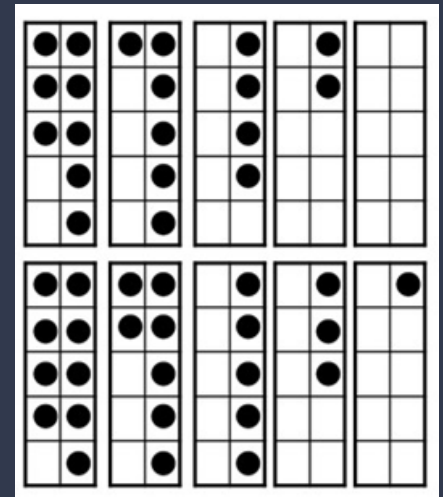
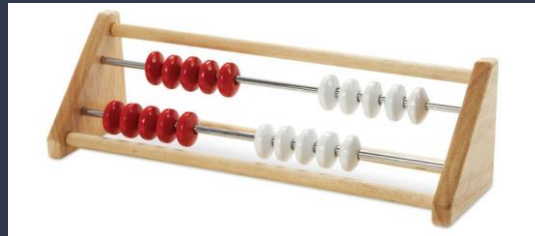




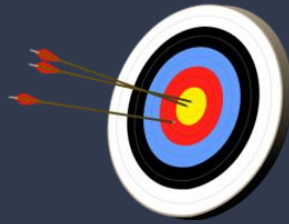
Developing Early Numeracy

April 4th, 2018

Anja Kitchen
Jeanette Wilkinson

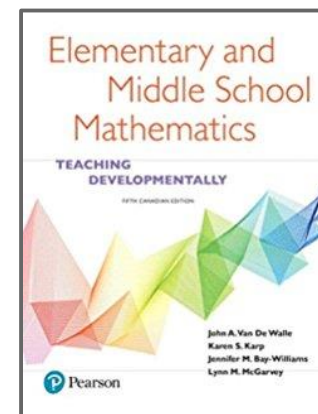
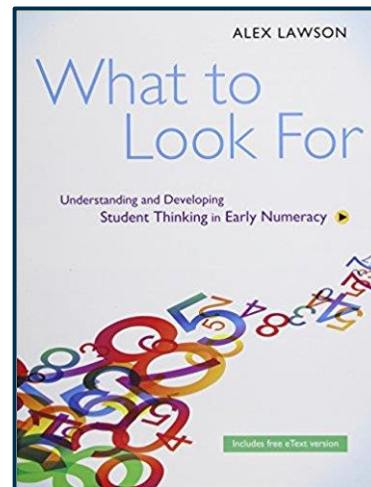
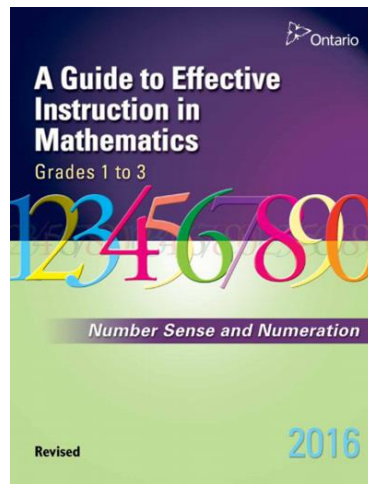


Goals

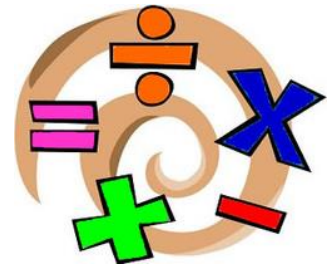
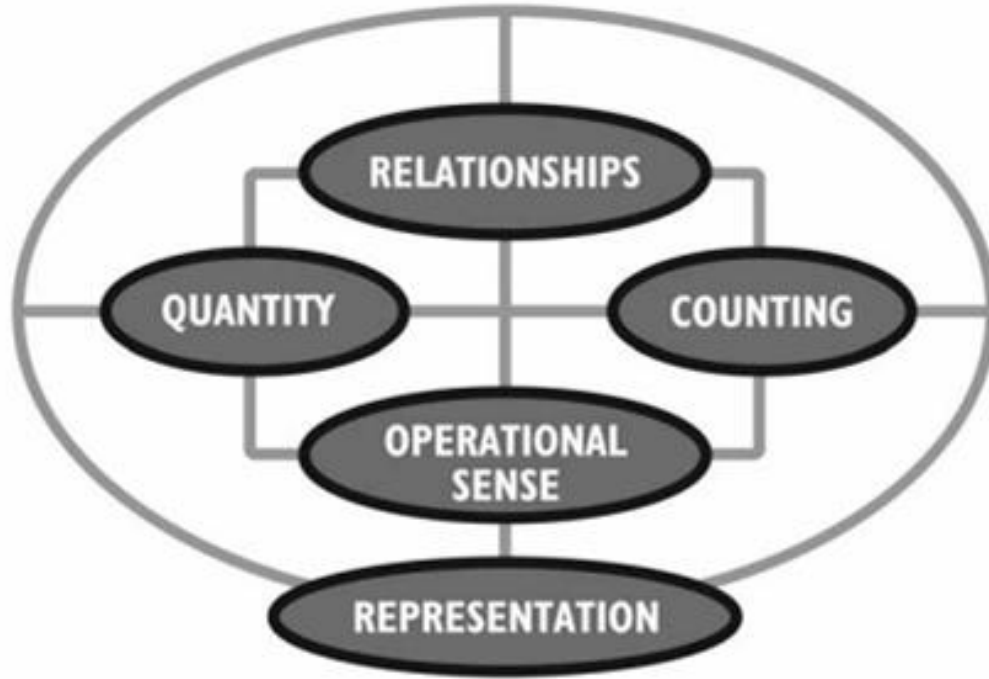


- develop an understanding of quantity and numerical relationships
- to develop an understanding of how rekenreks and 10 frames allow students to communicate and demonstrate their understanding of number relationships
- to model and demonstrate how to use the rekenrek and ten frame
- to develop a variety of strategies used to explore numbers using the anchors of 5 and 10





RESOURCES



Number Sense Overview

Number Sense Trajectory –Putting It All Together

Trajectory	Subitizing Being able to visually recognize a quantity of 5 or less.	Comparison Being able to compare quantities by identifying which has more and which has less.	Counting Rote procedure of counting. The meaning attached to counting is developed through one-to-one correspondence.	One-to-One Correspondence Students can connect one number with one object and then count them with understanding.	Cardinality Tells how many things are in a set. When counting a set of objects, the last word in the counting sequence names the quantity for that set.	Hierarchical Inclusion Numbers are nested inside of each other and that the number grows by one each count. 9 is inside 10 or 10 is the same as $9 + 1$.	Number Conservation The number of objects remains the same when they are rearranged spatially. 5 is 4&1 OR 3&2.
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Each concept builds on the previous idea and students should explore and construct concepts in such a sequence

Number Relationships	Spatial Relationship Patterned Set Recognition Students can learn to recognize sets of objects in patterned arrangements and tell how many without counting.	One and Two-More or Less Students need to understand the relationship of number as it relates to +/- one or two. Here students should begin to see that 5 is 1 more than 4 and that it is also 2 less than 7.	Understanding Anchors Students need to see the relationship between numbers and how they relate to 5s and 10s. 3 is 2 away from 5 and 7 away from 10.	Part-Part-Whole Relationship Students begin to conceptualize a number as being made up from two or more parts.
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Addition and Subtraction Strategies

Developing Number Sense: The Big Picture
 This trajectory is designed to show number sense development through the early years of elementary school. Although the graphic organizer flows horizontally left to right, it also aligns vertically. Each concept builds from the previous stage and is the foundation to developing the number sense required of all students.

One/Two More/Less These facts are a direct application of the One/Two More/ Less than relationships	Make a Ten Use a quantity from one addend to give to another to make a ten then add the remainder. $9 + 7 = 10 + 6$	Near Doubles Using the doubles anchor and combining it with 1 and 2 more/less.
Facts with Zero Need to be introduced so that students don't overgeneralize that answers to addition are always bigger.	Doubles Many times students will use doubles as an anchor when adding and subtracting.	

Clements, D. H., & Sarama, J. (2009). *Learning and teaching early math: The learning trajectories approach*. London: Routledge.
 Van de Walle, J., A., & Lovin, L., H. (2006). *Teaching student-centered mathematics grades k-3*. Boston: Person Education.

Elements of Counting

One-to-One Correspondence

Understanding that each object in a group can be counted once and only once. It is useful in the early stages for children to actually tag or touch each item being counted and to move it out of the way as it is counted.



Hierarchical Inclusion

Understanding that all numbers preceding a number can be or are systematically included in the value of another selected number.



TapintoTeenMinds.com

@MathletePearce

Cardinality

Understanding that the last count of a group of objects represents how many are in the group. A child who recounts when asked how many candies are in the set that they just counted, has not understood the cardinality principle.



<https://vimeo.com/157838163>

Perceptual Subitizing

The ability to 'see' a small amount of objects and know how many there are without counting.



"5"

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Movement is Magnitude

Understanding that as you move up the counting sequence (or forwards), the quantity increases by one and as you move down (or backwards), the quantity decreases by one or whatever quantity you are going up/down by.



Unitizing

Understanding that every quantity we measure is relative to another pre-measured group we call a unit. For example, counting equal groups of 2.



4
twos

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<https://tapintoteenminds.com/counting-principles/>

Unitizing refers to the understanding that you can count a large group of items by decomposing the group into smaller, equal groups of items and then count those.

Conceptual Understandings - p. 216



1. Numbers can be taken apart (decomposed) and put together (recomposed).
2. We can use objects, pictures, symbols, and/or words to represent number and quantity.
3. Quantity can be represented in many ways.
4. The same quantity can look different (concept of abstraction).
5. We are learning that as we move up or down the counting sequence, the quantity increases or decreases by the number we are counting by (concept of magnitude).

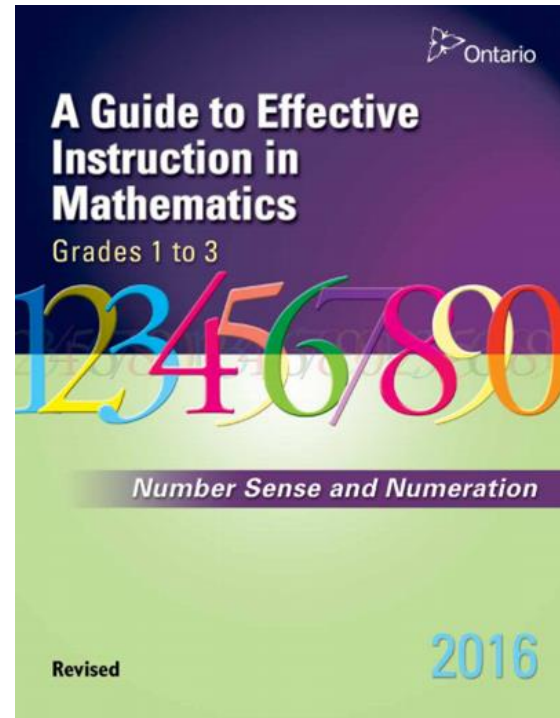
Specific Expectations - p. 216



- 15.1 investigate the idea that a number's position in the counting sequence determines its magnitude - **magnitude**
- 15.2 investigate some concepts of quantity and equality through identifying and comparing sets with more, fewer, or the same number of objects - **cardinality**
- 15.3 make use of one-to-one correspondence in counting objects and matching groups of objects
- 15.4 demonstrate an understanding of the counting concepts of stable order (i.e., the concept that the counting sequence is always the same – 1 is followed by 2, 2 by 3, and so on) and of order irrelevance - **conservation**
- 15.5 subitize quantities to 5 without having to count, using a variety of materials and strategies - **subitizing**
- 15.9 compose and decompose quantities to 10 - **anchors of 5 and 10**

Key Concepts of Quantity (Grade 1 - 3) - p. 33

1. Conservation of number
2. Cardinality
3. Subitizing
4. Magnitude
5. Part-Part-Whole
6. Anchors of 5 and 10
7. Decomposing and Composing
8. Estimation Skills
9. Proportion
10. Rational Numbers

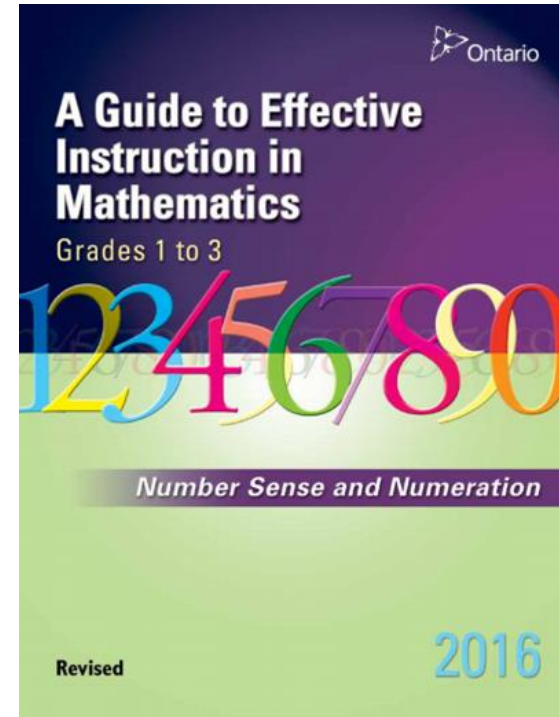


Relationships (Grades 1 -3)- p. 45

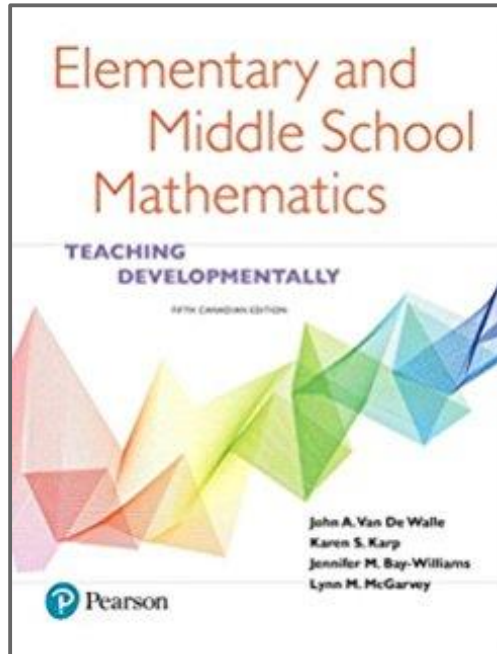
Key points p. 45-46

Relationships in:

- Ordering and comparing
- Number patterns
- Understanding & performing operations
- Anchors of 5 and 10



Chapter 8 - Developing Early Number Concepts & Number Sense



Big Ideas - p. 115

Developing Number Relationships - p. 122

Formative Assessment Notes - p. 77

Activities - p. 116 - 132

10 Frames

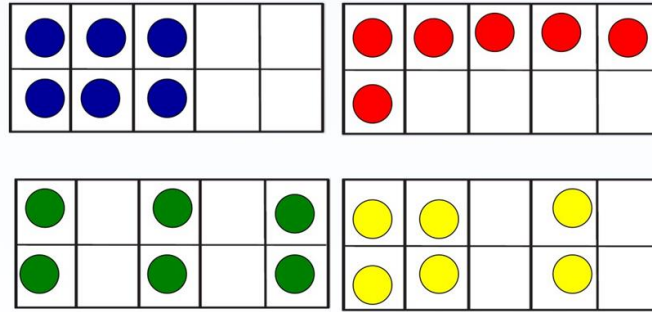
Ten Frames Foundations

- Begin with 5 frames then move to 10 frames
- Build quantities
- Compare quantities
- Establish five or ten as a unit (benchmark)
- Develop understanding of part-part-whole model
- Develop understanding of addition and subtraction
- Develop an understanding of place value



How could you use these arrangements to build number sense in your students?

Building Quantities



How Can You Make 6?

Do you like Easter?



YES

NO

Carter	Nikola	Kaiden	Perez	Bennett
Charlotte	Viktor	Jude	Andrew	Jack

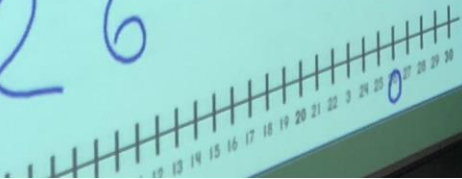
Sai				

Weston	Grace	Emmett	Kenzie	Kayla
Viktor	Elliot	Adilyn	Ali	Amara

Mackenna	Colten	Sara	Anaya	Aiden
Hareem				

Hanna
Ben Avery

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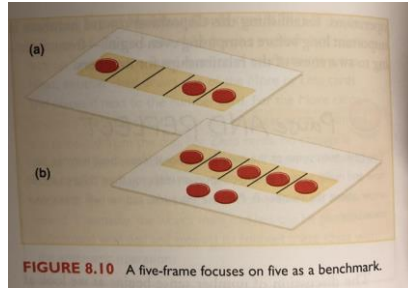


Anchors of 5 and 10

Activity 8.14

Five-Frame Tell-About

Have children show three on their **Five-Frame** (BLM-4), as seen in Figure 8.10(a). Ask, "What can you tell us about three from looking at your five-frame?" After hearing from several children, try other numbers from 0 to 5. Children may initially place their counters on the five-frame in a random arrangement. For example, with four counters, a child may place two on each end and say, "It has a space in the middle" or "It's two and two." Focus attention on how many more counters are needed to equal five. Next, try numbers between 5 and 10. As indicated in Figure 8.10(b), numbers greater than 5 are shown with a full five-frame and additional counters on the mat but not in the frame. In discussion, focus attention on these larger numbers as 5 and some more: "Seven is the same as five and two more."



We will share a folder with all of the blackline masters with you as well.

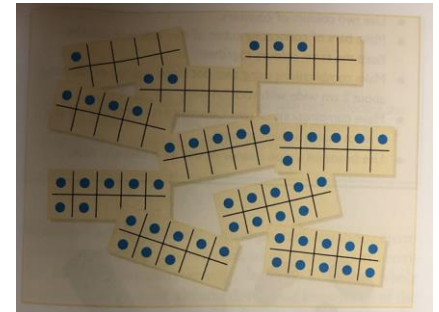
p. 124

From Van deWalle

Activity 8.15

Number Medley

Provide children with a Ten-Frame (BLM-6) and counters. Begin by having all the children make the same number on their ten-frame. Then call out or hold up random numbers between 0 and 10. After each number, the children change their ten-frames to show the new number. Children can play this game independently by using a prepared list of about 15 random numbers. One child plays "teacher" and the rest use the ten-frames.



p. 125

Rekenreks

Rekenreks support even the youngest learners with the visual models they need to discover number relationships and develop automaticity.

The rekenrek features two rows of 10 beads, each broken into two sets of five, much like ten frames.



Using 5 and 10 as anchors for counting, adding, and subtracting is far more efficient than one-by-one counting.

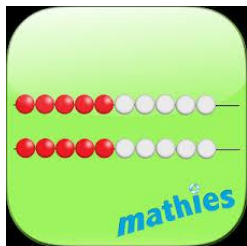
iPads apps to support Early Number Sense

(in HWDSB Catalogue)



NATIVE NUMBERS

- ✦ *Number Representations: Identify the numbers 1-9 as continuous quantities (rods), discrete quantities (sets of animals), and symbols (numerals)*
- ✦ *Number Relations: Answer questions about number relationships using a variety of visual representations and vocabulary (greater/less, bigger/smaller, heavier/lighter, etc.)*
- ✦ *Ordering: Arrange numbers in order from small to big and big to small*
- ✦ *Counting: Use numbers to put a set of objects in order (ordinal numbers) and to determine how many objects are in a set (cardinal numbers)*



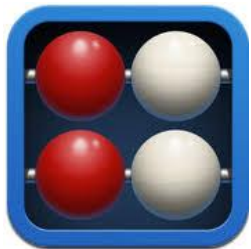
REKENREK by MATHIES

Make visual models that help explore mathematical thinking related to:

- ✦ understanding number relationships using anchors of 5 and 10
- ✦ representing numbers in different ways, composing and decomposing numbers
- ✦ subitizing (instantly seeing “how many”)
- ✦ counting principles
- ✦ understanding addition and subtraction

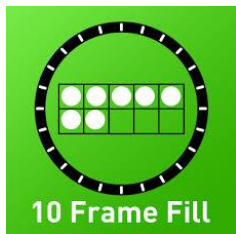
iPads apps to support Early Number Sense

(in HWDSB Catalogue)



NUMBER RACK

★The movable, colored beads encourage learners to think in groups of fives and tens, helping them to explore and discover a variety of addition and subtraction strategies.

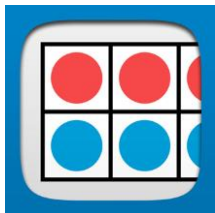


10 FRAME FILL

- ★ practice with recognizing additive "10 Families" (e.g., 1 and 9, 2 and 8, etc.).
- ★Set the 10 Frame to fill in sequence or randomly.
- ★Use contrasting color chips to fill the 10 frame as you determine the answer.

iPads apps to support Early Number Sense

(in HWDSB Catalogue)



NUMBER FRAMES

- ✦ Use standard 5-, 10-, 20-, and 100-frames, or create custom frames up to 12 x 12.
- ✦ Choose from a variety of counters and colors. Drag single counters — or stacks of 5 and 10 — into frames or on to the workspace.
- ✦ Apply a 5s grid to frames to emphasize every 5th line and reinforce grouping by five.
- ✦ Use the drawing tools to annotate work and show understanding.
- ✦ Write equations and expressions with the math text tool.



MATHIES NOTEPAD

- ✦ Write solutions, sketch diagrams, import pictures, create graphs and record your mathematical thinking.
- ✦ Use one of four backgrounds: grid, isometric dot, lined or blank. Use built-in line, shape and text annotation objects, including number lines, rulers, grids and polygons.
- ✦ Copy and rotate any annotation object.

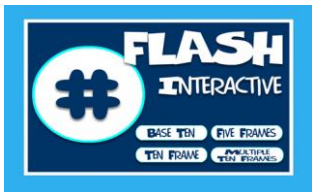
Websites to support Early Number Sense



Online Math Tools and Activities for Students

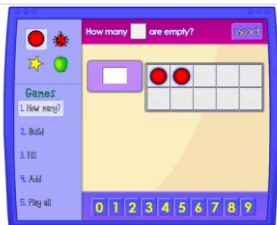
Mathies

- ★ interactive mathematics games, learning tools, and activities for students K – 12
- ★ build understanding of concepts and provide opportunities for practice



Fuel the Brain

- ★ Free Educational Games and Activities for elementary students.
- ★ Unique and fun games that focus on common core standards for math, science and more!



Illuminations

This site spans the entire K-12 range. Resources include:

- ★ online, interactive, multimedia math investigations

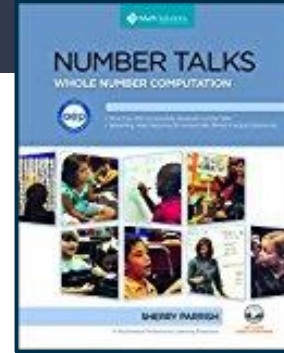
Songs and Videos to Support Early Number Sense



Another print resource

Mathematical Proficiency - p. 5

1. Accuracy
2. Efficiency
3. Flexibility Using Models and Tools to Anchor Student Strategies to Goals p. 40



Another resource with practical hands on activities for students.