Teaching with Intention in Primary Math

Marian Small

October 2018

Let’s do a problem

- Use 20 counters.
- Create three groups as equal as you can.
- Could they have been all equal?

Let’s do a problem

- Try again with 24 counters.

What did I get out of this?

- The idea that some numbers can be constructed into equal groups of a given size and some cannot.

Let’s do another problem

- Use 24 counters to make two groups, but one group is a double of the other (It’s like 2 of them put together.)

What did I get out of this?

- The idea that you could have just put together two of your three equal groups to get a group and its double ($x + 2x = 3x$).

Let’s do a third problem

- Use 20 counters to create three groups.
- One group has to be super big and the other two have to be little.

What did I get out of this?

- You can ALWAYS decompose a number 3 or greater into three parts and if the number is past 10, you could always have a big part and two little parts.

- The big part is almost all of the number.

I would argue

- That just “doing” outcomes is not enough to lead to mathematical success.
- Students need to meet ideas and not just solve random problems.

Valuable work

- Would be to look at outcomes and think about what ideas need to be addressed.
- Teachers should be expected to be able to articulate what those ideas are.

Let’s try one together

- What ideas are embedded in this outcome?

Grade 2

- counting:
  - skip-counting by 2, 5, and 10:
    - using different starting points
    - increasing and decreasing (forward and backward)

For me, it might be these ideas:

You skip numbers when you don’t count by 1s, and there is a pattern to how you skip.

For example, if you skip count by 2s, you start and skip a number you say the next one.

But if you skip count by 5s, you start and skip 4 numbers before you say the next one.

If you skip count by a bigger number, you get higher faster.

For example, 20 is the second number in 10, 20,… but the 10th in 2, 4, 6, 8,…

3e année

fraction concepts:

- Fractions are numbers that represent an amount or quantity.
- Fractions can represent parts of a region, set, or linear model.
- Fraction parts are equal shares or equal-sized portions of a whole or unit.
- Provide opportunities to explore and create fractions with concrete materials.
- recording pictorial representations of fraction models and connecting to symbolic notation
- equal partitioning
- equal sharing, pole ratios as visual parts, medicine wheel, seasons

- A fraction can be a lot or a little.

- You can’t interpret a fraction without knowing the whole.

- Some attribute of a whole is shared fairly, but not necessarily every attribute.

- The attributes you use to describe a fraction might relate to area or length or number or volume or capacity or mass or time….

So is there a list of essential understandings?

Yes and no.

I have various lists in different books I have written or am writing, but they are not everybody’s.

How does it play for me when teaching?

The first place is in setting learning goals for the lesson.

The second is in choosing activities to lead me to those goals.

How does it play for me when teaching?

The third is in consolidation.

The fourth is in assessment of learning.

Setting Learning Goals

Here are examples of learning goals I have set to fit some outcomes.

Setting Learning Goals

direct measurement:

- Non-uniform units are not consistent in size (e.g., children's hands, pencils); uniform units are consistent in size (e.g., interlocking cubes, standard paper clips).
- understanding the importance of using a baseline for direct comparison in linear measurement
- using multiple copies of a unit

Setting Learning Goals

- My goal might be that students realize that an appropriate unit changes depending on purpose.

Setting Learning Goals

- describing relative positions, using positional language (e.g., up and down, in and out)

My learning goal might be that often these words come in pairs and if you use one word to describe how two objects are positioned, you could have said the same thing using another word.

2D shapes and 3D objects:

- sorting 2D shapes and 3D objects, using two attributes, and explaining the sorting rule
- describing, comparing, and constructing 2D shapes, including triangles, squares, rectangles, circles

My learning goal might be that students realize that two objects might belong together for some reason, but the same two objects might also not belong together if you consider a different attribute.

For example, a carrot and a banana go together if you are putting together things that you eat, but they do not go together if you are considering which is a fruit.

Numbers to 1000 can be arranged and recognized:

- comparing and ordering numbers
- estimating large quantities

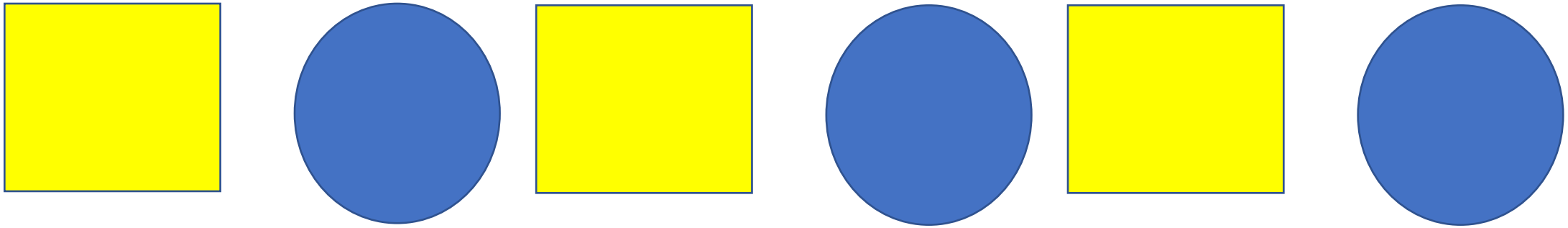
My learning goal might be that it is easier to estimate if you have a “related” benchmark that you know the quantity of.

patterns:

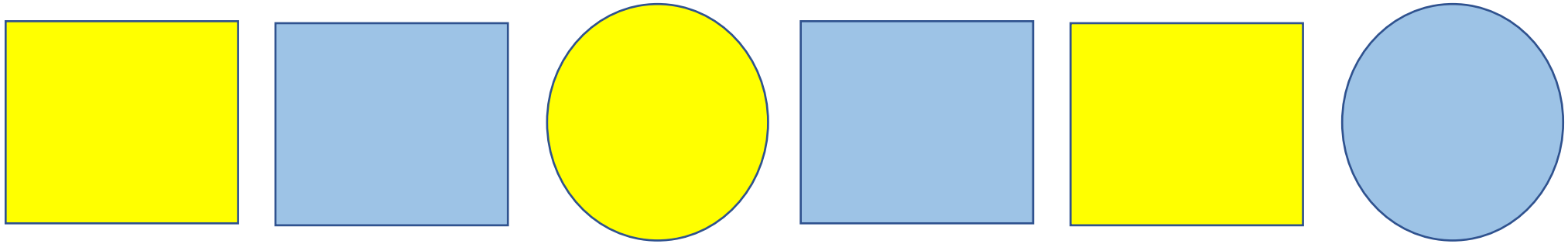
- exploring more complex repeating patterns (e.g., positional patterns, circular patterns)
- identifying the core of repeating patterns (e.g., the pattern of the pattern that repeats over and over)
- increasing patterns using manipulatives, sounds, actions, and numbers (0 to 100)

My learning goal might be that sometimes patterns repeat based on two attributes in the same way, but sometimes in different ways.

For example, this is an AB pattern in both colour and shape.



But this is AB in colour, but AAB in shape.



Choosing activities to lead to a learning goal

Once I have a goal, it should make it easier to choose an appropriate activity.

For example…

My learning goal in Grade 1 might be that students realize that an equation describes a balance.

For example…

The activity:

- Use 2 different colours of cubes on one side of the balance.
- Use 2 other colours of cubes on the other side of the balance.
- Make sure there is a balance.

For example…

- Write an addition equation that describes the balance.

- Repeat with other amounts of cubes.

Then I consolidate..

- I post some of the equations students have created and ask kids to notice things.

Then I consolidate..

- I ask:

If you lined up all the cubes on the left and then all the cubes on the right, what would happen?

Then I consolidate..

- I ask :
- Suppose one side had 6 red and some yellow.
- The other side had 8 blue and some green.
- Were there more yellow or green? How do you know?

Then I consolidate..

- I ask :
- Suppose one side had 3 red and some yellow.
- The other side had 1 blue and some green.
- Were there more yellow or green? How do you know?

Then I consolidate..

- I ask :
- Why were your equations addition equations?

Notice

My consolidation focused on my learning goal.

My learning goal might be that students realize that knowing you can usually represent two-digit numbers as tens and ones in many ways.

My activity might be to provide base ten rods and ones.

I ask them to accomplish these tasks:

- Represent 23 with 5 blocks.
- Represent 23 with 23 blocks.
- Represent 23 with a different number of blocks.

- Represent 65 with blocks at least 3 ways.

- Represent a number with 12 blocks. Now represent it with a different number of blocks.

Consolidation

- I might ask:

- You represented 23 with 5 blocks.

What 2-digit number could you have represented with 6 blocks?

Consolidation

- I might ask:

- Did anyone use 20 blocks to represent 65? How could you do that?
- How could you have used more blocks?

Consolidation

- I might ask:

- What number did you represent with 12 blocks?
- What other amounts of blocks could you have used for that number?

My learning goal might be that students realize that you can represent an amount of money in different ways and that it takes more bills and coins if they are of lower value.

I might set a task like this.

Choose an amount of money between $20 and $30.

Represent it using a LOT of bills or coins.

Then represent it using NOT MANY bills or coins.

Repeat with one other amount of money.

Consolidation

My questions:

- Who thinks they represented their amount using fewer pieces of money than anyone else in the room? Why do you think it could be you?

Consolidation

My questions:

- Who thinks they represented their amount using one of the most pieces of money in the room? Why do you think it could be you?

Consolidation

- Suppose you had used only dimes. Would you use a lot of coins or not many?

- Suppose you had used a $20 bill. Could you still have used a lot of pieces of money?

Consolidation

- When do you use a lot of pieces of money? When don’t you?

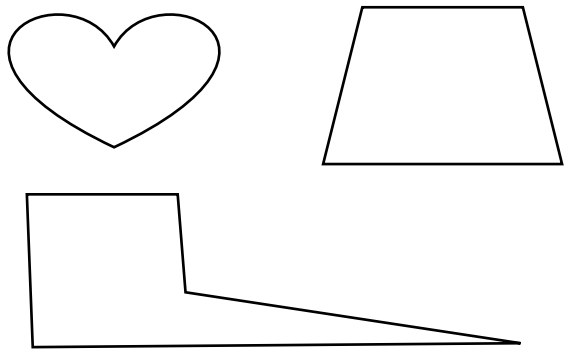
Learning Goals

- When you make a design with symmetry, there can be an odd number of shapes or an even number.

- It depends on whether there is a shape ON the line of symmetry.

Getting ready

Which two shapes do you think are most alike? Why those two?



Main activity

Make a pattern block design that follows these rules.

- There is symmetry.
- There are 4 more yellow blocks than blue ones.
- There are as many blue as red blocks.

How do you know there is symmetry?

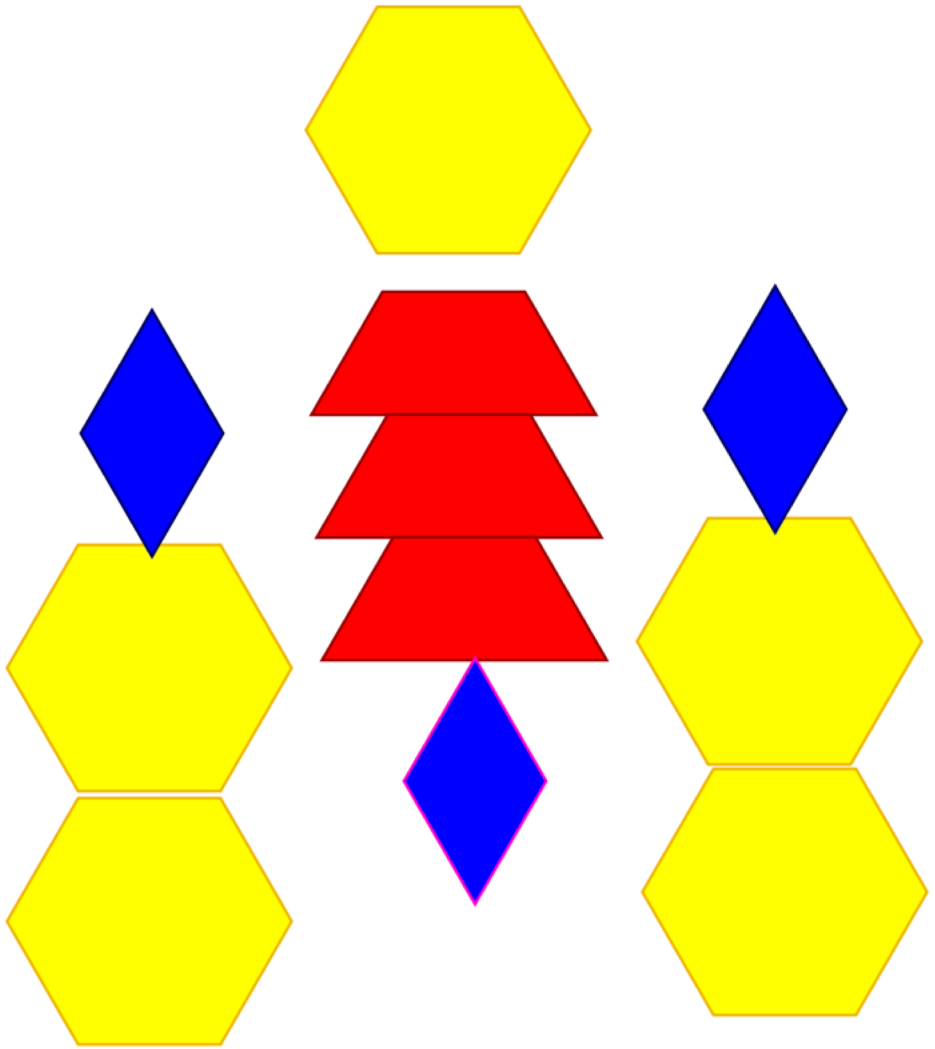
Possible design

Make a pattern block design that follows these rules.

- There is symmetry.
- There are 2 more yellow blocks than blue ones.
- There are as many blue as red blocks.

How do you know there is symmetry?

Possible design



consolidation

What questions can I ask?

consolidation

- How can you look at a design and know it does not have symmetry?

- Can a design made of 2 shapes have symmetry? How?

consolidation

- Can a design made of 3 shapes have symmetry? How?
- If there are only two yellow blocks in the design and one is far to the right, where is the other? How do you know?

Assessment

Assessment needs to match instruction.

Teaching with intention means assessing with intention.

Assessment

If your goal for your students in math is just “doing it”, you will have mostly knowledge items with some application thrown in.

Assessment

But if your goal is to build math thinkers, you will focus much more on understanding and thinking questions.

For example

Instead of: Which is greater? 49 or 76
You might ask: Which number is probably greater?
Why?
    4[] OR []6

For example

Instead of: Estimate 38 + 45.
You would ask: Why might someone estimate 70?
Why might someone else estimate 80?
Would 90 also be a good estimate?

For example

Instead of: What time does the clock show?
You would ask: If a clock could only have one hand, would you choose the minute hand or the hour hand? Why?

Today

Was a lot of hard thinking.

You can’t change overnight, but maybe choose something you heard today that you are ready to work on.

Download

- You can download this presentation at

www.onetwoinfinity.ca

Recent presentations

DCPrim