw in the art work and create their own unique design.

Interdisciplinary Framework Connections			
Science	**English/Language Arts**	**Visual and Performing Arts**	**Physical Education**
A.INQ.9. Count, order and sort objects by their properties.	• Organize information in proper sequence to use in a summary and/or retelling. • Generate and respond to questions. • Use content vocabulary appropriately and accurately (math, music, science, social studies, etc.). • Use oral language to communicate a message. • Determine purpose and choose an appropriate written, oral or visual format. • Publish and/or present final products in a myriad of ways, including the use of the arts and technology. • Use appropriate language as related to audience.	**Art** •Use different media techniques and processes to communicate ideas, feelings, experiences and stories. •Use elements of art and principles of design to communicate ideas. •Select and use subject matter symbols and ideas to communicate meaning (e.g., use art materials to create sorting pictures, such as cutting out pictures and sorting them, creating pictures of shapes, making collages, etc.).	**Responsible Behavior** • Follow class rules, activity-specific rules, safety practices, procedures, etiquette and good sportsmanship in various physical activity settings (e.g., identifying and categorizing the rules for indoor and outdoor activities).

Vocabulary: sort, alike, different, objects, shape, same, square, rectangle, triangle, circle, cube, rectangular prism, sphere, quadrilateral, rhombus, straight, inside, outside, top, bottom, close, closer, similar, more, less, most, least, size, length, weight, area, capacity, lighter, heavier, longer, shorter, sides, faces

Resources:

Electronic Resources:

Amazing Attributes: http://illuminations.nctm.org/LessonDetail.aspx?id=U186

What's My Rule for Sorting? http://illuminations.nctm.org/LessonDetail.aspx?ID=L494

Sorting: http://www.sciencenetlinks.com/lessons.cfm?DocID=19

Sorting Self-Assessment: http://www.readwritethink.org/lesson_images/lesson378/venn-assessment.pdf

Teacher Resources:

NCTM Principals and Standards, by Date and Probability Standards K-2

Engaging Young Children in Mathematics, by Douglas H. Clements

Adding It Up! by National Research Council

Elementary and Middle School Mathematics, by John Van De Walle

Investigations with Pattern Blocks, by Marcia Miller and Martin Lee

Children's Literature:

The Shapes Game, by Paul Rogers

The Legend of Spookley, The Square Pumpkin, by Joe Troiano

Circus Shapes by Stuart Murphy

Sea Shapes, by Suse MacDonald

This is the Way We Go to School, by Edith Baer

The Shape of Things, by Dale Ann Dodd

Shape Spotters, by Megan Bryant

Notes:

WORKING WITH DATA: PROBABILITY AND STATISTICS. Data can be analyzed to make informed decisions using a variety of strategies, tools and technologies.

COMPONENT STATEMENT: 4.1. COLLECT, ORGANIZE AND DISPLAY DATA USING APPROPRIATE STATISTICAL AND GRAPHICAL METHODS.

Grade-Level Expectations

1. **Pose questions about objects and events in the environment that can be used to guide the collection of data.**

   - Guide the children to ask questions that can be answered by each person contributing data on topics such as:
     - favorites: fruits, colors, seasons, pets, books, TV programs;
     - measures: time to complete a task, temperature, height, distance jumped, weight of various objects; and
     - number-family members, birth dates, letters in a name.

2. **Collect data and record the results using real graphs and picture graphs.**

   - When creating real graphs, have children use actual objects to represent data.
   - When creating picture graphs, have children use pictures in a one-to-one correspondence to the data being represented.

3. **Arrange information in a systematic way using counting, sorting, lists and graphic organizers. (See also GLE 1.1.1.)**

   - When children are sorting objects, encourage them to organize the objects by the same attributes or criteria used for the sort.
   - Use representative tallies or marks, and organizers such as yarn loops or hula hoops.

COMPONENT STATEMENT: 4.2. ANALYZE DATA SETS TO FORM HYPOTHESES AND MAKE PREDICTIONS.

Grade-Level Expectations

4. Describe data using the terms more, less and the same. (See also GLE 1.1.2 and GLEs 3.3.8, 3.3.9 and 3.3.10.)

- Describe data collected and arranged according to GLEs 1, 2 and 3.

❖ Possible Assessment Opportunities

❖ Have each child be responsible for displaying data in a real or picture graph and explaining the answer to a question similar to those suggested in GLE 1.

Intervention: Prompt the child with specific questions such as: What question did we ask to get these data? How should we organize the data? (Can we use the items, pictures of the items, or marks?) Should we use hoops or paper?

Challenge: Ask the child to offer suggestions for a question that might have been used to gather data that is already displayed. Ask if the child can display the same data in a different way.

5. Identify and extend patterns from organized data to make predictions. For example: More boys than girls in our class watch television every day. We predict that the same will be true for another kindergarten class.

- After surveying the class to answer the question "Who reads more than 2 books every day?", organize the data by gender and describe the results. Since boys read more than girls in our class, can we predict that the same will be true for another kindergarten class? If not, what do we need to do to be able to make a prediction?

COMPONENT STATEMENT: 4.3. UNDERSTAND AND APPLY BASIC CONCEPTS OF PROBABILITY

Grade-Level Expectations

6. Describe the likelihood of the future occurrence of events based on patterns and personal experiences using terms such as likely, unlikely or certainly.

- After children have become accustomed to the class schedule, which might include art on Wednesday mornings, ask if it is likely, unlikely or certain that art class will be on Wednesday afternoon.

7. Engage in simple probability activities and discuss the results.

- Display a large spinner divided into four equal parts. Color three sections blue and one section yellow. Have children take turns spinning the spinner. Discuss the results as a class.

- Place four same size balls in a box (three yellow and one blue). Have four children select one of the four balls from the box, without looking, and record the results. Display the four balls while the children discuss the results and compare them to the spinner test.

SAMPLE INTEGRATED LESSON — ACHOO!

Context: Mrs. Brown is allergic to cats and they make her sneeze, so she has a pet dog at home. Many of the children have pets at home and some have cats as pets. We want to find out how many children have cats at home.

Grade Level Expectations: 4.1.1, 4.1.2, 4.1.3, 4.2.4, 2.1.2

Time: One instructional period with additional time for displaying data contributed by the children

Objective: Children will collect and organize data that answer a question. Children will represent the data in different ways and count to compare the data.

Materials: Bulletin board; wall or chart paper; photographs of each child with or without the pet; photographs of pets or pictures of cats, dogs, fish, birds and any other living and nonliving (stuffed animal) pets the children have. Chalk or yarn circles large enough for the children to stand in.

Procedure: Ask the children to answer the question: Who has a pet at home?

- Have those children with pets stand in one circle and those without pets in another adjacent circle. Count the children in each circle by pointing to each one by one. Record the number of children in each category, using circles with pictures, Post-its or tallies. Have the children sit and count the number in each category along with the teacher.
- Ask questions such as: Are there more children who have no pets at home than have pets at home? How can you tell?
- Now ask the children who have pets to organize themselves in the circles by whether the pets they have are living or not living. Compare the data by asking which circle has more or less children.
- Ask the children who have living pets to identify the type of pet they have and then lead the children in displaying the data using a picture graph of actual photographs or pictures cut from magazines or downloaded from the internet. Ask the children to identify and name the types of living pets they see.

❖ Possible Assessment Opportunities

❖ Prompt the children to describe the number of each type of pet using the terms more, less or the same.

Intervention: Sit with the child and have the child organize up to 10 mixed pictures of living and nonliving (stuffed) animals into two groups. Ask the child to count the number in each group and describe the group using more, less and the same.

Challenge: Have the children decide on a question and survey another class. Ask the children to decide on the best way to share the results with classmates and explain why they chose the question and how their data compare to the data on class pets.

Interdisciplinary Framework Connections		
Science	**English/Language Arts**	**Physical Education**
A.3 Count objects in a group and use mathematical terms to describe quantitative relationships such as same as, more than, less than, equal, etc. **A INQ 4** Reads, writes, listens and speaks about observations of the natural world. **A INQ 9** Count, order and sort objects by their properties.•	• Draw conclusions and use evidence to substantiate them by using texts heard, read and viewed. • Follow classroom rules, activity-specific rules, safety practices, procedures, etiquette and good sportsmanship in various physical activity settings.	• Select and organize visual and auditory information to answer a specific question. • Work cooperatively with peers of varying skill levels.

Resources:

Electronic Resources:

How Old Are You? - Goals 2000

Sylvester's Pebbles - Goals 2000

Recognizing Possible and Impossible - Goals 2000

Notes: