Welcome to 2013-2014 Big Ideas in Early Math

Kentucky Center for Math

Early Math Collaborative @ Erikson

Session 5: Number Operations

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- Good morning, mathematicians
- We'll be greeting each other today by counting by 4's to 124
- If your number includes the digit 4—move to the Fab 4 club

How did this activity reflect last years session on:

Session	Topic
1	Sets and Sorting
2	Patterns and Regularity
3	Numerosity and Number Sense
4	Counting

How did the activity involve Sets & Sorting

Big Ideas	Key Skills
• Attributes can be used to sort collections into sets.	• Observe and name characteristics or attributes of objects that are the same or different.
• The same collection can be sorted in different ways.	• Create many different categories depending on the attributes chosen.
• Sets can be compared and ordered.	• Seriate/put in order sets from most to least or biggest to smallest or can show that they are the same

How did the activity involve Patterns

Big Ideas	Key Skills

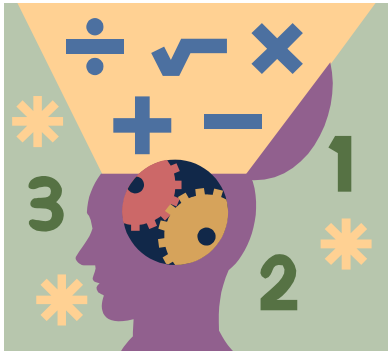
• Patterns are sequences governed by a rule; they exist both in the world and in mathematics
  • Repeating pattern—the most basic form of pattern; we need 3 repetitions or iterations of the pattern unit to know that there is a rule.
  • Growing pattern—the increase in each pattern unit follows the same rule (+1, +2…)
	• **Observing**
	• **Recognizing** the rule (can be different levels)
	• **Creating a pattern**

How did the activity involve Number Sense

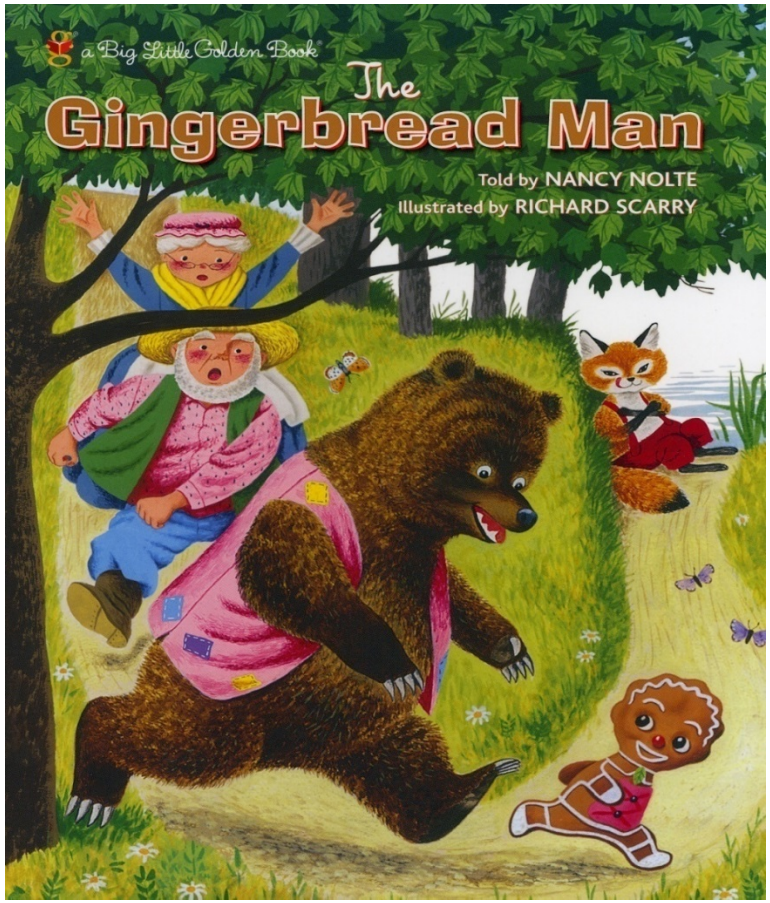
Big Ideas	Key Skills
• Quantity is an attribute of a set of objects & we use numbers to name specific quantities. • Small collections can be intuitively perceived without counting.	• **Naming** the quantity of sets • **Conceptual subitizing**
• A given quantity can be composed and decomposed in a variety of ways.	• **Fluency** in composing and decomposing numbers

How did the activity involve Counting

Big Ideas	Key Skills
• Numbers are used in many ways, 2 of which are mathematical	• Identify different functions of number
• Counting has rules that apply to any collection	• Naming • Tagging • Uses a system to expedite accurate counting • Expresses Cardinality



Let's Do Math
Number Operations



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Let's Think About It

- How were we doing math?
- What made each story ***mathematically different?*** (What did you know? Have to figure out?
- Were we counting or adding and subtracting?

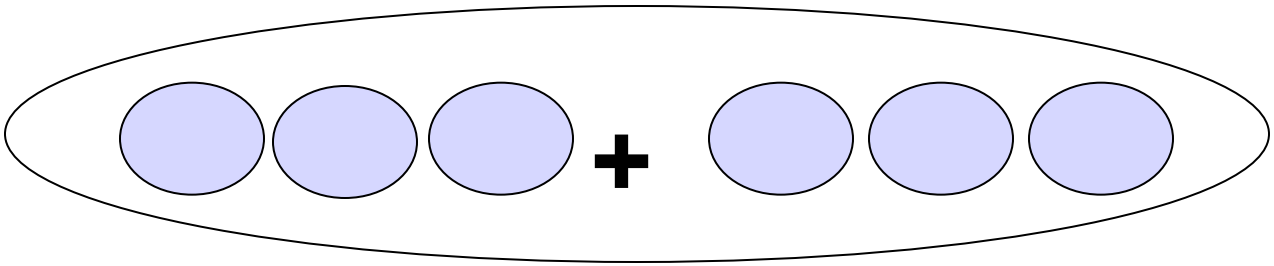
Turn & Talk

about these ideas

- Every number operation tells a story
- Adding and Subtracting are efficient ways of counting.

A Big Idea

- Joining and Separating: A collection can be made larger by adding items to it and made smaller by taking some away from it.
  - ***You have three balls and I have three balls. How many balls do we have together?***
  - ***If you give me one ball, how many will you have?***



A Big Idea

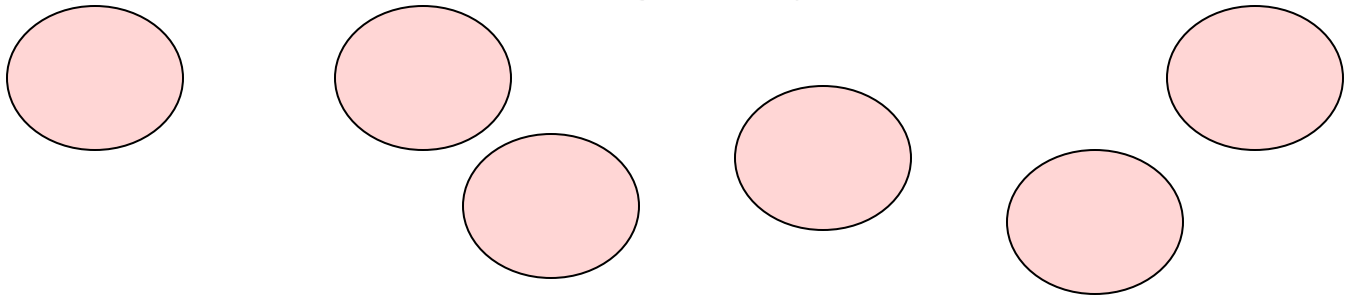
- Comparing and ordering—Collections can be compared and ordered, and numbers are one useful tool for doing so.
  - ***Do more kids have sneakers on or some other kind of shoe?***

It's easier to add than to subtract

- That's true in real life—for many of us! Developmentally it is especially challenging for young children to understand what it means to conceptualize
- ***You have 2 marbles. How many should I give you so that you can have 5 altogether?***
- ***You have 5 marbles and I have 7: How many more do I have?***

A Big Idea

- Number composition—A quantity (whole) can be *decomposed* into equal parts (fair share) or unequal parts. The parts can be *composed* to make the whole.
  - ***What would a "fair share" of these cookies be if there were 2 children? 3 children? Is there any other number of children that could give a fair share?***



Basic Types of Addition & Subtraction Number Stories

In real life, we frequently solve problems involving Change

- **Join** (how many now?)

  [1 + 3 = ?]

- **Separate** (how many left?)

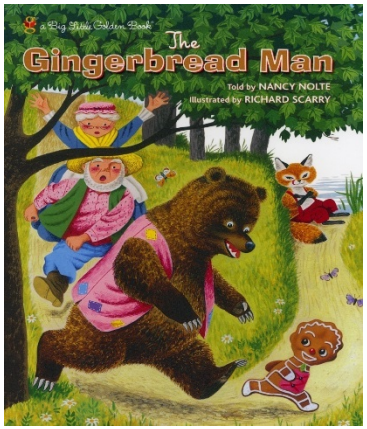
  [4 – 3 = ?]

In real life, we use addition and subtraction for 2 other kinds of number stories

- **Relationship Situations**
- **Compare** (which has more?) [4< 1] 4 is more than 1
- **Part/Part/ Whole**(composing and decomposing the quantity of a set)

Many different stories can be told depending on What do we know & What do we want to find out

- **Result Unknown (**how many at the end**)**
- **Change Unknown** (how many were added/taken?) [1 + ? = 4]
- **Start Unknown** (how many were there at first?) [? + 3 = 4]



Make up 2 different story problems for

The Gingerbread Man

What kind of problem does the story pose?

Join *Separate* *Compare* *Fair Share*

What do we know/ What do we need to find out?

Start Unknown *Result Unknown* *Change Unkr*

3+3=6

6-3=3

3+1=4

2+2=4

- Notice that in the number sentences alone we can't tell which number represents what character or situation in the story.

NAKED NUMBERS!!

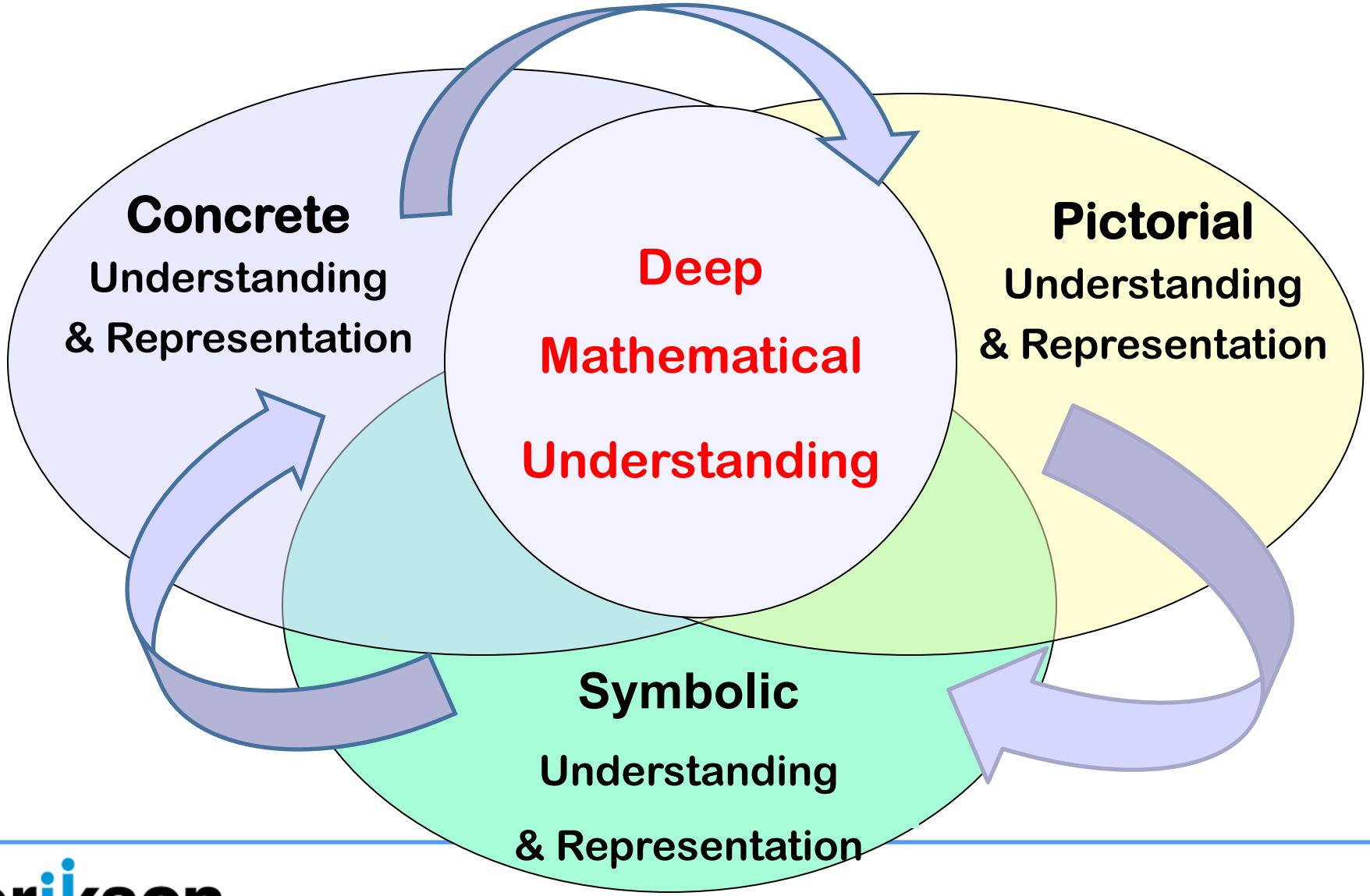
Big Ideas and Key Skills in Number Operations

Big Ideas	Key Skills
• Sets can be *changed* by adding items (joining) or taking some away (separating)	• Identifying the problem • Sequencing • Apply Cardinality • Counting on and counting back
• Sets can be *compared* using the attribute of numerosity, and ordered by more than, less than, equal to.	
• A quantity (whole) can be *decomposed* into equal or unequal parts; the parts can be *composed* to form a whole	

Naked Numbers= Arithmetic
Number stories =Mathematics

- It is much more EFFICIENT to deal with the number sentences if we have lots to calculate-
- BUT it is critical to remember the fundamental learning trajectory
- The C-P-S principle--CONCRETE TO PICTORIAL TO SYMBOLIC

C-P-S Principle is dynamic



Activity Planning: Developmental Considerations

1. Children need to experience **quantities** in all three forms: concrete, pictorial, symbolic
2. Number skills develop in a trajectory
   - Children can **recognize** that there are 4 things, before they can count them;
   - They can **count** a set of four before they can **count out** 4 things from a larger set.
3. Children need **many math all around experiences** of exploring the Big Question: ***How many more? How many less?***

What does learning look like?

Changing quantity:

Pre-schooler

Kindergarten, ELL

- What evidence is there that the story is important for making sense?
- What evidence is there that the children are thinking and problem solving?

Research Lesson: Mouse Collections

- What is the mathematical learning for these children?
- Why is the focus on identifying change rather than on counting?
- What do the teachers do and say to support children's learning?

Number Operations & CCSS Math Practice Standards

Practice #1: Make sense of problems and persevere in solving them

Students:		Teachers:
• Identify the important information needed to make a plan • Monitor work throughout the process, verifying strategies and solutions • Keep trying until a clear understanding emerges • Show patience and a positive attitude		• Model how to pull out important information by asking questions and re-reading the problem carefully • Encourage the use of different strategies and give time for students to explain strategies to one another • Avoid providing too much assistance (e.g., giving answers or directing procedures) • Encourage students to continue until they are confident they have done their best

Number Operations & CCSS Math Practice Standards

Practice # 3: Construct viable arguments and critique the reasoning of others

Students:		Teachers:
• Communicate answers and logical thinking processes using words, pictures, acting it out, etc. • Identify confusions to discover clarity • Ask clarifying questions to improve understanding • Actively compare thoughts of others to own ideas		• Plan time for students to share and compare thinking (explain, rephrase, turn & talk, etc.) • Establish classroom norms for the safe discussion of different ideas • Model and encourage the asking of questions to clarify thinking • Use confusion as an opportunity for learning

In this session's activities

What did the facilitators do to activate the 2 CCSS Practice Standards?

What is evidence that as participants you were putting these standards into practice?