

Asking Richer Questions in Instruction and Assessment

Marian Small

January 2020

- I have the opportunity today to share my perspective on what I think matters the most in teaching students and why.
- Most of my examples will focus on mathematics, but not all and the ideas will pertain to all disciplines

What is the Point of School?

- Clearly, part of the point of school is the learning of social skills.
- But what about the learning side?

What is the Point of School?

My goals as a teacher are:

- To make learning something attractive
- To teach a student to make sense of what that student sees and hears and to teach him or her to figure out how to handle new situations

What is the Point of School?

- There is some element of memorizing or repeating in schooling, but in a digital era, this can't be the most important goal anymore.

Within our disciplines

- I think we have an obligation to focus more on important ideas and not treat every skill or piece of information as equally important.
- I am not sure the curriculum we are given always helps us do that, so we will need to analyze our curriculum to figure out what those ideas are.

And

- We also have to figure out how to make sure we both instruct and assess an understanding of those ideas we have deemed as important to make sense of.

Making Sense

- David Sousa and Carol Ann Tomlinson in “Differentiation and the brain: How neuroscience supports the learner-friendly classroom” suggest:
- Nothing goes into long-term memory unless it makes sense and has meaning.

So this morning

- We will look at two ideas.
 1. How do we decide on what is important?
 2. How do we make sure the questions we ask in both instruction and assessment focus on understanding and not just repeating?

First

- Making decisions about what is important

Some example

- Grade 7 math

Here is an Alberta outcome:

- Solve problems involving percent from 1% to 100%

Some examples

Achievement indicators:

- Express a given percent as a decimal or fraction.
- Solve a given problem that involves finding a percent.
- Determine the answer to a given percent problem where the answer requires rounding, and ...

But..

- Much of this can be done without much understanding, by copying.
- We do want some of that, but that cannot be the focus.
- So what would be my focus?

Maybe

- That a visual of a percent problem is a great way to help you estimate the solution.

Let's try

- Everyone in the room think of a visual that would help you estimate 35% of 82.

Here are some of mine

8 8 8 8 8 8 8 8 8 8

Or

Percent

0

33

67

100

Number

0

27

54

32

Or it might be

- Sometimes it is easier to figure out the percent of a number by thinking of the percent as a fraction, but not always.
- E.g. 25% of 444 VS 56% of 80

Or it might be

about the relationships between percents.

- For example, suppose 15% of a number is 72.
- What is 30% of that number? Do you need to figure out the number?
- What is 5%? Do you need to figure out the number?

Let's look at Grade 10

- Solve problems that involve scale diagrams, using proportional reasoning.

Some achievement indicators

- Determine, using proportional reasoning, the scale factor given one dimension and its representation.
- Determine, using proportional reasoning, an unknown dimensions of a shape given a scale factor.

Some achievement indicators

- Draw a scale diagram according to a specified scale factor.
- Solve a contextual problem involving a scale factor.

Textbook type problem

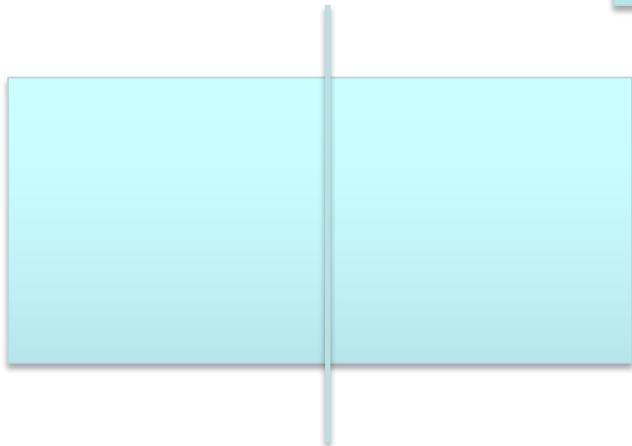
- 6. *The length of the road is 1000 miles.
If 1 inch represents 100 miles, what is
the length of the road on the map?*

- 7. *If on a scale drawing 35 feet are
represented by 25 inches, then a
scale of $\frac{1}{8}$ inch represents how
many feet?*

Maybe we could focus on

- what the clues are that something is or is not a good scale diagram
- how you choose an appropriate scale for a situation and what influences that choice

Which is the scale diagram?



For example

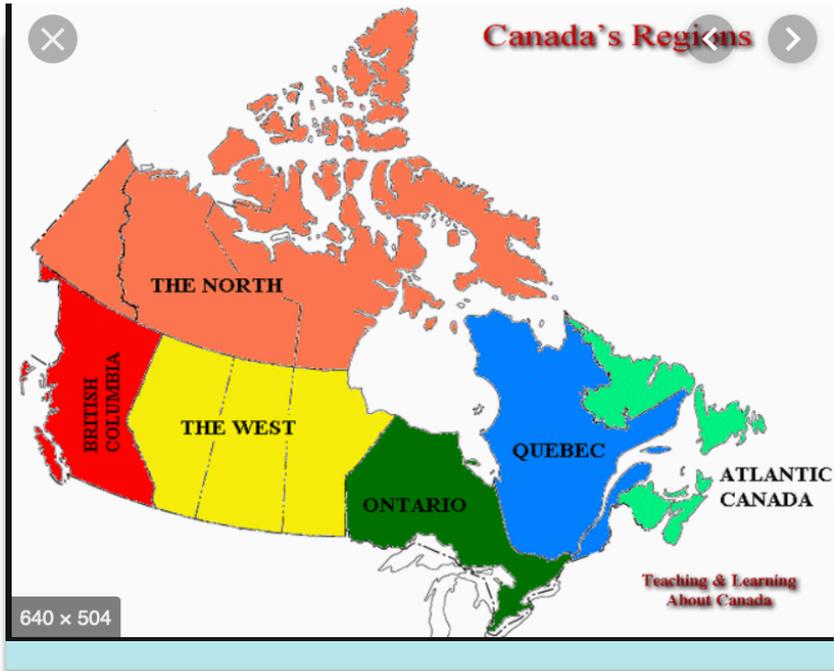
- Is an 8 x 10 photo an exact “scale diagram” of a 5 x 7?



Map of Canada

- You want to make a map of Canada on a piece of paper.
- Would you use the same scale if you drew it horizontally as if you did it vertically?

Map of Canada



So...

- What would be a good scale in each case?
- [Canada is about 6500 km across and 3600 km from Ellesmere Island to US border]

So...

- How might the scale for a city map be different from the scale for a map of the world?
- What sort of scales would you expect?
- What sort of map might have a scale of
1: 24 000?
1: 1 000 000?

So whatever the curriculum is..

- You need to know to decide what is really important. It seems harder in the math curriculum, but might apply more broadly.

So whatever the curriculum is..

- If it's selecting information sources that will provide effective support, convincing argument or unique perspectives, you have to learn what it means to be convincing or unique.

So whatever the curriculum is..

- If it's learning music, it's not just knowing that there are sharps and flats, but what the point of them is.

So whatever the curriculum is..

- If it's developing media literacy, the question is how you can detect bias and what bias really is.

I am proposing

- That groups of teachers would benefit from collegially deciding what the bigger ideas that matter are in their curriculum.

Take a moment now

- Talk to someone near you.
- Talk about something you teach and think about one or two important ideas you would want to get across.

Let's talk a bit more about assessment

- Formative assessment
- Performance tasks

Formative assessment

- Makes a huge difference
- Needs to focus on important learning goals
- Requires feedback
- There are different types of feedback.

Opportunities for self-correction

- A student has made an error.

$$\frac{2}{3} + \frac{5}{6} = \frac{7}{9}$$

- You ask a question that allows the students to discover the error on their own without indicating there is an error, e.g. How could you explain to someone why the answer is less than 1?

Feedback on Strategy Choices

- A student gets a correct answer, but might not have used a thoughtful or efficient strategy.

E.g. $2\frac{4}{5} + 1\frac{3}{5}$

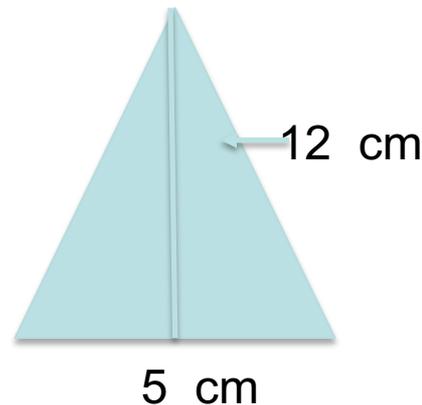
$$= \frac{14}{5} + \frac{8}{5} = \frac{22}{5} = 4\frac{2}{5}$$

- You might ask about how else a student could have figured it out.

Feedback to Encourage Creativity

- A student is prompted to think about whether there is a more unusual response that would make sense.

E.g. Draw a triangle with an area of 30 cm^2 .



Feedback to Extend

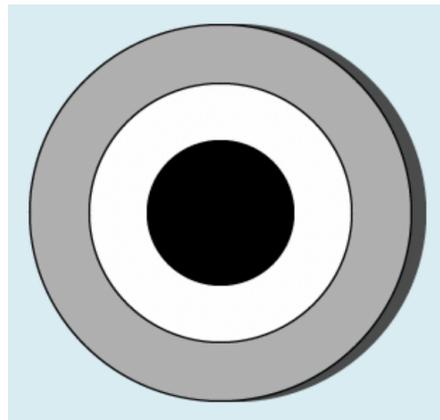
- A student performs appropriately, but the work could be extended a bit.
- One measurement of a circle is 10 cm. What are some of the other measures?

Performance Tasks

- Can be used for formative or summative assessment.
- In math, it should focus on important ideas not just lots of skills.

For example

- Work on circle measurements might have a task like this:
- **1.** Shawna designs a dart board with a grey circle, a white circle, and a black circle.



For example

- Each circle shares the same centre.
- The radius of the white circle is double the radius of the black circle.
- The radius of the grey circle is triple the radius of the black circle.
- What fraction of the area of Shawna's board is black? What fraction is white? What fraction is grey?

For example

- **2.** Design a dart board similar to Shawna's. Make the grey area $\frac{1}{2}$ of the whole area of the board. How are the radii of the grey and white circles in your board related?
- **3.** Design a new dart board with grey, white, and black sections. Make the circumference of the grey circle 10 times the circumference of the black circle. How are all three radii related?

Now let's talk about understanding versus doing

- I am going to use math as a vehicle to talk about what the differences in questions would look like.
- But then you will have an opportunity to consider other disciplines too.

An example

- DO: What is $\frac{3}{5} + \frac{2}{3}$?
- UNDERSTAND: WITHOUT ADDING, tell what a good estimate for $\frac{3}{5} + \frac{2}{3}$ would be and why.

An example

- DO: What is the area of a trapezoid with bases of 10 cm and 15 cm and a height of 4 cm?
- UNDERSTAND: Two trapezoids have the same area. One has bases that are twice as long as the other's. What else do you know about the trapezoids?

An example

- **DO:** What is $\frac{5}{8} \times \frac{7}{6}$?
- **UNDERSTAND:** I want to multiply two fractions and the answer has to be just a little bit less than each of them. What could I multiply?

An example

- DO: Solve $100x + 6 = 87x + 2$
- UNDERSTAND: WITHOUT SOLVING, tell why the solution to $100x + 6 = 87x + 2$ HAS TO be negative.

An example

- DO: What is $-4 - (-9)$?
- UNDERSTAND: When you subtract two negative integers, the result is -10 . What could they be? OR
- What does this mean on a thermometer?

An example

- DO: Evaluate $3x - 2y - 4$ when $x = \frac{1}{2}$ and $y = -3$.
- UNDERSTAND: $\square x - \square y - 4$ is negative when $x = 1$ and $y = -2$. What could the missing values be?

An example

- DO: What is the mean of 27, 18, 19, 35 and 47?
- UNDERSTAND: The mean of 5 numbers is 29.2.

The greatest and least are about 30 apart.

What could the values be?

An example

- DO: Solve $\frac{4}{x} = \frac{3}{7.6}$
- UNDERSTAND: WITHOUT solving, tell what a good estimate for x would be and why.

An example

- **DO:** What is the volume of a cone with a base radius of 8 cm and a height of 12 cm?
- **UNDERSTAND:** Two cones have the same volume, but one is much taller than the other. What could the radius and height of each be?

Now you try

- Think of a straightforward question in your discipline (if it's not math) or in math and talk about how to change it to an understanding question.

This afternoon

- I hope to see some of you again this afternoon.
- Our focus will be on differentiating instruction, but there will be continued attention to checking on understanding and not just doing and focusing on ideas that matter.

Any questions?

- I would be happy to entertain any questions.

Download

- www.onetwoinfinity.ca
- Recent Presentations
- FMKey34