

Building Firm Mathematical Foundations in Reception with Rebecca Kelly

July 2021

What maths do you notice here?



 **NCETM**
NATIONAL CENTRE FOR EXCELLENCE
IN THE TEACHING OF MATHEMATICS

 **MATHSHUBS**
NORTH-EAST HANTS AND SURREY

Aims of this session:

- To reflect on Mastery and how this can be achieved in the EYFS
- To establish the importance of direct teaching for younger children, whilst linking with continuous provision learning opportunities
- To focus on the progression of counting, cardinality, comparison, composition and the role of Learning Trajectories
- To explore why spatial reasoning is so important in children's development

Focus on Mastery in the Early years: Implications for learning and teaching

Expectations
of ALL

Early
Learning
Goals

Early Years
appropriate
pedagogy

Direct
teaching

Continuous
provision

Progression

Predictors

Early math skills have the greatest predictive power of later achievement.

(Duncan et al 2007)

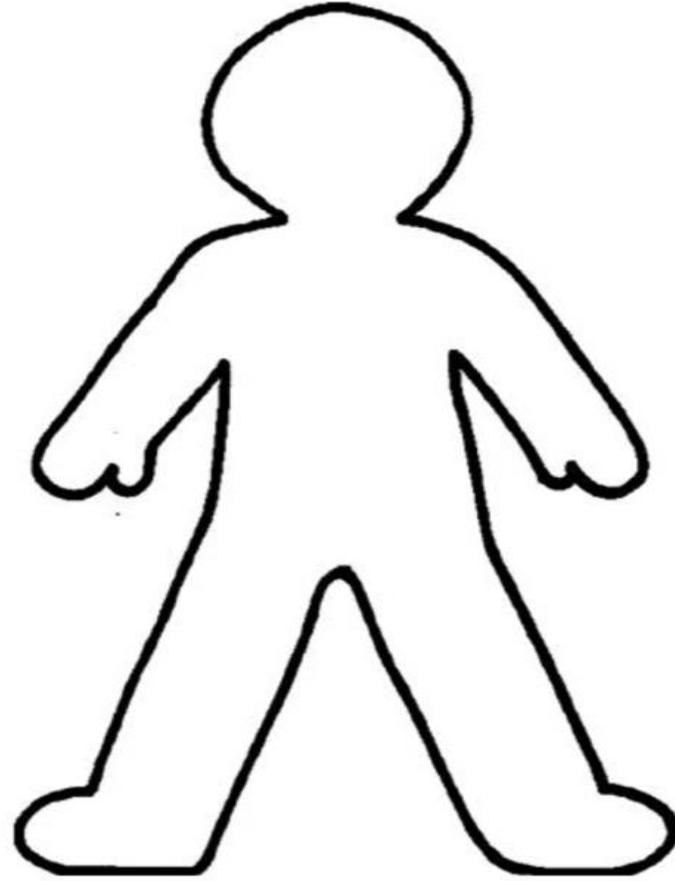
Pre-school number knowledge helps later achievement.

(TIMMS)

*Pre- schools that helped children to understand **early number concepts** led to better outcomes in mathematics at 11.*

(EPPSE)

This 4 year old child has a strong sense of number.
What knowledge, skills and dispositions do they have?



Characteristics of Effective Learning

Characteristics of Effective Learning
<p>Playing and exploring – engagement</p> <p>Finding out and exploring Playing with what they know Being willing to 'have a go'</p>
<p>Active learning – motivation</p> <p>Being involved and concentrating Keeping trying Enjoying achieving what they set out to do</p>
<p>Creating and thinking critically – thinking</p> <p>Having their own ideas Making links Choosing ways to do things</p>

Find these on the DfE website:

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/942421/EYFSP_Handbook_2021.pdf

How are the Characteristics of Effective Learning promoted in your school?

- How do you use CoEF?
- Do you consider them as a part of your observation processes?
- Do you use them to reflect on the effectiveness of your learning environment?
- Does your Senior Leadership Team use the Characteristics as part of lesson observations?
- In pupil progress meetings, are the CoEF used as a way of evaluating progress?
- Are the CoEF used to reflect on the transition process to KS1 and beyond?

Draw a simple map of your EYFS classroom and identify the ‘hotspots’ for CoEF and which spaces are the ‘coldspots.’

1

Develop practitioners' understanding of how children learn mathematics



- Professional development should be used to raise the quality of practitioner' knowledge of mathematics, of children's mathematical development and of effective mathematical pedagogy.
- Developmental progressions show us how children typically learn mathematical concepts and can inform teaching.
- Practitioners should be aware that developing a secure grasp of early mathematical ideas takes time, and specific skills may emerge in different orders.
- The development of self-regulation and metacognitive skills are linked to successful learning in early mathematics.

2

Dedicate time for children to learn mathematics and integrate mathematics throughout the day



- Dedicate time to focus on mathematics each day.
- Explore mathematics through different contexts, including storybooks, puzzles, songs, rhymes, puppet play, and games.
- Make the most of moments throughout the day to highlight and use mathematics, for example, in daily routines, play activities, and other curriculum areas.
- Seize chances to reinforce mathematical vocabulary.
- Create opportunities for extended discussion of mathematical ideas with children.

3

Use manipulatives and representations to develop understanding



- Manipulatives and representations can be powerful tools for supporting young children to engage with mathematical ideas.
- Ensure that children understand the links between the manipulatives and the mathematical ideas they represent.
- Ensure that there is a clear rationale for using a particular manipulative or representation to teach a specific mathematical concept.
- Encourage children to represent problems in their own way, for example with drawings and marks.
- Use manipulatives and representations to encourage discussion about mathematics.
- Encourage children to use their fingers— an important manipulative for children.

4

Ensure that teaching builds on what children already know



- It is important to assess what children do, and do not, know in order to extend learning for all children.
- A variety of methods should be used to assess children's mathematical understanding, and practitioners should check what children know in a variety of contexts
- Carefully listen to children's responses and consider the right questions to ask to reveal understanding.
- Information collected should be used to inform next steps for teaching. Developmental progressions can be useful in informing decisions around what a child should learn next.

5

Use high quality targeted support to help all children learn mathematics



- High quality targeted support can provide effective extra support for children.
- Small-group support is more likely to be effective when:
 - children with the greatest needs are supported by the most experienced staff;
 - training, support and resources are provided for staff using targeted activities;
 - sessions are brief and regular; and
 - explicit connections are made between targeted support and everyday activities or teaching.
- Using an approach or programme that is evidence-based and has been independently evaluated is a good starting point.

Focus on research: Breakout rooms

What are the key ideas that you take from this document?

How can you put this evidence to good use within your setting?

<p>1</p> <p>Develop practitioners' understanding of how children learn mathematics</p>  <ul style="list-style-type: none">Professional development should be used to raise the quality of practitioners' knowledge of mathematics, of children's mathematical development and of effective mathematical pedagogy.Developmental progressions show us how children typically learn mathematical concepts and can inform teaching.Practitioners should be aware that developing a secure grasp of early mathematical ideas takes time, and specific skills may emerge in different orders.The development of self-regulation and metacognitive skills are linked to successful learning in early mathematics.	<p>2</p> <p>Dedicate time for children to learn mathematics and integrate mathematics throughout the day</p>  <ul style="list-style-type: none">Dedicate time to focus on mathematics each day.Explore mathematics through different contexts, including storybooks, puzzles, songs, rhymes, puppet play, and games.Make the most of moments throughout the day to highlight and use mathematics, for example, in daily routines, play activities, and other curriculum areas.Seize chances to reinforce mathematical vocabulary.Create opportunities for extended discussion of mathematical ideas with children.	<p>3</p> <p>Use manipulatives and representations to develop understanding</p>  <ul style="list-style-type: none">Manipulatives and representations can be powerful tools for supporting young children to engage with mathematical ideas.Ensure that children understand the links between the manipulatives and the mathematical ideas they represent.Ensure that there is a clear rationale for using a particular manipulative or representation to teach a specific mathematical concept.Encourage children to represent problems in their own way, for example with drawings and marks.Use manipulatives and representations to encourage discussion about mathematics.Encourage children to use their fingers—an important manipulative for children.	<p>4</p> <p>Ensure that teaching builds on what children already know</p>  <ul style="list-style-type: none">It is important to assess what children do, and do not, know in order to extend learning for all children.A variety of methods should be used to assess children's mathematical understanding, and practitioners should check what children know in a variety of contexts.Carefully listen to children's responses and consider the right questions to ask to reveal understanding.Information collected should be used to inform next steps for teaching. Developmental progressions can be useful in informing decisions around what a child should learn next.	<p>5</p> <p>Use high quality targeted support to help all children learn mathematics</p>  <ul style="list-style-type: none">High quality targeted support can provide effective extra support for children.Small-group support is more likely to be effective when:<ul style="list-style-type: none">children with the greatest needs are supported by the most experienced staff;training, support and resources are provided for staff using targeted activities;sessions are brief and regular; andexplicit connections are made between targeted support and everyday activities or teaching.Using an approach or programme that is evidence-based and has been independently evaluated is a good starting point.
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What do we mean by direct teaching? What is it? What is it not?

What do we mean by direct teaching?

Commonly, the most effective early numeracy approaches include individual and small group work, and balance guided interaction with both direct teaching and child-led activities, depending on the age and capabilities of the child. A number of studies also indicate that it is important for early years professionals to understand young children's mathematical development (such as the typical stages in learning to count) and to understand how to assess this development. This understanding will support the provision of more effective activities.

<https://educationendowmentfoundation.org.uk/evidence-summaries/early-years-toolkit/early-numeracy-approaches/>

Professional learning

Participants will

- **demonstrate an understanding of progression in mathematics (specific elements of the key areas and how that is translated into direct teaching) and other Early Years provision**
- **demonstrate how the principles of the NCETM teaching for mastery approach can be applied appropriately within the context of a Reception classroom**



Describe what was happening when you saw/taught an activity where a single mathematical focus was the main thing.
What was the impact?

Describe what was happening when you saw/taught an activity where there were several mathematical foci.
What was the impact?

Focusing of the Mathematics – Learning Trajectories next time

- We should use our knowledge of these to help make our teaching precisely focused on a developmental aspect of mathematics – what is the ‘main thing’?
- Arguably, they can help us to make young children’s mathematical development more ‘visible’ (Hattie, 2009)
- Using a learning trajectory can help us to know:
 - Where to start
 - Where to go next
 - How to get there

Early Learning Goal 1

- **ELG: Number**

- Children at the expected level of development will:

- Have a deep understanding of number **to 10**, including the **composition of each number**;
- **Subitise** (recognise quantities without counting) **up to 5**;
- **Automatically recall** (without reference to rhymes, counting or other aids) number bonds **up to 5** (including subtraction facts) and some number bonds to 10 including double facts.

Early Learning Goal 2

- **ELG: Numerical Patterns**

- Children at the expected level of development will:

- **Verbally count beyond 20**, recognising the pattern of the counting system;
- **Compare quantities up to 10** in different contexts, recognising when one quantity is greater than less than or the same as the other quantity;
- **Explore and represent patterns within numbers up to 10**, including evens and odds, double facts and how quantities can be distributed equally.

<https://www.ncetm.org.uk/earlyyears>



News & Features

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Teaching for Mastery

Maths Hubs



EARLY YEARS

The materials in this section are designed to support Reception teachers (those working with 4-5 year olds)



“Children are born ready, able and eager to learn. They actively reach out to interact with other people, and in the world around them. Development is not an automatic process, however. It depends on each unique child having opportunities to interact in positive relationships and enabling environments.”⁽ⁱ⁾

Focusing of the Mathematics – Progression Maps

SIX KEY AREAS OF EARLY MATHEMATICS LEARNING



Cardinality and Counting

Understanding that the cardinal value of a number refers to the quantity, or 'howmanyness' of things it represents



Comparison

Understanding that comparing numbers involves knowing which numbers are worth more or less than each other



Composition

Understanding that one number can be made up from (composed from) two or more smaller numbers



Pattern



Shape and Space



Measures

Find these on the NCETM website.

<https://www.ncetm.org.uk/earlyyears>

Listen:

<https://www.ncetm.org.uk/podcasts/how-early-years-children-develop-mathematical-thinking/>

Typical progression of key ideas in this concept

- ✓ Counting: saying number words in sequence
- ✓ Counting: tagging each object with one number word
- ✓ Counting: knowing the last number counted gives the total so far
- ✓ Subitising: recognising small quantities without needing to count them all
- ✓ Numeral meanings
- ✓ Conservation: knowing that the number does not change if things are rearranged (so long as none have been added or taken away)
- ✓ Common errors in this area may include
- ✓ What to look for

Find these on the NCETM website.

<https://www.ncetm.org.uk/earlyyears>

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Focusing of the Mathematics – Learning Trajectories

Learning Trajectories

Counting	2D Shapes	Measurement: Length
Subitizing	Composing 2D Shapes	Measurement: Area
Comparing Number	Disembedding Shapes	Measurement: Volume
Adding / Subtracting	3D Shapes	Measurement: Angle and Turn
Composing Numbers	Composing 3D Shapes	Classification and Data Analysis
Multiplying / Dividing	Spatial Visualization and Imagery	
Fractions	Spatial Orientation	
Patterns, Structure, and Algebraic Thinking		

The Learning Trajectories website by Clements and Sarama may also be of use.



Cardinality and Counting

Lets start with counting....

When
does it
start?

So what is counting?



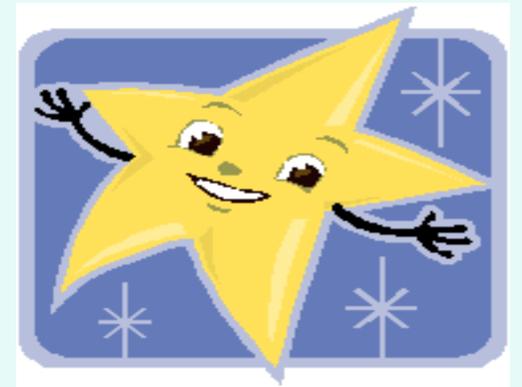
Recitation and Enumeration

Twinkle, Twinkle Counting

The new number names are: Twinkle, little, how, wonder...

You **must not** 'translate' these number names into the **banned** number names *one, two, three,*

- Count with me....
- Can you count by yourself?
- Can you count from *how* to *the*
- Can you count back from *up*
- Can you count in *littles*



The problem with early counting

Understanding the relationship between numbers

Subitising and partitioning

Keeping track

Understanding conservation of number



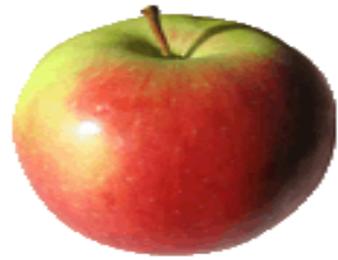
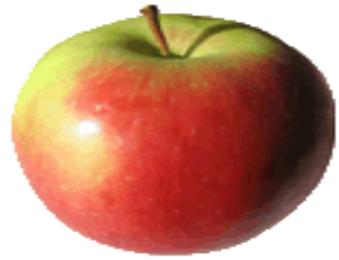
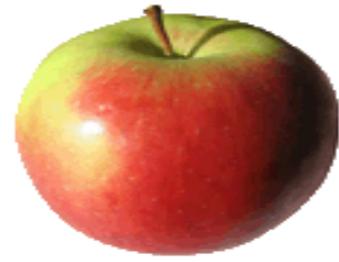
Subitising

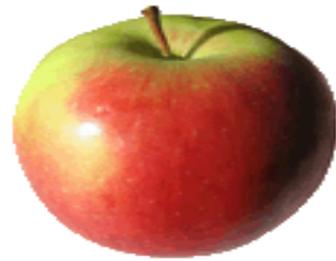
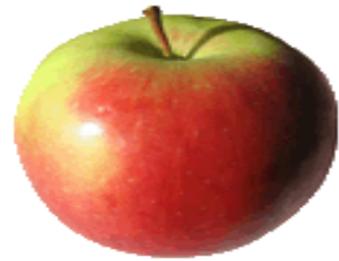
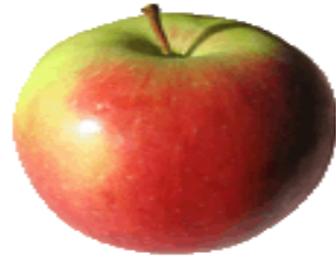
**‘A quick attention towards numerosity
when viewing a small set of objects’**

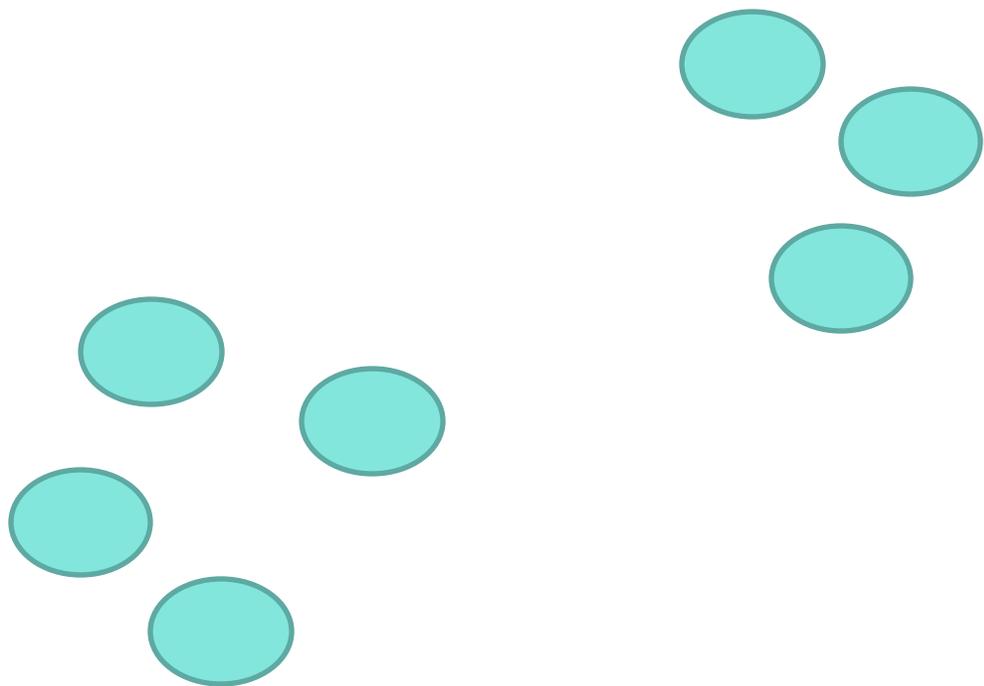
Samara and Clements 2009

perceptual subitising

conceptual subitising

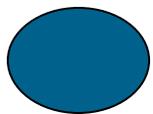
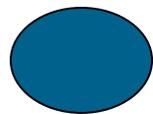
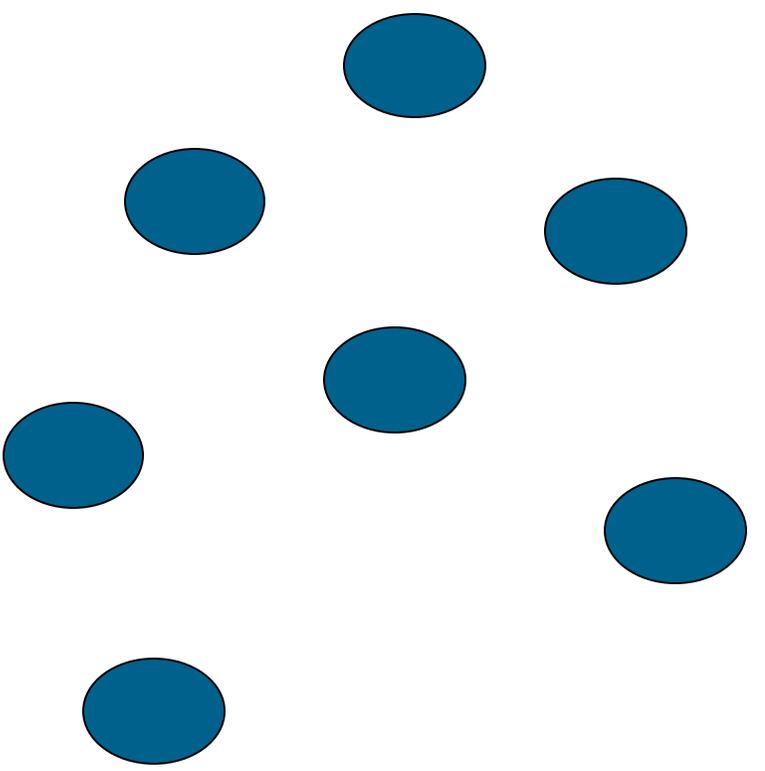
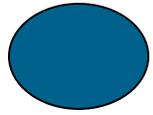






How many dots are
there now?

How did you see them?



How many dots are there now?
How did you see them?



Counting principles

- The 'one to one' principle
- The 'stable order' principle
- The 'cardinal' principle
- The 'abstraction' principle
- The 'order irrelevance' principle

Counting principles

<http://prek-math-te.stanford.edu/system/files/media/document/2017/The%20Principal%20Counting%20Principles.pdf>

Thompson, I (2008) Early Years Foundation Stage: How much does it count?

<https://www.atm.org.uk/write/mediauploads/journals/mt210/non-member/atm-mt210-40-41.pdf>

One-to-one principle

Each counting word (number) matches an object



Order Irrelevance

It doesn't matter in which order you count objects.



Stable order principle

When counting, numbers must be said in the correct order



Cardinal Principle

The last number you say is the cardinal value, (total)



I have 5 bears

Abstraction principle

- Mixed sets – what is countable.



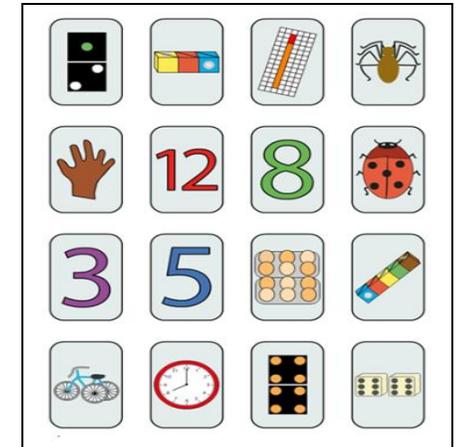
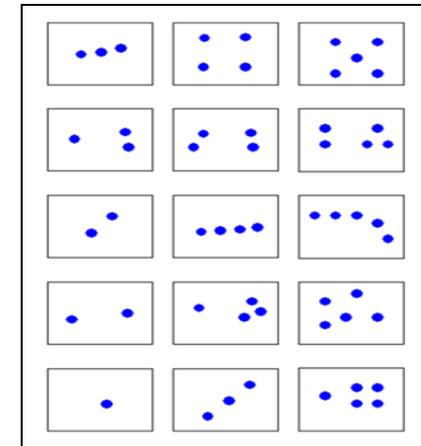
Using the numberblocks



<https://www.youtube.com/watch?v=a2hDWmkF0YI>

Games to support counting

- Deal and Copy
- Memory Match
- Matching numbers
- Feel and Find
- Monster hide
- Frogs and bubbles
- Pass the elephant



Monster hide!

In pairs spread out on the table 10 monsters in total.
 Player A closes eyes.
 Player B 'hides' some of the monsters.
 Player A must say how many monsters have been hidden.
 Replace the monsters for Player A to hide.
 Keep going until you don't want to play anymore.

- Resources: monsters

Pass the elephant

- Start with 5 elephants each
- Take turns to roll the dice
- Pass that many elephants to the person on your left (or partner)
- The winner is the one with no more elephants

Frogs and bubbles

2-4 children arrange five lily pads across the pond.
 Children decide how many bubbles to be on each lily pad (0-3) then draw them.

Take turns to roll die/spin spinner and hop that many lily pads popping (and collecting) bubbles as you go.
 The winner is the frog who has the most bubbles.

- Resources: 5 lily pads, pencils, bubble counters, die/spinner marked 0, 1, and 2.

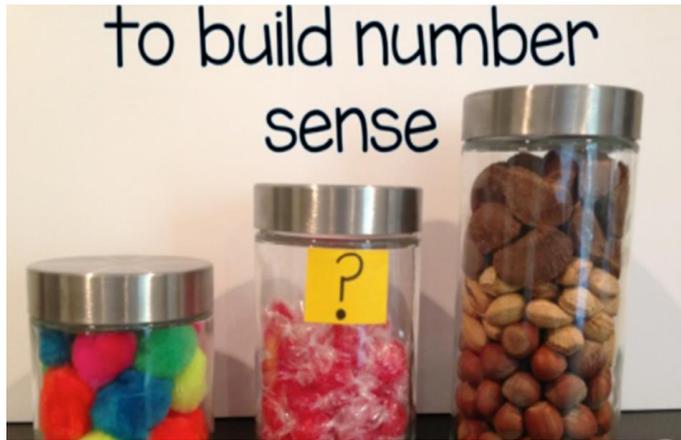


When
does it
start?

**So what is
comparison?**

Understanding that comparing numbers involves knowing which numbers are worth more or less than each other.

Comparison



When
does it
start?

**So what is
composition?**



Knowing that one number can be made up from two or more smaller numbers.

Say what you see



Say what you see



Register Time



here today

away today

Snack Time



Tidying Up



Spatial Reasoning

Understanding Relationships
Language
Spatial Memory
Sense of Direction
Spatial Representations



Why is Spatial Reasoning So Crucial?



Thank you

