Some of the Bigger Issues in Planning Primary Math Instruction

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What matters first?

- The classroom environment.
- But today my focus will be, assuming we get this right, instruction and assessment.

What else matters?

- MOST FUNDAMENTAL-
- Recognizing that math is not about doing stuff, but about thinking mathematically.
- We will readdress this later.

What else matters?

- MOST FUNDAMENTAL-
- Recognizing that different children have different needs and these must be addressed.
- This might be tasks you set as well as the type of feedback you give.

What else matters?

- MOST FUNDAMENTAL-
- Knowing why you are teaching what you are teaching.
- That means MORE DEEPLY understanding the purpose of expectations

For example…

- Grade 1:
- Estimate, measure and record lengths, heights and distances
- What are the most important markers for you that the student has been successful on this expectation?

For me…

- How reasonable are their estimates? (i.e. can they relate two measurements to each other)
- Do they use unit size as a factor?
- Do they recognize bad measuring vs good measuring?

For me…

- Do they have a good sense of which attributes matter and which don’t when they measure?
- Do they realize units need to be the same size and why?
- Do they choose appropriate units?

For me…

- Do they know what to do if they don’t have enough units?
- Do they know what to do if the fit is not perfect?

What ideas

- You need to know what ESSENTIAL UNDERSTANDINGS/BIG IDEAS to pull out of a lesson, not just what problem to do and to get kids to share.

So..

- You might create your own, or use mine or use someone else's, but you need to do this to teach with confidence and to be able to respond effectively to students.

In K

- By more deeply understanding expectations, you can make more meaningful inquiries.

For example

- Consider “explore and communicate the function/purpose of numbers in a variety of contexts”
- What really matters here? How might that affect what you inquire about?

OR

- Consider “explore different Canadian coins, using manipulatives”
- What really matters here? How might that affect what you inquire about?

In Grades 1 – 4

- By more deeply understanding expectations, you can cluster them.
- This might be a collaborative effort.
- Clustering might facilitate planning, particularly in ensuring you keep returning to important ideas.

Using Open Questions clustering

- Some of you may have a[illegible]pen Questions for the [illegible]son for different strands.
- Expectations have [illegible] for you.

GRADE 1

2 Area

- Demonstrate an understanding of the use of non-standard units of the same size for measuring
- Estimate, measure (i.e., by minimizing overlaps and gaps), and describe area, through investigation using non-standard units
- Compare two or three objects using measurable attributes, and describe the objects using relative terms

4 Time

- Read time using analogue clocks, to the nearest five minutes, and using digital clocks, and represent time in 12-hour notation
- Solve problems involving the relationships between minutes and hours, hours and days, days and weeks, and weeks and years, using a variety of tools

GRADE 2

2 Comparing Numbers and Rounding

- Represent, compare, and order whole numbers to 100, including money amounts to 100¢, using a variety of tools
- Determine, using concrete materials, the 10 that is nearest to a given two-digit number, and justify the answer

Longer term planning

- Consider what you think are the big ideas in math.
- Make sure you keep returning to them over the course of the semester/year.

For example – Look at your grade

- **Look at the NUMBER (not Operations) expectations.**
- **What two to four concepts are most important?**

Consider K

- Maybe super important to compose and decompose quantities to 10

Maybe a bit less on

- Coins

Grade 1 - maybe

- **Compose and decompose numbers to 20 (with a variety of representations)**
- Estimating number of objects in set
- Counting forwards and backwards different ways

Less so

- Read and print number words
- Coins
- fractions

In Grade 2, maybe

- Compose and decompose two-digit numbers including visual representations of the decompositions
- Comparing numbers

Less so

- Printing number words
- Rounding to nearest ten
- Fraction stuff

For example – Gr 3

- **Composing and decomposing in a variety of ways using materials**
- **Some understanding of how whole numbers are symbolized**
- **Fraction meanings**
- **Skip counting by 2's, 5s, 10s**

Less so

- Rounding
- Money problems (just a context for the other)
- Other skip counting

In the background

- **You are always focusing on sense of size of numbers.**

You could do the same for

- Operations
- **Measurement**
- **geometry**
- **Pattern**
- **Algebra**
- **Data**
- **probability**

So you might…

- Go back and forth between strands, e.g. for grade 3

Compose/decompose—concrete- adding and subtracting

Include relationship between + and –

Sense of size of number

Growing and shrinking patterns

Length including relating unit size to measure

Two attribute sorting

Compose/decompose- place value

Adding and subtraction including + and – equations and properties

Sense of size of number

Decomposing shapes

Angles

Repeating patterns and pattern rules

Area including relating unit size to measure

Movement on grids

Data collection and graphs and interpreting data

Fractions

Compose/decompose- money

Sorting 2-D and 3-D

Intro mult and division; continued adding and subtracting
Including properties

Mass/capacity including relating unit size to measure

Frequency and fairness

Sense of size of number

You need to…

- Focus and keep revisiting important expectations.
- Some are truly less critical and much less attention to them is warranted.

Notice that..

- You DO NOT have to (nor likely should you) visit the expectations in order.

You might also…

- Ensure that every couple of weeks, you do at least some small activity in pattern, or data and some in geometry or measurement.
- You might use some of the open questions minds-on activities for these, e.g.

Q

Why can you use different measurements to describe how big a pumpkin is?

Q Use square tiles to create a growing pattern. Represent the same pattern again, but use an action this time.

Relating strands

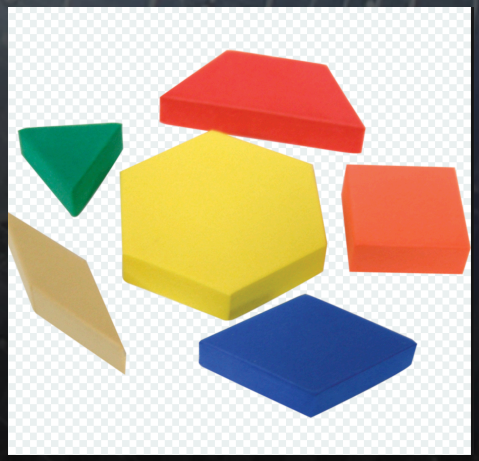
- Or you might use one topic as a context for another,

Measurement for number

- The length of one line is 4 times as long as another line.
- Draw two possible lines.

Geometry for fractions

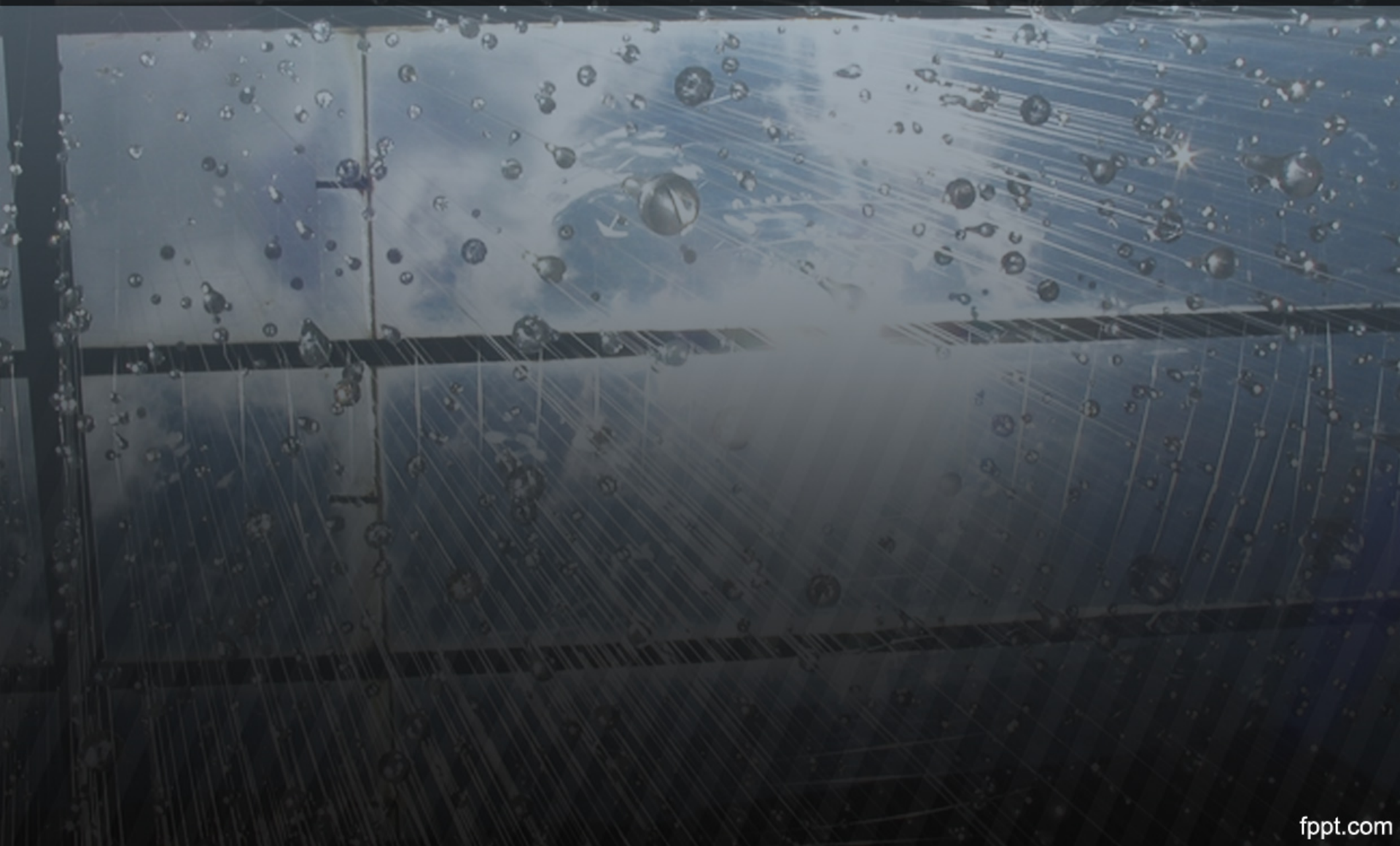
- Put together three pattern block shapes to make one full shape.
- What does the shape look like?
- What would you call it?
- What fraction of the whole area
- is each colour?



Revisiting concepts

- Some ideas are important enough to revisit, changing the task, of course, each time.
- In Grade 2, this might include composing/decomposing numbers, addition and subtraction.

For an individual lesson…



Learning goals

- Learning goals for the bulk of your lessons (certainly 3-part lessons) should be about ideas, and not just performances, so that a teacher can stay focused on the IDEAS s/he is trying to get at.

For example…

- Instead of a learning goal being about adding 3-digit numbers, it might be about the notion that adding big numbers always involves breaking up the addition into manageable pieces.
- The lesson focuses on variations on what those manageable pieces might be.

The main teaching task…

- Is not what you start with, but is in service to getting to the IDEA learning goal you have set.

Consolidation

- What consolidation is relates to sharing, but is NOT JUST SHARING.
- You need to know what critical questions need to be asked at the end of the lesson to ensure that students really knew what math you were trying to get across

So it might look like this

- Learning goal: There are many numbers that might meet the same place value criteria.

Main Problem

- Create three numbers to meet each rule.
- Create three that do not.

Main Problem

- Rule 1: There are more ten-sticks than one-cubes.
- Rule 2: There are exactly three more one-cubes than ten sticks.
- Rule 3: The total number of ten-sticks and one-cubes is between10 and 20.

Consolidation

- (for any of the rules)
- Who thinks they have one of the smallest numbers that satisfy the rule? Why?
- The greatest? Why?
- If a number works, will it also work if you switch the tens and ones?

Consolidation

- How do you get from one number that works to another that works?
- Can two numbers in a row ever work?
- Can every number be represented with different numbers of ten sticks?

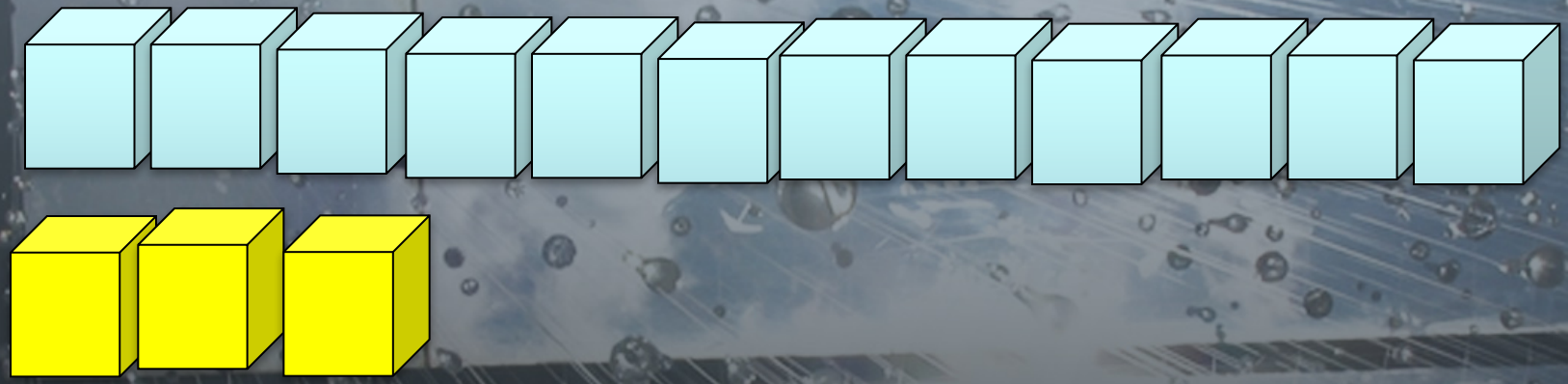
Manipulatives/visuals

- There should be a lot of use of manipulatives and visuals not just in procedural ways but in service of “seeing” ideas.

For example

- How could you use linking cubes or counters to show that 12 + 3 has to have the same answer as 10 + 5 WITHOUT GETTING THE ANSWER.

For example



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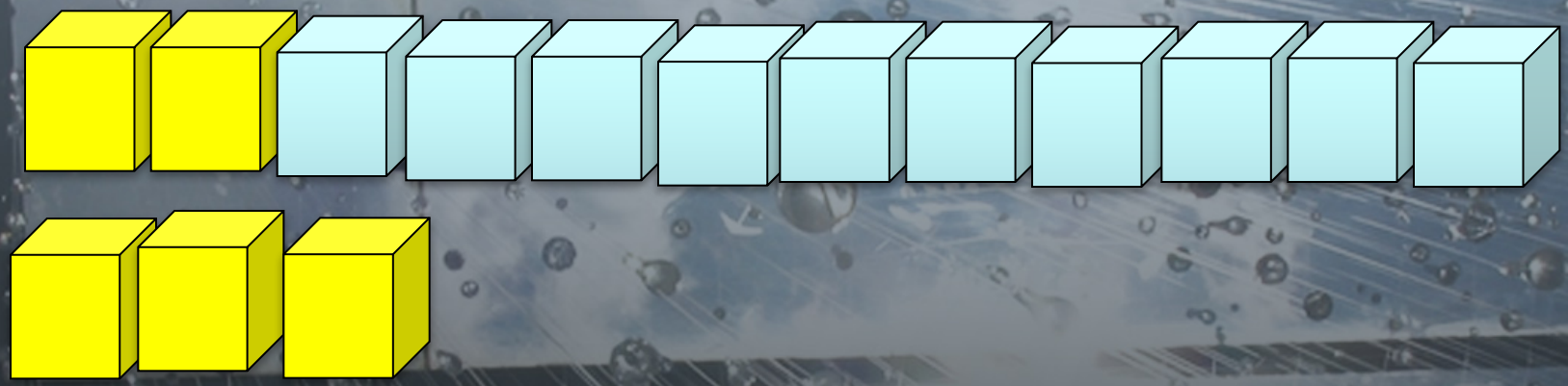
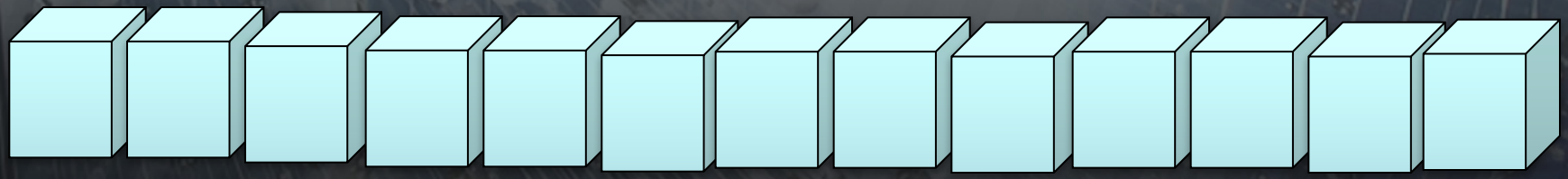


For example

- You add a number twice and a smaller number to get to 12. What could the numbers be?



For example

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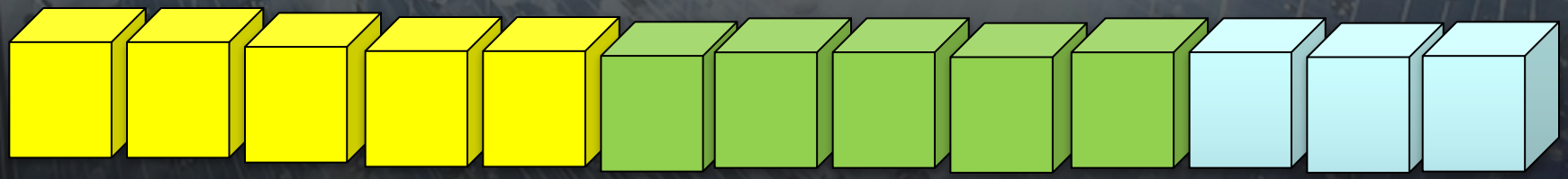

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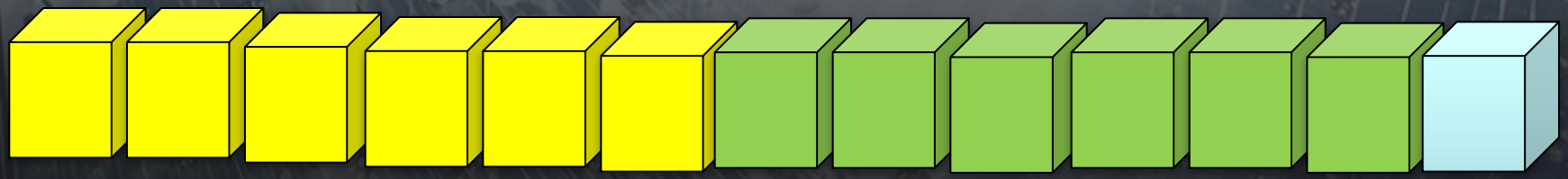

Success criteria

- Success criteria need to focus not only on how many strategies to use but the quality of what is done and the ideas that the students show an understanding of.
- So, for example,…

Task

- What numbers can you show with exactly 12 base ten blocks?

Success criteria

- Some criteria should be discussed before the task is begun, but some should be discussed after consolidation.

Success criteria

1. I create a lot of numbers that used 12 base ten blocks.
2. I can name each of the numbers I represented..

Consolidate

- What was the smallest number you could create? Why?
- What was the greatest number you could create? Why?
- Could you have used 10 ones? How? What number would you create?
- Could you have used 9 flats? How? What number could you create?

Consolidate

- What do all of the numbers we created have in common?

Maybe

- 12
- 120
- 102
- 111
- 201
- 66
- 75
- 444
- 192
- 552

Success criteria

3. You could use one answer to get to another one

4. You could come up with numbers when you were given part of the number.

5. You noticed what the numbers had in common.

Kinds of tasks you use

- You need a good blend of “3-part lessons”, game days, etc.
- You need a good blend of very focused tasks to reveal very particular math ideas and bigger, thinking tasks that apply what has already been learned.

For example

- Focused task:
- 1. Trace your foot and your hand.
- 2. Look and predict how long a piece of string would need to be to go all the way around the edge of the footprint and the handprint.
- 3. Test your prediction.
- 4. Do kids with bigger feet have bigger hands?

For example

- Application task: About how many people do you see in a day?

Understanding

- You need to focus more on understanding than just knowledge.

For example

- **Knowledge:** List numbers that add to 10.
- **Understanding:** Two numbers add to 10. One is close to 10. What do you know about the other number? How do you know?

For example

- **Knowledge:** Which is greater: 34 or 92?
- **Understanding:** Which number is probably bigger? Why?
- []2 OR 8[]

Differentiation

- There needs to be significant use of open questions to allow for differentiation as well as parallel tasks.
- This is true in both the tasks assigned as well as assessment.

For example

- Instead of: What is 43 – 21?
- Choose two 2-digit numbers to subtract. Subtract them.
- OR
- You subtract two 2-digit numbers. The answer is close to the number you subtract. What might they be?

Continua focused on the big stuff

- You need to be aware of what comes before and after in the curriculum, but also what comes before and after in the development of ideas.

Problems should be houghtful, not complicated

- Compare the two:

Complicated

- I bought 3 items that each cost 75¢.
- I bought 4 items that each cost $1.39
- I bought 3 other items that cost $1.21, 35¢, and 19¢.
- How much of the $10 I had do I have left?

Thoughtful

- I bought 5 items that cost under $1 and bought 5 items that cost more than $1. I spent almost $10.

- What are possible prices for the 10 items? Explain your thinking.

What it might look like in P

- You are on the number 5 on this path:

1	2	3	4	5	6	7	8	9

- You move SOME steps forward.
- Then you move SOME steps back.
- You repeat both moves
- You land at 9.
- How many steps each way?

What it might look like in P

- How many might be in each yellow box? How many in each red?

What it might look like in P

- I had more than 20 counters or linking cubes.
- I split them up into 2 small piles and 2 large piles.
- The large piles had twice as many counters/cubes as the small ones.
- How many might have been in each pile?

What it might look like in P

- I represented an amount of money with 8 coins.
- I represented the same amount with 22 coins.
- What coins might I have had each time?

You might think

- Every time I trade 1 quarter for 5 nickels, I would get 4 extra coins.
- Every time I trade 1 toonie for 2 loonies (or 1 dime for 2 nickels), I would get 1 extra coin.
- 14 extra coins is 4 + 4 + 4 + 1 + 1 extra.

You might think

- So I could have started with
- 3 quarters,
- 2 dimes and
- 3 nickels and traded for
- 15 nickels,
- 4 nickels and
- 3 nickels = 22 nickels

Differentiating Instruction

- Different kids are ready for different tasks; it is not reasonable that all kids are ready for exactly the same thing on a particular day.
- This means alternate tasks or parallel tasks or open tasks.

For example

- If your plan were that all work on 2-digit plus 1-digit addition, some kids might not be ready for it.
- So how could you handle this?

Gathering preliminary data

- You might want to gather data topic by topic to decide who is ready for what, what requires re-teaching, what can be omitted.
- Diagnostics should be focused, short and useful, and not something to make the system happy.

For example

- Grade 1 diagnostic for pattern (based on K work)

For example

- What would you put next to continue this pattern?
- 
- Why is it a pattern?

For example

- What would you put next to make this a pattern?
- 
- What could you put instead?
-
- Make your own pattern.

Feedback

- Generically, it is about focusing on what the kid is thinking, not about whether or not the answer is right.
- But it is mostly about figuring out how to respond to what you see.

For example

- A kid counts these buttons: Top left (1), top right (2,3), bottom right (4, bottom left (5, 6), bottom right again (7)..
- What do you say?

For example

- A child adds 44 + 88 and gets 1212.
- What do you say?

For example

- A child is asked to solve this problem and doesn’t know where to start.

- *Jeff was 4 years old at his brother’s birthday party.* [we see a cake with 7 candles.]. *How old will Jeff be when his brother is 10?*

- What do you say?

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