Building Capacity: Geometry in the Gymnasium

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Today's Presentation

- Focus on engaging learner's during instruction
- Overview of the Common Core
- Common Core Planning
- Avoiding Pitfalls for Questioning Techniques
- Common Core Math Domains
  - Operations and Algebraic Thinking
  - Numbers and Operations Base 10
  - Numbers and Operations Base Fractions
  - Measurement and Data
  - Geometry
- Conclusions

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What this presentation is NOT about….

- Direct Instruction Definition
  - a general term for the explicit teaching of a skill-set using lectures or demonstrations of the material, rather than exploratory models such as Inquiry based learning. May often lead to **ROTE learning** - memorization by repetition, often without an understanding of the reasoning or relationships involved in the material that is learned
- Our View of Direct Instruction-
  - "Direct instruction is an effective strategy that allows children to disengage from their environment and productively daydream about where they wish they were and what they wish they could be doing…." Claudia Burgess
- Physical Education View-
  - "Too often direct instruction results in learning out of context with little meaning to the learner and little attention paid to engaging the learner at a more holistic and higher level", Judy Rink.

Direct Instruction Pitfalls

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Why the Common Core?

Mathematical Practices

- The Common Core State Standards for Mathematics, provide opportunities for educators to imagine new ways of teaching and new modes of learning.
- The Mathematical Practices are intended to guide the teaching/learning process in ways that promote the deep and meaningful understanding of mathematics. This is more in line with a Constructivist Learning Theory.

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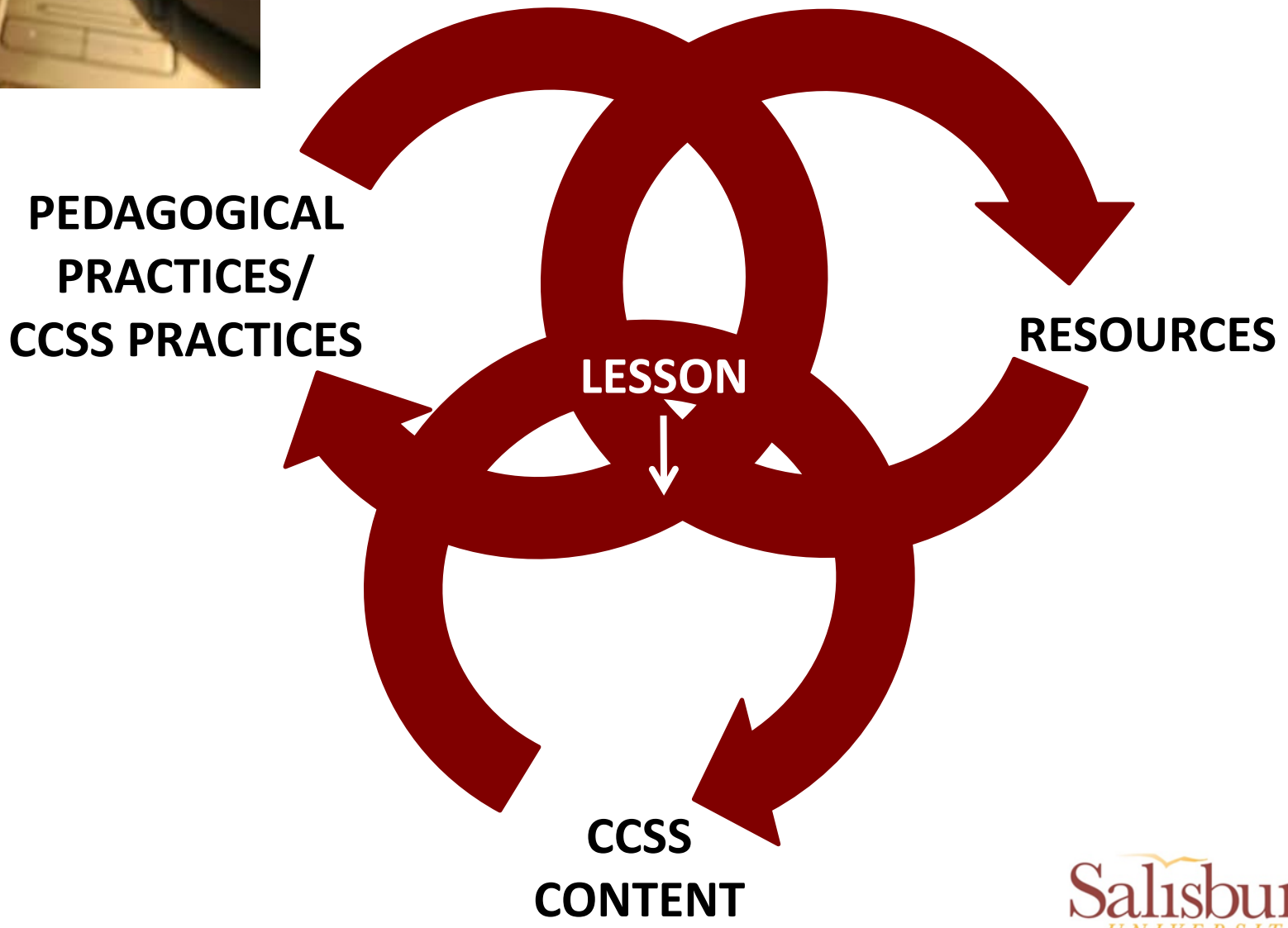
The Planning Process



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New Questions to ASK when Planning

- What are Focus Standards?
- What are Supplementary Standards?
- What Standards for Mathematical Practice will be attended to?
- What Open Ended/Differentiated Questions?
- How will Students Be Organized?

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Mathematical Practices

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

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Breaking Down the Practices

1. Make sense of problems and persevere in solving them

- ❑ Students find the meaning of problems and determine starting points
- ❑ Students analyze givens, constraints, relationships and goals of a problem or problems
- ❑ Students make conjectures about the problem/s and determine how to reach a solution/s through logical reasoning
- ❑ Students use problem solving strategies to solve problems and monitor their own progress as they seek solutions
- ❑ Students explain, verbally or in writing, their thinking processes and the processes they used while engaging mathematically (does not mean they have a correct solution)
- ❑ Students understand the processes by which to check their answers using a different method and to ask whether answers make sense.
- ❑ Students understand the approaches of others and find connections between approaches

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Jeopardizing the Question

Teacher gives the answer and children develop problems that are equal to the answer provided by the teacher.

- **The answer is 10.**
- **The answer is even.**
- **The answer is a prime number.**
- **The answer is a parallelogram.**

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CCing the a Problem – Comparing and Contrasting

Teacher chooses 2 items (numbers, shapes, graphs, etc.) and asks how they are alike and/or different.

- **How are the representations for 22 and 34 similar and different?**
- **How is a square similar and different from a rectangle?**
- **How are the two graphs similar and different? .**

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Vagueing or Blanking a Problem

Replace a number with a vague word or a blank

- **If you had an even number of moves and an odd number of moves, would the sum of the moves be odd or even?**
- **How does the way in which the ball is thrown effect the graph?**
- **How many movements can you make in 30 seconds?**

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Vocabularize a Question

Have students create a verbal or mathematical sentence or a word problem with certain words or numbers.

- **Create a number representation that can be described with the numbers 3 and 6.**
- **Create a shape that can be described using the words symmetrical and quadrilateral.**
- **Create two shapes that can be described using the words similar and four.**

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Broaden the Parameters of the Question

Change a closed question to become an open question.

A girl threw a ball a certain number of times. Her friend then threw the ball an even number of times and together they threw the ball 17 times. How many times might they each have thrown the ball?

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Can you tell me….

Ask the students general questions about a situation, graph, table, etc.

- **Can you tell me something interesting that you see?**
- **Can you tell me any patterns that you notice?**
- **Can you tell me something that you find unusual about the solution?**

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Operations and Algebraic Thinking Grades 1-3

- First – How many ways can we make a sum?

1.OA.3 Apply properties of operations as strategies to add and subtract.3 *Examples: If 8 + 3 = 11 is known, then 3 + 8 = 11 is also known. (Commutative property of addition.) To add 2 + 6 + 4, the second two numbers can be added to make a ten, so 2 + 6 + 4 = 2 + 10 = 12. (Associative property of addition.)*

- Second – Odd and Even Groups

2.OA.3 Determine whether a group of objects (up to 20) has an odd or even number of members, e.g., by pairing objects or counting them by 2s; write an equation to express an even number as a sum of two equal addends.

- Third – Numbers on the Floor

3.OA.4 Determine the unknown whole number in a multiplication or division equation relating three whole numbers. *For example, determine the unknown number that makes the equation true in each of the equations 8 × ? = 48, 5 = □ ÷ 3, 6 × 6 = ?.*

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Operations and Algebraic Thinking Grades 4-5

- Fourth – Factors and Multiples in Movement

4.OA.4. Find all factor pairs for a whole number in the range 1–100. Recognize that a whole number is a multiple of each of its factors. Determine whether a given whole number in the range 1–100 is a multiple of a given one-digit number. Determine whether a given whole number in the range 1–100 is prime or composite.

- Fifth – T Table Patterns

5.OA.3. Generate two numerical patterns using two given rules. Identify apparent relationships between corresponding terms. Form ordered pairs consisting of corresponding terms from the two patterns, and graph the ordered pairs on a coordinate plane. *For example, given the rule "Add 3" and the starting number 0, and given the rule "Add 6" and the starting number 0, generate terms in the resulting sequences, and observe that the terms in one sequence are twice the corresponding terms in the other sequence. Explain informally why this is so.*

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Number and Operations Base 10 Grades 1-2

- First – Counting Activities from n to n+23

1.NBT.1. Count to 120, starting at any number less than 120. In this range, read and write numerals and represent a number of objects with a written numeral.

- First – Base Ten Block Shuffle

1.NBT.3. Compare two, two-digit numbers based on meanings of the tens and ones digits, recording the results of comparisons with the symbols >, =, and <.

- Second – Count Activities by 5s, 10s, and 100s

2.NBT.2. Count within 1000; skip-count by 5s, 10s, and 100s.

- Second – Base Ten Block Shuffle

2.NBT.1 Understand that the three digits of a three-digit number represent amounts of hundreds, tens, and ones; e.g., 706 equals 7 hundreds, 0 tens, and 6 ones. Understand the following as special cases:

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Number and Operations Base 10 Grades 3-5

- Third – Adders and Subtracters

3.NBT.2. Fluently add and subtract within 1000 using strategies and algorithms based on place value, properties of operations, and/or the relationship between addition and subtraction.

- Fourth – Jump Left or Jump Right

4.NBT.3. Use place value understanding to round multi-digit whole numbers to any place.

- Fifth – Decimal Face off

5.NBT.3b. Compare two decimals to thousandths based on meanings of the digits in each place, using >, =, and < symbols to record the results of comparisons.

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Open Ended Questions for a Physically Based Base Ten Lessons

- Can you represent a number with your body? Can you represent a two digit number?
- Can you represent an even number through physical activity? An odd number?
- Can you represent a number that has all even digits in a group with others?
- Can you represent a number that is larger than 30?
- Can you represent a number with all tens rods? With all unit blocks?
- Can you represent 2 different numbers and explain which one is larger? Smaller?
- Can you represent a number that has twice as many ones as tens?
- Can you represent a number with the same number of ones and tens?
- What is the greatest number of blocks you can use to build a two digit number? (depends if they build the number with tens and unit cubes or if they build the number with all unit blocks)
- Can you represent a number and then represent a number that is ten more than that number? Twenty more?

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Number and Operations Fractions Grades 3-5

- Third – Groups of Fractions

3.NF.1. Understand a fraction 1/*b as the quantity formed by 1 part when a* whole is partitioned into *b equal parts; understand a fraction a/b as* the quantity formed by *a parts of size 1/b.*

- Fourth – Two Color Equivalent fractions

4.NF.1. Explain why a fraction *a/b is equivalent to a fraction (n × a)/(n × b)* by using visual fraction models, with attention to how the number and size of the parts differ even though the two fractions themselves are the same size. Use this principle to recognize and generate equivalent fractions.

- Fifth – Can you do this ½ x 4 times?

5.NF.5b. Explaining why multiplying a given number by a fraction greater than 1 results in a product greater than the given number (recognizing multiplication by whole numbers greater than 1 as a familiar case); explaining why multiplying a given number by a fraction less than 1 results in a product smaller than the given number; and relating the principle of fraction equivalence *a/b = (n×a)/(n×b) to the effect of multiplying a/b by 1.*

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Measurement and Data
Grades 1-3

- First – Measuring Animal Lengths with jumps

1.MD.1 Order three objects by length; compare the lengths of two objects indirectly by using a third object.

- Second – Human Clock – 5 minute intervals

2.MD.7 Tell and write time from analog and digital clocks to the nearest five minutes, using a.m. and p.m.

- Third – Look What I Can Do from 2:31 to 2:35

3.MD.1 Tell and write time to the nearest minute and measure time intervals in minutes. Solve word problems involving addition and subtraction of time intervals in minutes, e.g., by representing the problem on a number line diagram.

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Measurement and Data
Grades 4-5

- Fourth – Area and Perimeter Ropes

4.MD.3 Apply the area and perimeter formulas for rectangles in real world and mathematical problems. *For example, find the width of a rectangular room given the area of the flooring and the length, by viewing the area formula as a multiplication equation with an unknown factor.*

- Fifth – Cotton Ball Throw Line Plot

5.MD.2 Make a line plot to display a data set of measurements in fractions of a unit (1/2, 1/4, 1/8).

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Measurement and Data
Grades 1-5

Pictographs, Bar Graphs and Line Plots can be used with almost any physical activity.

- How many times can you throw a ball in 10 seconds?
- How many hops does it take to get from a starting point to the finish line?
- How many pushups can you do?
- Role a giant die and make a physical movement the number of times indicated by the die. Plot this data.

Use Post It Notes to Make the Graphs – By giving different groups or boys and girls different colors of post it notes, it makes the graph more dynamic

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Geometry
Grades 1-3

- First – Sentence Strip Shape Aerobics

1.G.1. Distinguish between defining attributes (e.g., triangles are closed and three-sided) versus non-defining attributes (e.g., color, orientation, overall size); build and draw shapes to possess defining attributes.

- Second – Building Rectangles and Counting

2.G.2. Partition a rectangle into rows and columns of same-size squares and count to find the total number of them.

- Third – Partitions of People Shapes

3.G.2. Partition shapes into parts with equal areas. Express the area of each part as a unit fraction of the whole. *For example, partition a shape into 4 parts with equal area, and describe the area of each part as 1/4 of the area of the shape.*

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Geometry
Grades 4-5

- Fourth – Geometry Vocabulary Aerobics

4.G.1 Draw points, lines, line segments, rays, angles (right, acute, obtuse), and perpendicular and parallel lines. Identify these in two-dimensional figures.

- Fifth – Throwing the Ball

5.G.1 Use a pair of perpendicular number lines, called axes, to define a coordinate system, with the intersection of the lines (the origin) arranged to coincide with the 0 on each line and a given point in the plane located by using an ordered pair of numbers, called its coordinates. Understand that the first number indicates how far to travel from the origin in the direction of one axis, and the second number indicates how far to travel in the direction of the second axis, with the convention that the names of the two axes and the coordinates correspond (e.g., *x-axis and x-coordinate, y-axis and y-coordinate).*

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Today's Physical Ed./Math Activities

OPERATIONS AND ALGEBRAIC THINKING (OA)

- Grade 1 – How many ways can we make a sum?
- Grade 2 – Odd and even groups?

NUMBER AND OPPERATIONS BASE TEN (NBT)

- Grade 3 - Numbers on the Floor.
- Grade 3 – Adders and Subtracters.

NUMBER AND OPPERATIONS FRACTIONS (NF)

- Grade 3 - Groups of Fractions.
- Grade 4 – Two Color Equivalent Fractions.

GEOMETRY (G)

- Grade 1 – Sentence Strip shape Aerobics.
- Grade 2 – Building Rectangles and Counting.
- Grade 4 – Geometry Vocabulary Aerobics.

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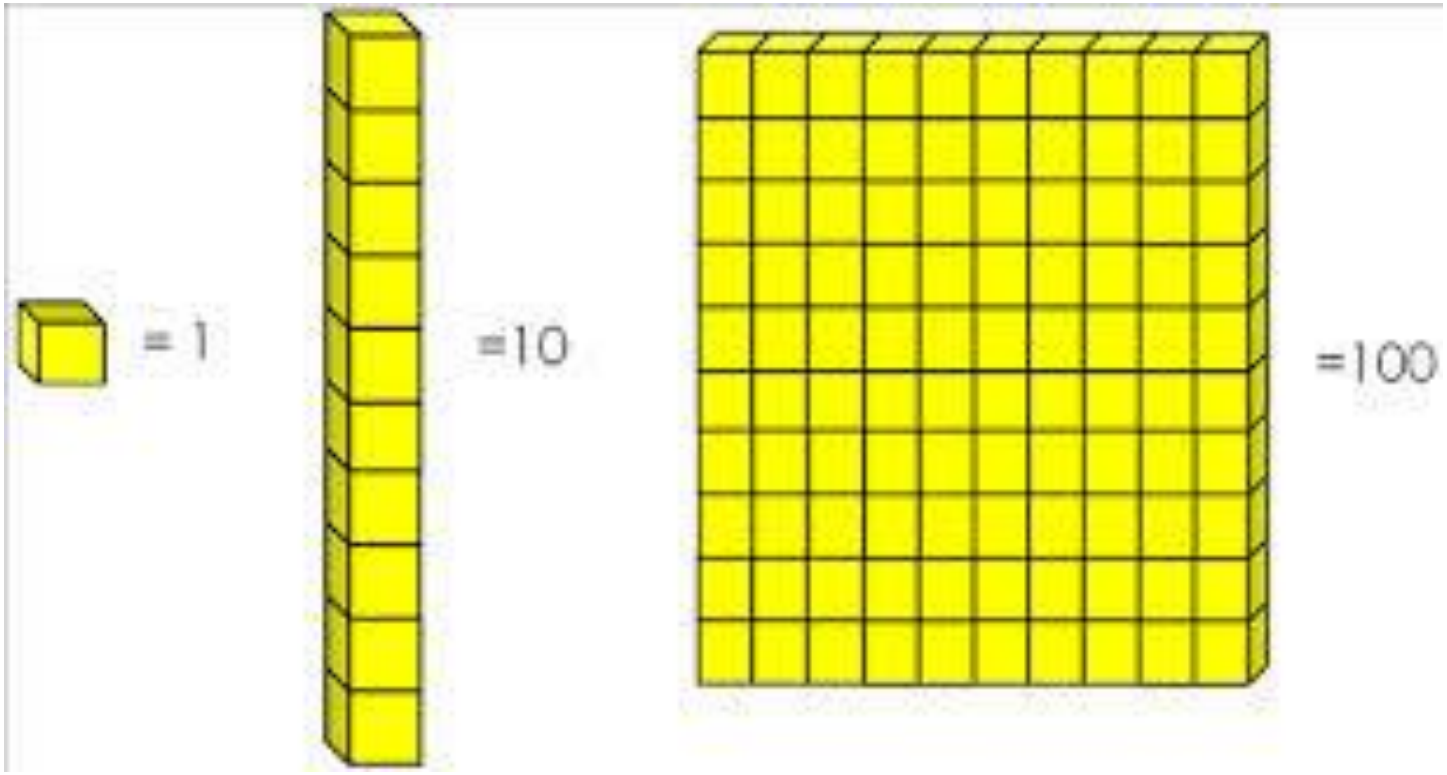
Base Ten Blocks



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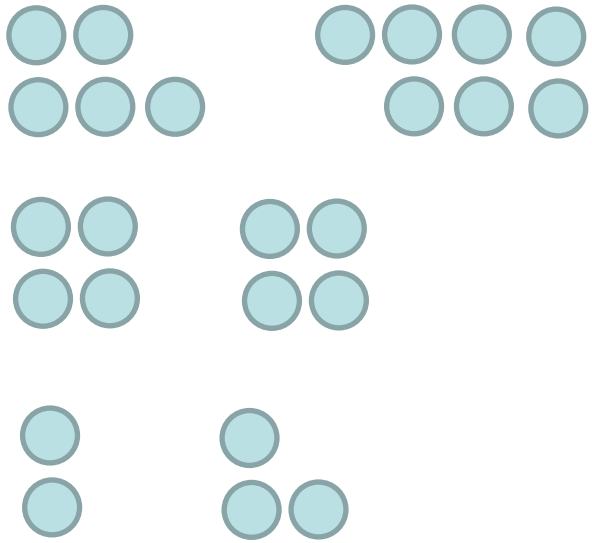
Today's Physical Ed./Math Activities



ODD PLUS ODD

EVEN PLUS EVEN

EVEN PLUS ODD

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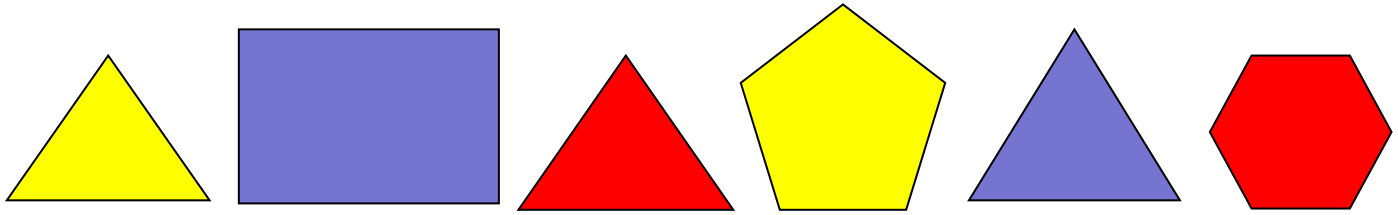
Today's Physical Ed./Math Activities



TRIANGLE = hop
QUADRILATERAL = Turn around to the right 360 degrees
PENTAGON = One jump back
HEXAGON = Reach down and touch the ground and then jump up
Yellow = Flap your arms
Blue = Move your left foot in a circle
Red = Snap your fingers

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Geometry Vocabulary Aerobics

Point

Line

Line segment

Ray

Right angle lines are perpendicular and form a 90 degree angle.

Acute angle has an angle that is less than 90 degrees.

Obtuse angle has an angle that is more than 90 degrees.

Parallel lines are lines that are consistently equidistant and will never touch.

Perpendicular lines are lines that form 90 degree angles.

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Thank You For Coming

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