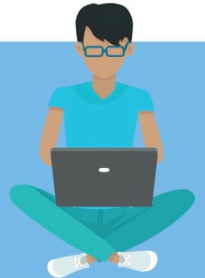
Make it Count: Opportunities to Develop Early Number Sense (K-2)

Presented by: Laura Cronshaw



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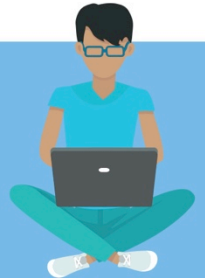
What is Number Sense?



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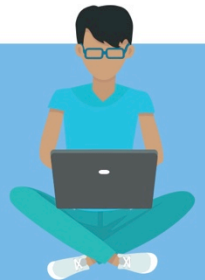
"Number sense refers to a general understanding of **number and operation** as well as the ability to apply this understanding in **flexible** ways to make **mathematical judgments** and to **develop useful strategies** for solving problems."

(Ontario Ministry of Education, 2005, p. 8)

"Number is a **complex and multifaceted** concept. A well developed understanding of number includes a grasp not only of **counting and number recognition** but also of a **complex system of more and less relationships**, **part whole relationships**, the role of special numbers such as **five and ten**, **connections between numbers and real quantities and measures** in the environment and much more."

(Ontario Ministry of Education and Training, 1997, p.10, as cited in Ontario Ministry of Education, 2016, p. 1)



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Developing Mathematical Proficiency

Conceptual understanding—comprehension of mathematical concepts, operations, and relations;

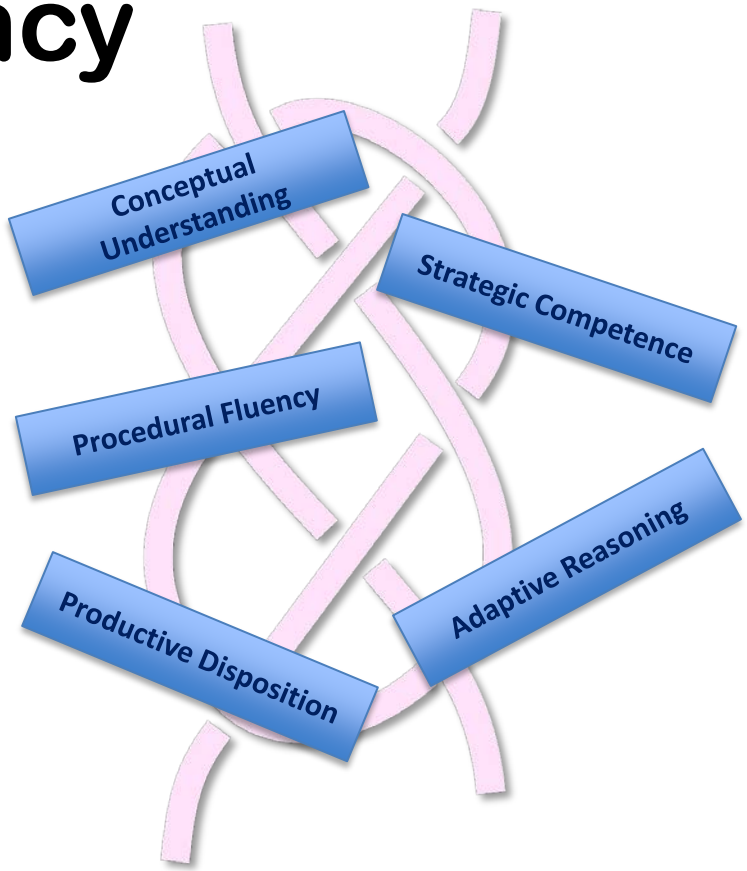
Procedural fluency—skill in carrying out procedures flexibly, accurately, efficiently, and appropriately;

Strategic competence—ability to formulate, represent, and solve mathematical problems;

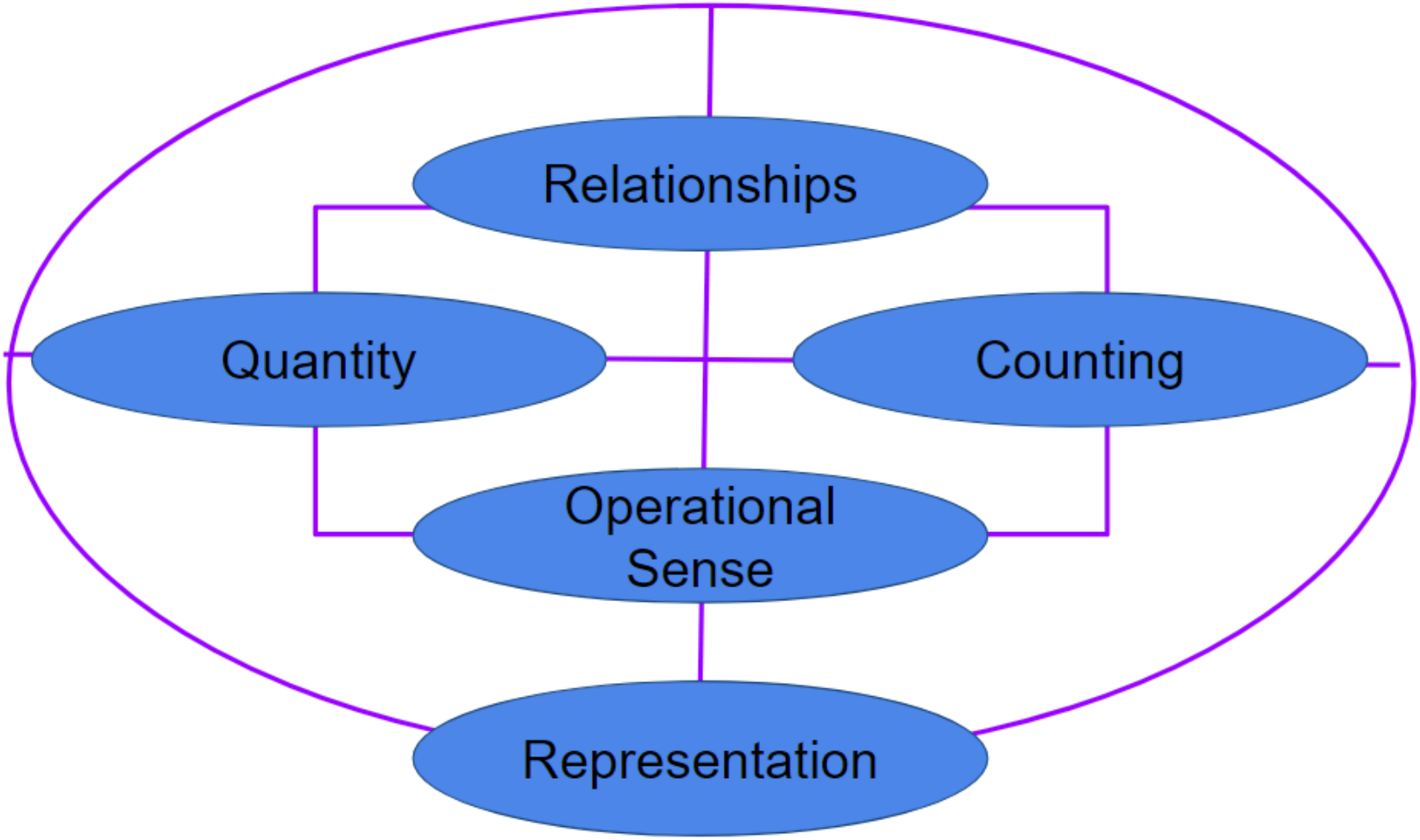
Adaptive reasoning —capacity for logical thought, reflection, explanation, and justification;

Productive disposition —habitual inclination to see mathematics as sensible, useful, and worthwhile, coupled with a belief in diligence and one's own efficacy

From: Adding it Up --National Research Council (Kilpatrick, Swafford, & Findell, 2001)



(National Research Council, 2001, p. 117)

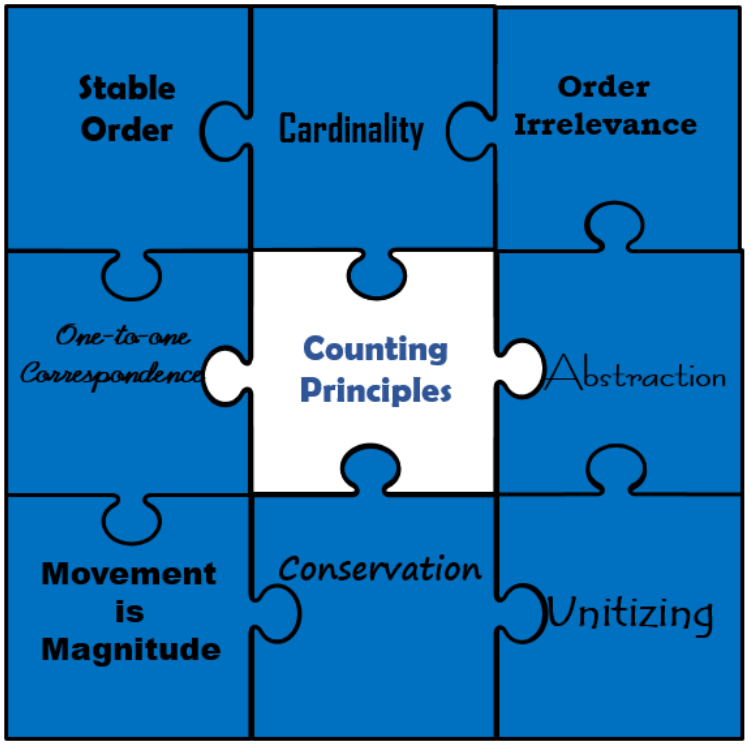


(Ontario Ministry of Education, 2016, p.2)

For consideration when thinking about how children's counting develops:

- Details matter when we look for what students know about counting
- Students can have more counting understanding than we see in a given moment
- Counting principles don't emerge in a set sequence
- Counting principles emerge concurrently

(Carpenter, Franke, Johnson, Turrou & Wager, 2016, p.22)



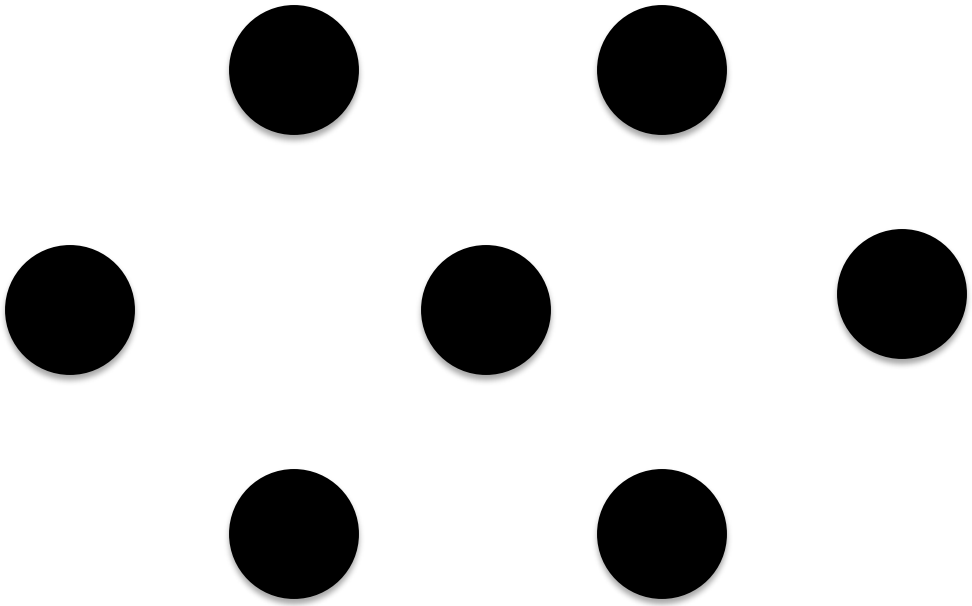
(Ontario Ministry of Education, 2016, pp.11-12)

Other important ideas:

- What gets counted
- Counting collections and making collections
- Comparing collections
- Counting collections and ordering the objects in a collection (cardinal and ordinal)
- Number and numeral

(Carpenter, Franke, Johnson, Turrou & Wager, 2016, pp. 14-16)

How many dots do you see?
How do you see them?



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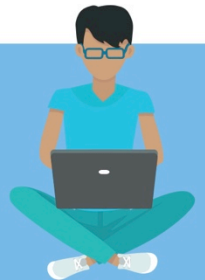

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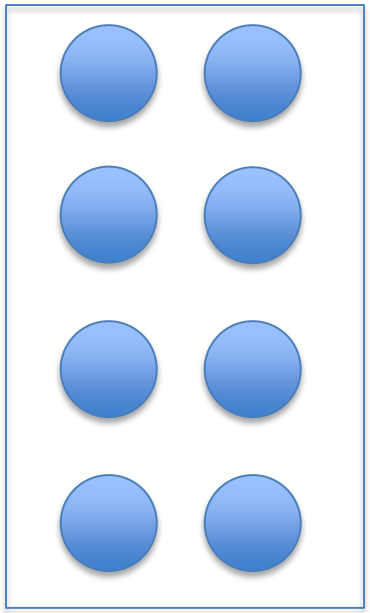
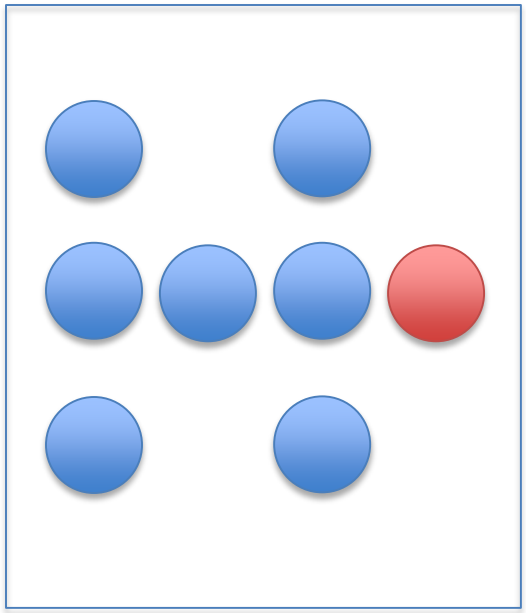
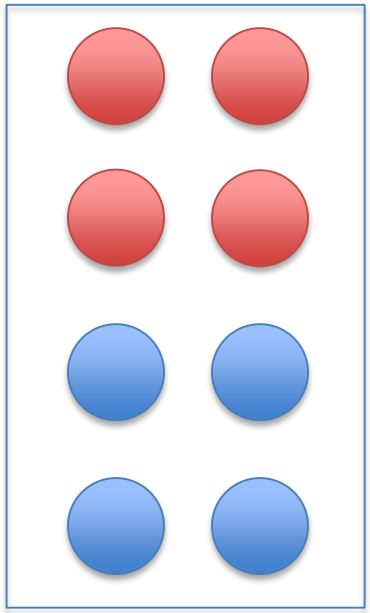
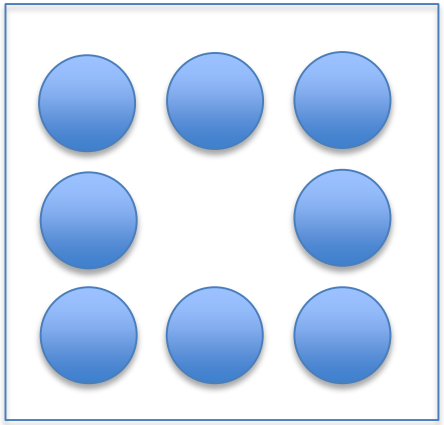
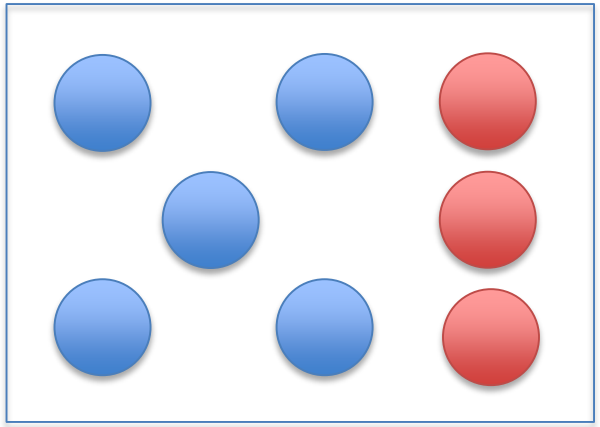
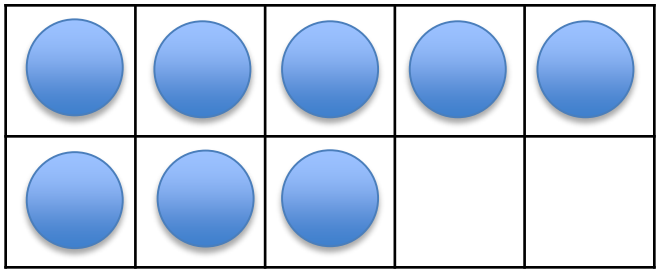






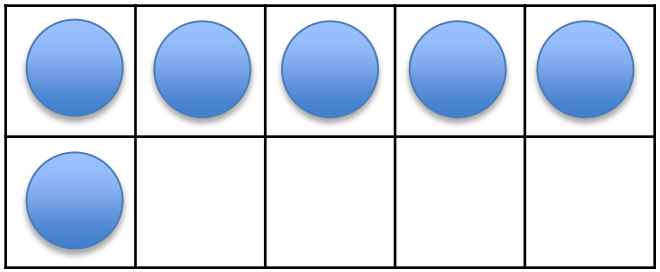




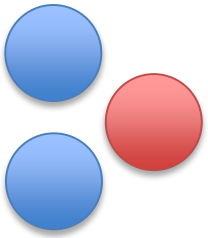


Van de Walle, Lovin, Karp & Bay-Williams, 2018, p. 122

Four Number Relationships

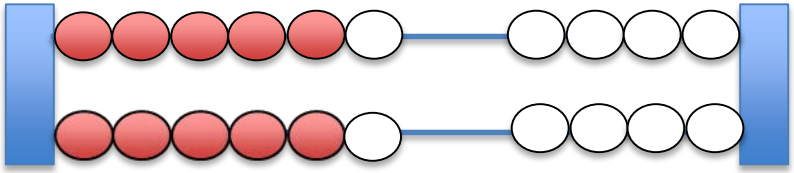


Spatial Relationships

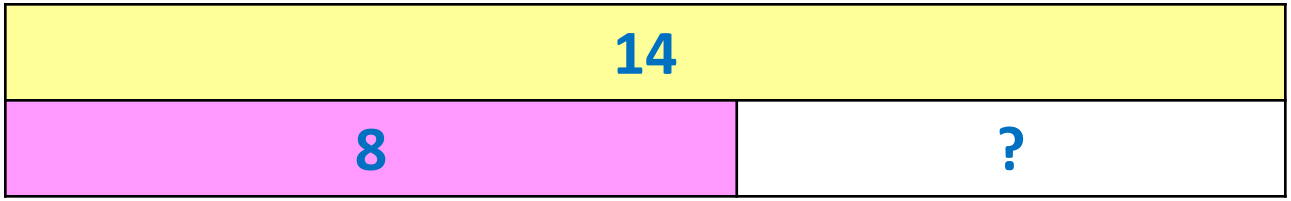


One/Two More/Less

Benchmarks of 5 and 10



Part-Part-Whole Relationships



(Van de Walle, Lovin, Karp & Bay-Williams, 2014)

What prior learning is necessary for developing operational sense?

Students need prior experience with exploring some of the “big ideas” of Number Sense and Numeration (in particular, counting and quantity). For example, young students who are learning to **add and subtract** need to know:

- How to **count** from 1 to 10
- That each **count** should **correspond to the objects** being counted (one-to-one correspondence)
- That each **number represents a network of connections** between the **quantities** (such as counters), the **symbol**, the **number name**, and **pictures** (such as a number line)
- That numbers can be acted on and that such action represents a **change in magnitude** (3 fingers and 3 fingers will create a new quantity of 6 fingers)
- That the **magnitude of numbers increases** as students count on and **decreases** as they count back
- That **5 and 10 are anchors** for all numbers
- **“Part-Part-Whole” concepts**

(Ontario Ministry of Education, 2003, p.13)

Understanding Basic Facts & Relationships

"To ensure that all students move away from inefficient counting strategies and become fluent with their basic facts, we need to commit to making **reasoning strategies** a central part of basic fact instruction" (Van de Walle, Lovin, Karp & Bay-Williams, 2018, p. 184).

Counting

Reasoning Strategies

Mastery

(Baroody 2006, as cited in Van de Walle, Lovin, Karp & Bay-Williams, 2018, p. 181)

What is Fluency?

Accuracy- denotes the ability to produce an accurate answer

Efficiency- denotes the ability to choose an appropriate, expedient strategy for a specific computation problem

Flexibility - refers to the ability to use number relationships with ease in computation

(Russell, 2000)

“Reasoning and pattern searching are never facilitated by restricting time. Some children simply cannot work well under pressure or in situations that provoke stress…Speed in a testing situation is debilitating for many and provides no positive benefits… In every instance, timed tests reward few and punish many. They can have a lasting negative impact on student attitudes. They should be avoided whenever possible.”

(Van de Walle, 2004, p. 146)

Using Strings to Develop an Understanding of Relationships:

Using the five- and ten- structure, doubles and near doubles, compensation

5 + 5

5 + 6

7 + 7

7 + 8

8 + 6

9 + 5

(Fosnot & Uittenbogaard, 2007, pp. 54-55)

“We want to support children and build upon and extend their informal strategies both to develop understanding for arithmetic that is consistent with the ways they naturally think and foster their problem solving.”

(Carpenter, Franke, Johnson, Turrou & Wager, 2016, p.92)

Thank You

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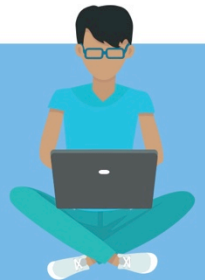

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