Teaching to Big Ideas in Primary Math

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Oakville
June, 2017

- Our mission today:
- What are **SOME** of the Big Ideas in Primary Math?
- How do we organize teaching around them?

To start

- On a paper nobody else sees, you or you and a partner make a list of two ideas that you think are important in:
- - number
- - measurement
- Put it aside.

Let’s consider numeration

- There are many ways to count; different ways are useful in different situations.

So..

- In different situations I might ask how they might count the total and why.

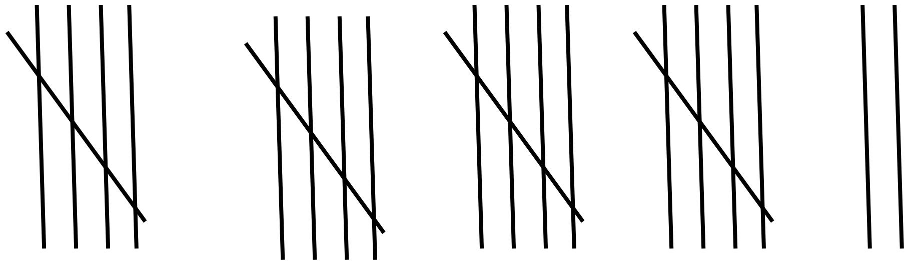
How many wheels?



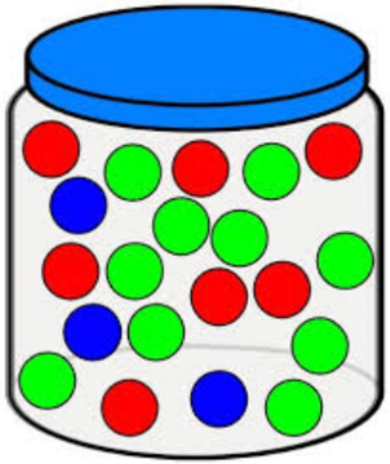



How much is this worth?

How many people responded?



How many marbles are there?



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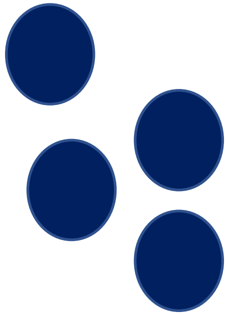

Or…

- Draw a picture of 16 items so it is EASY to tell it is 16.
- Why is it easy?

Let’s consider numeration

- Numbers sometimes, but not always, describe “how much” or “how many”.

So…

- We repeatedly need to expose kids to situations where numbers do describe quantity and ones where they don’t.

Which describe quantity? Which don’t?

PROGRESSIVE

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Perhaps

- You frequently talk about whether a number does or does not represent an amount when the number arises.

Let’s consider numeration

- Every whole number can be represented in many ways. Each way highlights something different about that whole number.

So..

- Show 24 in a lot of ways.
- Which of your ways made it easy to see that:

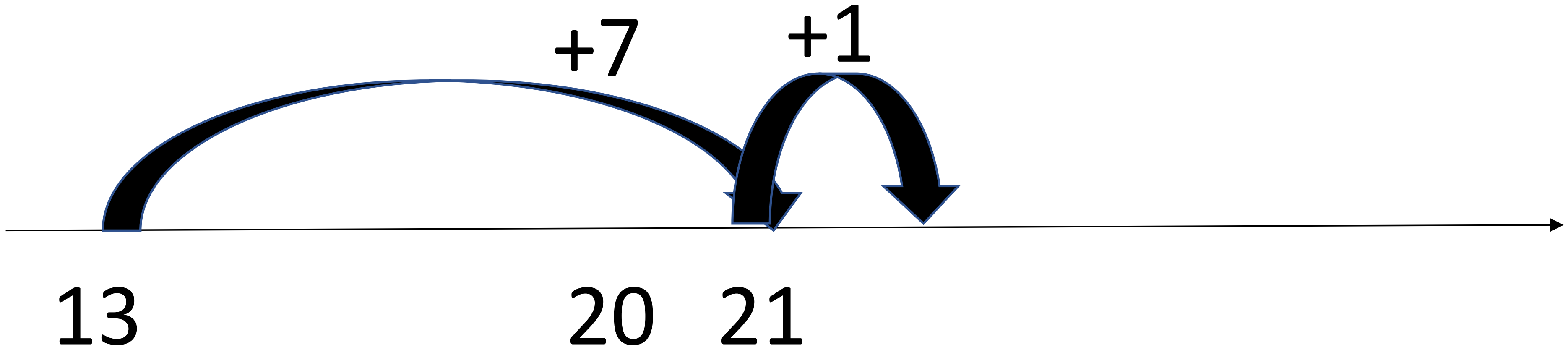
- 24 is more than 20
- 24 is less than 30
- 24 is even
- is closer to 20 than to 30
- is about 25

It means that..

- Whenever you have kids do a representation in any unit, you ask what they see.

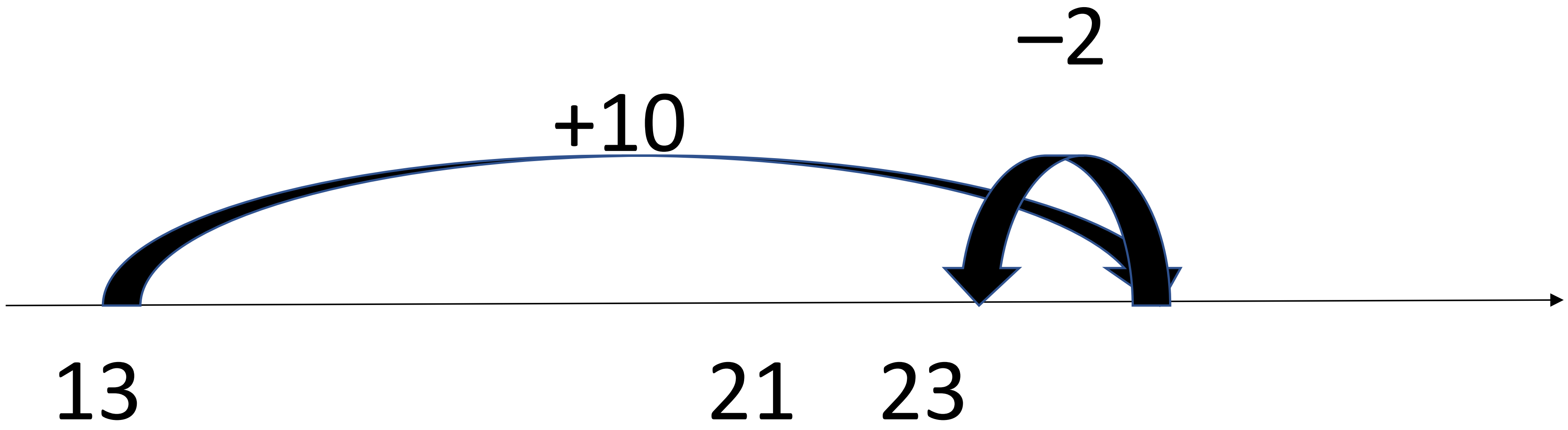
For example…

- They model 13 + 8 on a number line:



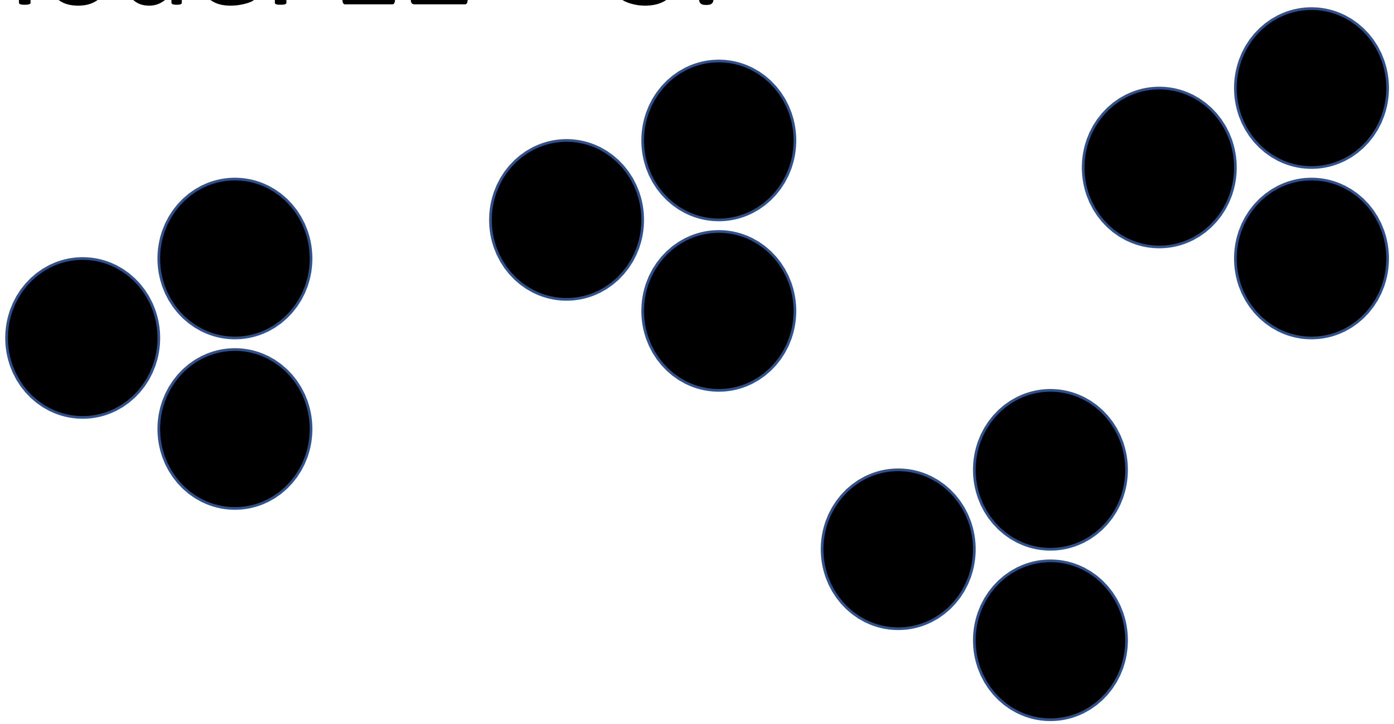
For example…

- They model 13 + 8 on a number line:



Or

- They model 12 ÷ 3:



Let’s consider numeration

- Every number can be decomposed and recomposed in different ways; this often makes it easier to estimate the size of the number or calculate with it.

“Lesson”

- You use 12 base ten blocks to show a number.
- What can it be?

Probably

• 12	66
• 120	57
• 111	390
• 300	417

Or

- You have LOTS of bags of 3 counters.
- You have LOTS of bags of 7 counters.
- What numbers can you show?
- Can’t you show?

Cans

- 3, 6, 9, 12, 15,…
- 7, 14, 21, 28, 35,…
- 10, 17, 31, 38,…
- 13, 20, 34,….

can’ts

- 1, 2, 4, 5,8, 11,

Or..

- Choose a 2-digit number.
- Take that many counters.
- How can you arrange your counters into equal groups?

Whenever…

- you add or subtract or multiply or divide, you are doing composition or decomposition.
- you use place value ideas, you are doing composition or decomposition.

Whenever…

- you work with money, you are doing composition or decomposition.

Let’s consider numeration

- Benchmark numbers can be used to estimate, compare, and give meaning to numbers.

So.. For example

- I am thinking of a number that is:
- Close to 400
- About 35
- Closer to 350 than to 400

So.. For example

- I am thinking of a number that is:
- A reasonable number of kids in a classroom
- A reasonable number of kids in a school
- A reasonable number of steps I can take in one minute

So.. For example

- How do you know that 411 > 289?
- You add two numbers that are 40 apart and the total is close to 300. What could they be?

Let’s consider numeration

- Addition and subtraction are related. They always involve parts and wholes.

So I might ask…

- Describe a situation where you might subtract 43 from 122.
- What addition also describes that situation? Why?

So I might ask…

- Fill in one of the boxes with the number 23. Then fill in the other boxes so the total lengths are the same.

So maybe

- You teach addition and subtraction together.
- You repeatedly ask for what addition is related to a subtraction situation kids are dealing with or the reverse.

Let’s consider numeration

- Multiplication and division are related to each other and to addition and subtraction.

So I might ask…

- Draw a picture or build a model that shows multiplication.
- What divisions do you see in your picture or model?
- What additions?
- What subtractions?

So I might ask…

- Solve 85 ÷ 5 using only subtraction.
- Solve 3 x 42 using only addition.

Perhaps…

- Frequently when students are doing a computation involving one operation, you ask how a different operation could have been used.

Consider measurement

- When you consider an object, there are always lots of different measurements you can associate with it.

This means

- Children are asked to think about many ways to "measure" any object, e.g.

Or I might ask

- What kind of object might be VERY long, but VERY light? OR
- What kind of object might be VERY tall, but not hold a lot?

Consider measurement

- Using units when describing a measurement makes it easier to describe and compare measurements.

I might ask

- You want to know which shape has more area. What could help you figure that out?

Perhaps

- You present lots of situations where two objects are being compared that are not able to be "brought together". You keep asking how knowing how many units "big" they are can be useful.

Consider measurement

- There is always a choice of unit when measuring an object; that choice is affected by many factors.

For example

- You want to know how long a room is.
- What units could you use to measure it?
- Why might you choose one of those units rather than another?

Perhaps

- Many times when students choose units, you ask them to justify their choice, but also think of a reason they might make a different choice.

Consider measurement

- Some measurements of an object are independent of other measurements, but some are not.

So I might ask

- You measured one side of a table.
- What other side lengths are you sure of now? Not sure of?

Perhaps

- You frequently bring up situations where knowing one measurement of an object tells you another one and talk about how they know. You also bring up situations where measurements are independent and discuss those.

Consider pattern

- Every pattern involves repetition.

You might ask

- Why might you think this is a pattern?
- 4, 7, 10, 13….?

Perhaps

- Frequently when patterns are being addressed, you go back to why they are patterns--- focus on predictability because of repetition.

Consider pattern

- There is no way to be certain how a pattern continues without a pattern rule.

So I might ask

- Continue this to form a pattern in three different ways:
- 5, 10,…

Perhaps

- You are careful to not say: What is the tenth shape in this pattern?
- Instead, you ask what MIGHT be the tenth shape.

Consider algebra

- Equality is an expression of balance.

You might ask

- Put some yellow and some red linking cubes on one side of the balance.
- Put some blue and green on the other.
- Never use the same amount.
- Make them balance; write the equation.

You might ask

- Line up two different Cuisenaire rods.
- Now use different combinations of rods to make the same total length.
- Write the equations.

Perhaps

- When you read 4 + 3 = 7, you say either “4 + 3” balances”7” or you say “4 + 3” is another name for 7.

Consider algebra

- An equation describes many situations.

You might ask

- Describe different situations that are described by this number sentence: $5 - 2 = 3$.

Consider algebra

- There are many things that are true about “all” numbers or all of a particular set of numbers.

You might ask

- I add two numbers.
- I subtract the same two numbers.
- The “add” answer is 10 more than the “subtract” answer.
- What numbers could they be?

For example

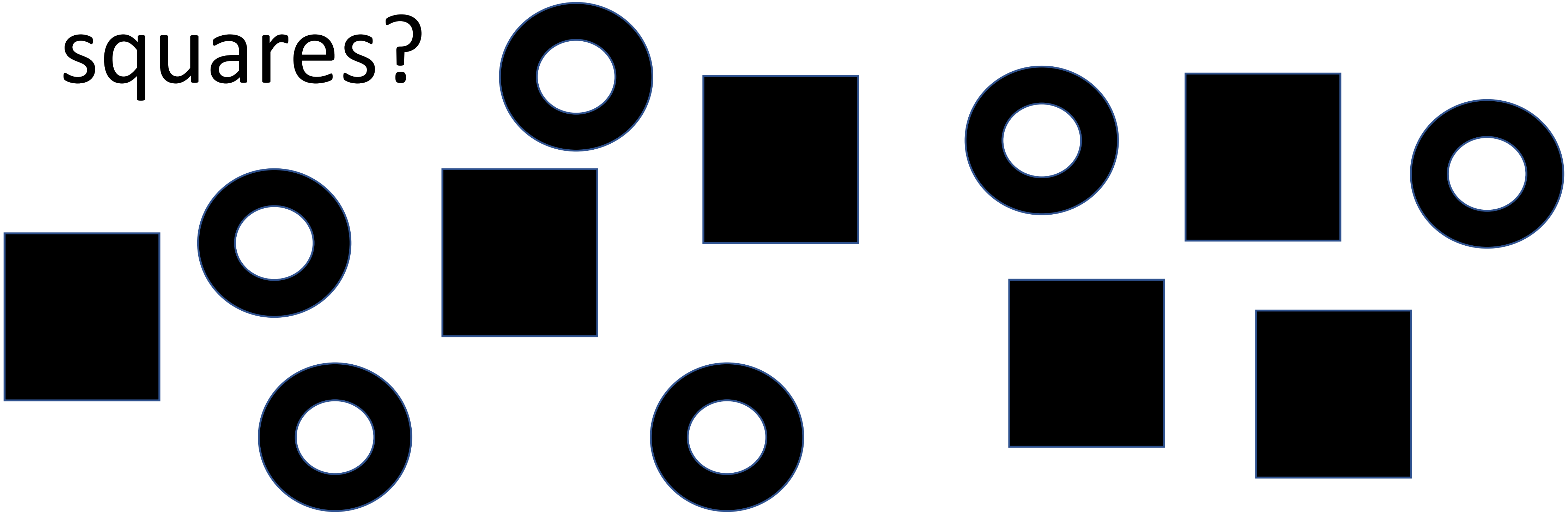
- When you talk about ideas like adding numbers in any order, you ask kids for other mathematical things that are “always true” .

Consider data

- Often an organized visual display makes it easier to “see” data.

You might ask

- How could we make it easy to see whether there are more circles or squares?



You might ..

- provide a table with some data and the same data in a simple bar graph and ask a question about the data; discuss which organization they find most helpful and why.

Consider probability

- Probabilities are always predictions that are rarely certain.

You might ask

- I flipped a coin and got H, T, T.
- What will happen next?

Or

- I chose 10 cubes and got 2 red, 8 blue.
- What will happen next time I choose 10 cubes?

What does planning look like?

- I probably use the expectations in conjunction with these big ideas to create learning goals.

What does planning look like?

- I build lessons with the commitment to address some essential understandings (as well as expectations) each time.

For example

- I choose an expectation

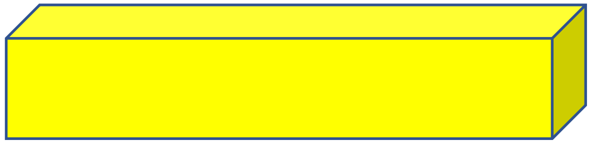
  – relate numbers to the anchors of 5 and 10 (e.g., 7 is 2 more than 5 and 3 less than 10);

I decide

- To connect this to the idea that it makes sense to relate numbers to more familiar ones/to the notion that different representations show me different things/ to the notion that every comparison can be said two ways

I create some activities like these:

- This shows 5



- And this shows 10.

Then

- Choose each other rod and tell how much shorter or longer it is than the yellow and orange.
- Write a number sentence that tells that.

But then ask questions like these

- Why might it be useful to know that something is just 1 more than 5? Or 3 less than 10?
- What does writing 8 = 5 + 3 tell you about 8?

But then ask questions like these

- Suppose you know that 9 is 1 less than 10.
- What’s another way to say the same thing?

- AND/OR

- I look at the big ideas.
- I figure out which expectations they might marry with.
- I build lessons around that big idea that cover those expectations.

So

- Let's try it.
- You either start with an expectation, marry it to a big idea and build a lesson. OR
- Start with the big idea, find related expectations, and build a lesson.

Now

- Take out your old paper about your ideas of big ideas.
- Have they changed?
- Do you feel there are important ones we missed?

- Questions?

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