Building a Solid Foundation of Number Sense

Sandra Ball  ball_s@sd36.bc.ca
August 29, 2012
Agenda

• Big Ideas

• Number Sense Routines

• BUILD – Math Centres

• Number Talks
What’s so special about ‘Early Learners’?

- Curious
- Kinesthetic
- Egocentric
- Social
- Spontaneous
- Suitcase full of experiences
The Learning Environment

✓ Meaningful
✓ Engaging
✓ Curriculum based
✓ Child centered
✓ Connected
✓ Address diversity
Today’s mathematics classrooms should be ...

• **dynamic** places where children are involved and **engaged** in their own learning
• include activities that promote **higher level thinking**, cooperative **problem solving** and **communication**.
How do we build a ‘Math Community’?
Building a Math Community

The goal is to facilitate the development of an inclusive classroom where all students feel safe, valued, and supported in their learning.

- demonstrate mutual respect
- willingness to take risks
- explore, share and apply strategies to solve problems
- learn successfully together
What is Number Sense?
How I Boost My Student’s Number Sense

It’s not as tough as you think! Try these strategies.

At the Chinese New Year celebration at Park School in Mill Valley, California, third graders couldn’t wait for Danny’s mother to teach them how to eat with chopsticks. As the anticipation grew, I said to the class, “There are 28 of us and each of us gets 2 chopsticks. Figure out in your heads how many chopsticks we need altogether.” Eddie’s hand shot up. “I guess 75,” he volunteered. “That can’t be right,” Josh replied, “because the answer has to be even.” Rebecca suggested, “I counted by twos and got 56.” Ramón added, “I counted by twos and got a different answer.” Carla agreed with Rebecca and said, “I know 25 and 25 makes 50 and we have 3 more people, so we need 6 more chopsticks. The answer is 56.”

Why do some students seem to have a good grasp of numbers while others don’t? What about your students? Is their number sense developing, and what are you doing to help it improve?

To answer these questions, you need a good handle on what number sense is and how it fits into your math program. This can be a tall order, because while the National Council of Teachers of Mathematics Standards call for teachers to give increased attention to number sense, many of us are not sure what that means. This article will help you make sense of number sense and find innovative ways to promote it in your classroom.

Reprinted with permission from Instructor Magazine and Marilyn Burns.
Number Sense . . .

- is the most important foundation in the development of numeracy
- helps children discover the relationships between the real world and abstractions.
- develops as a result of exploring and visualizing numbers in a variety of contexts
The Big Ideas about Number Sense

Subitizing numbers is important.

Counting tells how many things are in a set.

Numbers are related to each other.

Number concepts are intimately tied to the real world.

Addition and Subtraction are related.
Counting: Five Basic Concepts

1. Stable Order: Words used in counting must be the same string of words from one count to the next.

2. One to One: Each counting word must be paired with exactly one object being counted.

3. Abstraction: Any collection of objects can be counted; the objects don’t need to be uniform to be counted.

4. Cardinality: (how much-ness) When a set is counted, the last counting word said indicates the total number of objects in the set.

5. Order Irrelevance: A set can be counted in any order and get the same result.
What is **REALLY** important in Early Numeracy?
What Do They Know?

September 24, 2012 – DEC -3:30 -5:00
# The “What Do They Know” Assessment at a Glance

<table>
<thead>
<tr>
<th>Administered by</th>
<th>Classroom Teacher</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Key Learnings</strong></td>
<td></td>
</tr>
<tr>
<td>Dot Task – subitizing</td>
<td></td>
</tr>
<tr>
<td>Story Task – part-whole thinking (decomposition)</td>
<td></td>
</tr>
<tr>
<td>Pattern Task – sequencing, recognizing &amp; extending patterns</td>
<td></td>
</tr>
<tr>
<td><strong>Components</strong></td>
<td></td>
</tr>
<tr>
<td>Fall assessment tool</td>
<td></td>
</tr>
<tr>
<td>Spring assessment tool</td>
<td></td>
</tr>
<tr>
<td>Instructional Resource</td>
<td></td>
</tr>
<tr>
<td>Assessment Rubric</td>
<td></td>
</tr>
<tr>
<td><strong>Time needed</strong></td>
<td></td>
</tr>
<tr>
<td>Dot Task – approximately 20 minutes</td>
<td></td>
</tr>
<tr>
<td>Story Task – 30-40 minutes</td>
<td></td>
</tr>
<tr>
<td>Pattern task – 30-40 minutes</td>
<td></td>
</tr>
<tr>
<td><strong>Time of year</strong></td>
<td>Fall - Late October, early November</td>
</tr>
<tr>
<td></td>
<td>Spring - Late April, early May</td>
</tr>
<tr>
<td><strong>Groupings</strong></td>
<td>Whole class or small group</td>
</tr>
</tbody>
</table>
## Dot Card Task Fall Recording Sheet

**Assessment date:** ________________________

<table>
<thead>
<tr>
<th>Name</th>
<th>Flash &amp; Show</th>
<th>Flash &amp; Build</th>
<th>Confident to (#)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>correct fingers</td>
<td>no counting</td>
<td>2 hands</td>
<td>correct image</td>
</tr>
</tbody>
</table>

### Codes for Observations:
- **C** Confident
- **S** Self-corrected
- **NP** Needed Prompting
- **P** Persistent
- **W** Watches others

---

Numeracy in Early Primary – The “What Do They Know” Assessment -- Ball & Fullerton, June 2011
Subitizing Strategies

- Recognizing sets of objects at a glance without counting
- Making the leap from counting to recognizing a group as a whole
- Visualizing quantities – “Take a picture like a camera”
- Subitizing dot cards is like recognizing sight words
Number Sandwiches

• Choose a target number.

• Find two dot cards that can be put together to make the total of the target number.

• Place the cards together with the dots facing outward to make the sandwich.

• Take turns picking up a sandwich and showing one side of the sandwich and ask what is on the other side.
Rules:

1. Each player chooses a colour of counters.
2. Players take turns finding 2 sets of dots that total 5.
3. When all the spaces are covered...the one with the longest line wins.

Change quantity to 10 for Terrific 10 Snake.
That's Dicey!
**Prizes**

**PRIZES for 2 Players**

**you need:**
- plenty of counters in two colors
- 9 prizes (buttons, beads, animals...)
- 1-6 dice

**When it's your turn**
Roll the dice and say the number.
Take that many of your counters and put them on the circles on the board, wherever you like.

When all the circles in a box are covered in counters in your own colour, take a prize.

**The end of the game**
Be on until you have covered all the circles.
Now play another game.
Partitioning
Partitioning

• breaking a set into parts and putting it back together again.

• building an understanding of addition and subtraction

• allows students to explore and understand ‘why’ fact families exist
Building Number Sense

Games & Activities to Practice Combinations to 10

Catherine Jones Kuhns
## Shake and Spill

<table>
<thead>
<tr>
<th></th>
<th>Red</th>
<th>Yellow</th>
<th>Equation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Two Part Bags
Story Mats
Ten Wands
Go Fish
Patterning
Patterning

• establish a pattern core, repeat and name it

• predict what comes next and extend both ways

• develop pre-requisite skills for success in algebra –
Types of patterns to explore...

- **Rhythmic**
  
  clap, clap, snap; clap, clap, snap; ...

- **Colour**

  green, green, green, yellow, yellow, red; green, green, green, yellow, yellow, red; ...

- **Shape**

  triangle, square, square; triangle, square, square; ...
- **Designs**
  - Tree, tree, sun, sun; tree, tree, sun, sun; ...

- **Position or arrangement**
  - Up, down, sideways; up, down, sideways; ...

- **Attributes**
  - 4 holes, 2 holes; 4 holes, 2 holes; ...

- **Size**
  - Long, long, short, short; long, long, short, short; ...
Pattern Fish
Action Patterns

jiggle stretch up
Pattern Hands

Pattern Core
“Children need to develop an understanding of pattern.

By working with pattern children begin to make sense of their own world.

Once children begin to understand and trust the notion of pattern, they begin to see patterns in other areas: number sentences, reading, art, and music.

In short, the world around them.”

Mary Baratta-Lorton
Quick Images

- Dot cards
- Dominoes
- Pictures with arrays
Dot Cards help students develop their ability to subitize and visualize numbers.

- Standard dice formation 1-6
- Non-standard formations
- Different colours
Five and Ten Frame Tools
- Build quantities
- Compare quantities
- Establish ten as a unit (benchmark)
- Develop understanding of part-part-whole model
Five Frame
Single Ten Frame
Double Ten Frame
Terrific 10 snake!

http://www.beam.co.uk/
Animals on Board
Stuart J. Murphy
Build It - Record Your Thinking

[Blank spaces for input]

[Blank spaces for input]

[Blank spaces for input]
Build It - Record Your Thinking

[Blank spaces for recording]
BUILD Math
Numeracy Centres in Action

- B – Buddy Building
- U – Using Tools
- I – Investigating
- L – Linking Math
- D - Discovering
What’s Inside?
Number Strand

1. Candy Bags - Matching Activity - 1 set
   - students match quantities of candies with the numeral on the trick-or-treat bags.

2. Floating Ghosts - Partner Game - 3 copies
   - reinforce ‘subitizing’ numbers to 10
   - players take turns rolling a 6 sided die
   - player #1 moves the number of spaces indicated on the die and tells how many more to make ten.
   - player must roll the exact number to make 10
   - the winner can float into the haunted house

3. Black Cat Jumps - Partner Game - 3 copies
   - use 5 as a benchmark to compare numbers to 10.
   - players take turns rolling a 6 sided die
   - the player moves the number of spaces indicated on the die and tells how many more to make ten
   - the player must roll the exact number to make 10 to win

4. Capture the Ghosts - Cover Them - Partner Game - 6 copies
   - player #1 needs to roll die, build quantity on a ten frame and cover up the numeral
   - players will need their own game boards
   - first one to cover all the numerals wins

5. Rattling Bones — Independent Activity - 1 set
   - skeletons have numerals from 0 – 10 on them
   - students used linking chains to match a quantity of ’bones’ to the numeral on the skeleton card
Math Centres

- Building sets of numbers
- Comparing quantities
- Sequencing in numerical order
- Problem solving
Bowling

- Bowling Record Sheet
- Use bingo dabbers to track the # of pins still standing each turn
- Print number in box
Let's Bowl!

Name: 

---

![Bowling pins and ball]
Literature Connections

• Ten Black Dots (Donald Crews)
• “7 purple dots is a robot’s face.”
• Or...
• Students create what makes sense to them.
• Try using lick and stick circles, bingo dabbers, or other shapes
The Teacher’s Role

- listen to what the students say
- watch what they do
- ask questions
- respond carefully
- provide time talk
- allow students to struggle
Jason’s Story . . .
Questions to extend thinking ...

- How do you know . . . ?
- Tell me what you are thinking . . .
- What do you see in your head . . . ?
- Show me what you know . . .
- Tell me what you know . . .
- How did you do that . . . ?
- What did you notice . . . ?
- What questions did you ask yourself . . . ?
- If you were going to tell someone else what you did . . . ?
- What was your strategy . . . ?
- How did you start . . . ?
- Close your eyes. What do you see . . . ?
- What do you think the problem is . . . ?
- Why do you think ____ . . . ?
Math Talks

What math connections did I make today?
NUMBER TALKS
HELPING CHILDREN BUILD
MENTAL MATH AND
COMPUTATION STRATEGIES
GRADES K-5

- More than 850 purposefully designed number talks
- DVD featuring 19 number talks filmed in actual classrooms

SHERRY PARRISH
A Multimedia Professional Learning Resource
Number Sense – A Combined Grades Resource for Kindergarten and Grade 1 Math Classrooms

Carole Fullerton

http://mindfull.wordpress.com/
Math Exchanges
Guiding Young Mathematicians in Small-Group Meetings
Kassia Omohundro Wedekind
Foreword by Suzanne H. Chapin
Starting With the Beginning
Sandra Ball

http://startingwiththebeginning.wordpress.com/

Carole Fullerton
http://mindfull.wordpress.com/
Children will become confident “doers” of mathematics only if mathematics makes sense to them and if they believe in their ability to make sense of it.