Understanding Geometry and Measurement
Pre-K – 2nd Grade:

Facilitating Coherence and Connections
Conceptual Understanding – Coherence and Connections

• Carefully connect the learning within and across grades so that students can build new understanding on foundations built in previous years.

• Begin to count on solid conceptual understanding of core content and build on it. Each standard is not a new event, but an extension of previous learning.

(www.achievethecore.com)
Boats, Shapes, Weights and Counting
Coherence and Connections?
Understanding Measurement

**PreKindergarten**
- **Foundational Concepts:** Identify measureable attributes; focus on vocabulary to describe comparison
- **Length:** direct comparison
- **Area:** direct comparison by one side only
- **Capacity:** direct comparison by pouring

**Kindergarten**
- **Foundational Concepts:** Identify measureable attributes; explore conservation, begin iteration, transitivity
- **Length:** direct comparison; focus on conservation; serial orderer with lengths marked in units
- **Area:** covering shapes with squares and grids
- **Capacity:** direct comparison by pouring

**First Grade**
- **Foundational Concepts:** Iterates with accuracy; explains transitivity
- **Length:** indirect measurer with same-size length units
- **Area:** Begins to count some but not all rows of area; explores by drawing squares and structuring shape.
- **Volume:** Begins to explore by packing boxes with centimeter or inch cubes; counts cube one at a time.

**Second Grade**
- **Foundational Concepts:** Inverse relationship between size of the unit used to measure and the number of units.
- **Length:** Measure accurately using a ruler and the alignment of zero point. Uses standard units
- **Area:** Structures space by drawing conserves and reasons about additive composition
- **Volume:** Uses same-size units to fill and count accurately.

**Routine:** Measurement Moves
- Whole Group and Center: I'm Heavy!!
- Circle and Small Group: Parking Cars
- Circle and Small Group: Race to the Top
- Center: Exploring Capacity

**Routine:** How Tall is that Tower?
- Small Group: Rockets
- Whole Group and Partners: Cubits and Rods
- Center: Heavier, Lighter, About the Same
- Center: Measuring Around

**Whole Group:** Exploring Shapes*
- Small Group: Inch Tools
- Whole Group and Center: Measuring Pizza**
- Center: Stick Designs
- Whole Group and Small Group: Robert Wadlow and Feet**

**Routine:** Cover It and Fill It!
- Homework Project: Measuring Porsche
- Center: Long, Wide, High and Around
- Whole Class and Centers: Estimation Olympics
- Small Group: Face Measures
NCTM Publications

Developing Essential Understanding of Geometry and Measurement Pre-K–Grade 2

Putting Essential Understanding of Geometry and Measurement into Practice Pre-K–2
Topics

- Classifying objects \(\leftrightarrow\) Big Idea ONE
- Structuring space and identifying locations \(\leftrightarrow\) Big Idea TWO
- Decomposing and composing shapes \(\leftrightarrow\) Big Idea FOUR
- Measuring geometric attributes \(\leftrightarrow\) Big Idea FOUR
- Transforming shapes and objects \(\leftrightarrow\) Big Idea THREE
Classifying Objects

Big Idea ONE

• A classification scheme specifies for a space or the objects within it the properties that are relevant to particular goals and intentions.
  – Refine and extend categorizations by more precise language
  – Same collection of objects may be categorized in different ways
Sorting: Flats and Solids ("Fats")
Making Prints with Solids
“Stacking” Attributes of Solids
“Tall” and “Squ” Shapes
“I like circles and red big ones!”
2D Loop Games
“We gotta’ put them together!”
Creating and Labeling 2D Shapes

Anglegs

Straws with threaded pipe cleaners

Sticks and Playdoh
Triangles and Quadrilaterals
“My frogs jump in rectangles!”
Finding Square Corners

“When you find 1 square corner, you find 3 more.... sometimes!”
First Grade Created Shapes

[Image of a girl holding a paper with vertices and sides labeled]
pentagon
hexagon
Structuring Space and Identifying Locations

Big Idea TWO

• Geometry allows us to structures spaces and specify locations within them.
  – Describe locations with reference point and distance and direction from point.
  – Position in space can be labeled with numbers.
Organized Using Subitizing, Colors and Grids -
Tangram Blocks Provide Good 3D Building Explorations
Drawing 3D Structures: Kindergarten
Exploring with Froebel’s Gifts
Where’s the Stick?

Red circles are placed in the NOT squares.
Decomposing and Composing Shapes

Big Idea FOUR

- One way to analyze and describe geometric objects, relationships among them, or the spaces that they occupy is to quantify – measure or count – one or more of their attributes.
  - Objects can be decomposed and composed to facilitate their measurement.
3D Shapes Made with Straws and Pipe Cleaners Make Excellent Bubble Tools.

Rectangular Prism

Hexagonal Prism

Triangular Pyramid
A Home Built for Twins
Making Rectangular Quilts

PreKindergarten Students
Triangular Quilt by First Graders
Triangular Quilts with 8 Triangles and Labeled with Unit Fractions: 2\textsuperscript{nd} Grade

Is \(\frac{1}{2}\) of the square pink? Is \(\frac{1}{2}\) of the square blue? How do you know?
Measuring Geometric Attributes

Big Idea FOUR

• One way to analyze and describe geometric objects, relationships among them, or the spaces that they occupy is to quantify – measure or count – one or more of their attributes.

• Measurement can specify “how much” by assigning a number to attributes (length, area, volume, and angle).
• Quantities can be compared or measured directly, indirectly or computed for other measurements.
• Size of the unit and the number are inversely related to each other.
Race to the Top
Which Pizza Would you Like?
2nd Grade
Measuring Project:
My New Puppy
Transforming Shapes and Objects

Big Idea THREE

• We gain insight and understanding of spaces and the objects within them by noting what does and does not change as we transform these spaces and objects in various ways.
What Shapes Can You Make Using a Mirror?
<table>
<thead>
<tr>
<th>Diagram</th>
<th>Text</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Diagram" /></td>
<td>&quot;Same shape again . . . I can put the mirror one way or the other, and I still get the same thing!&quot;</td>
</tr>
<tr>
<td><img src="image2.png" alt="Diagram" /></td>
<td>&quot;I just made a little diamond . . . Or a crooked square!&quot;</td>
</tr>
</tbody>
</table>
| ![Diagram](image3.png) | "I made a bow tie! What's it called?"  
"Count the sides."  
"Six sides! That's an octagon, I think!" |
| ![Diagram](image4.png) | "Looks kinda like a football!"  
"Yeah, the circle is boring!"  
"Let's stick with the other ones . . ." |
| ![Diagram](image5.png) | "If you put the mirror on opposite corners, you always get the same shape again no matter what way the mirror is facing!" [From a second grader] |
After this presentation, I will...

- Start doing...
- Keep doing...
- Stop doing...
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