Leadership in School Math

March, 2018

Agenda

- Part 1: How do you start?
  - Being intentional in going in the right direction
  - Being coherent
- Part 2: Finding out where your staff is
  - In terms of beliefs
  - By looking at common tasks
- Part 3: Look Fors
  - What to look for in classrooms
  - What to look for in conversations with staff

Agenda

- Part 4: How should lessons look?
  - What should learning goals look like?
  - What should consolidation look like?
  - What should differentiation look like?
- Part 5: Questions

Part 1:

How Do You Start?

Part 1

- Teachers must choose PURPOSEFUL activities that lead students to MATHEMATICAL insight and understanding.

Try This Problem That Might Be Used in a Grade 2 Classroom

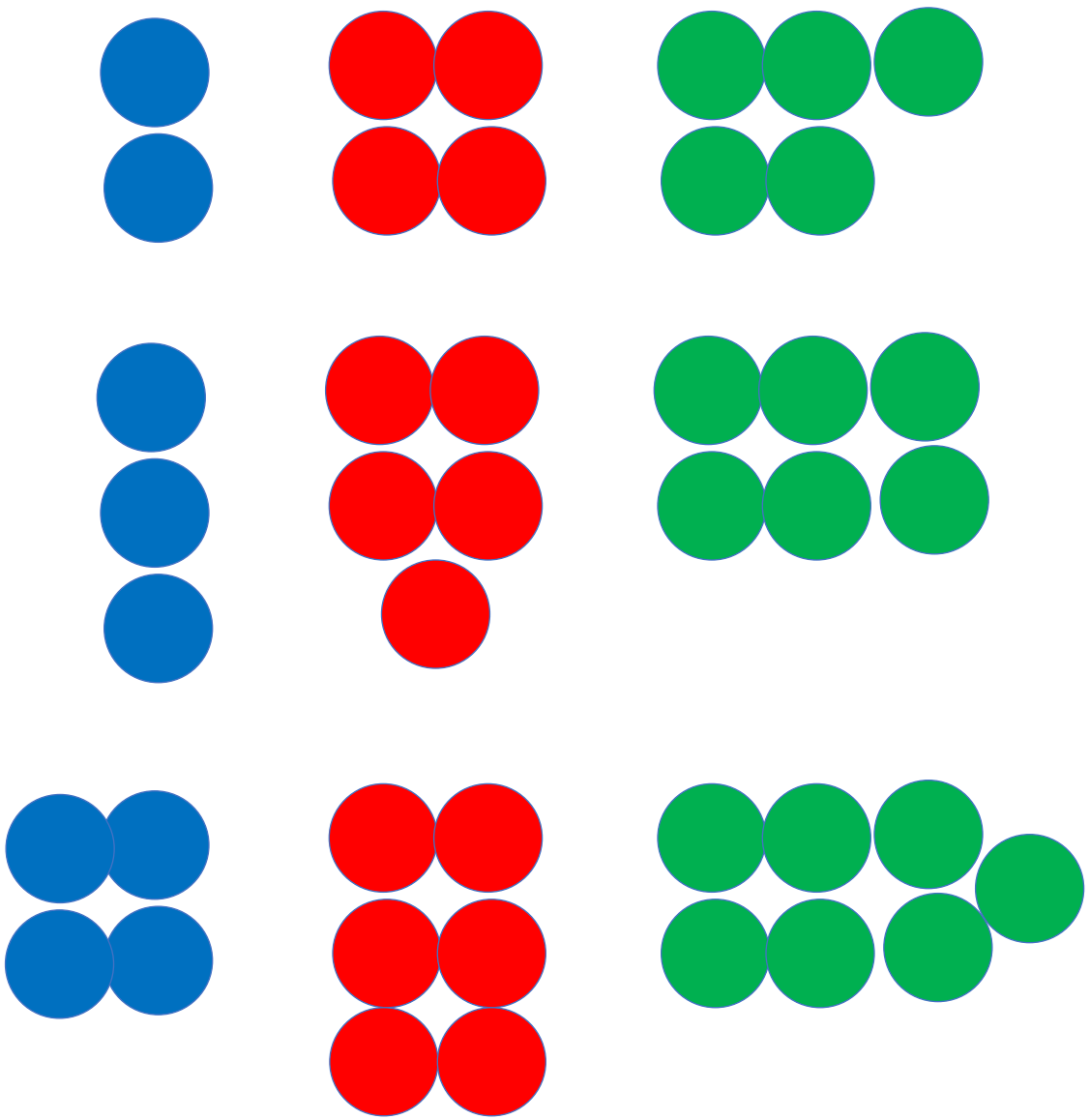
- Choose between 20 and 40 counters.
- The amount you choose must be used for ALL parts of the task.

Decomposing

- Which way of decomposing will work with your number of counters?
    - 3 equal groups.
    - 2 groups — one exactly double the other.
    - 1 big group and 2 small ones.

Variation for Grade 1

- You have red, blue, and green counters.
- You have 2 more red ones than blue ones.
- You have 3 more green ones than blue ones.
- How many counters of each colour might you have?
- How many counters might there be altogether?



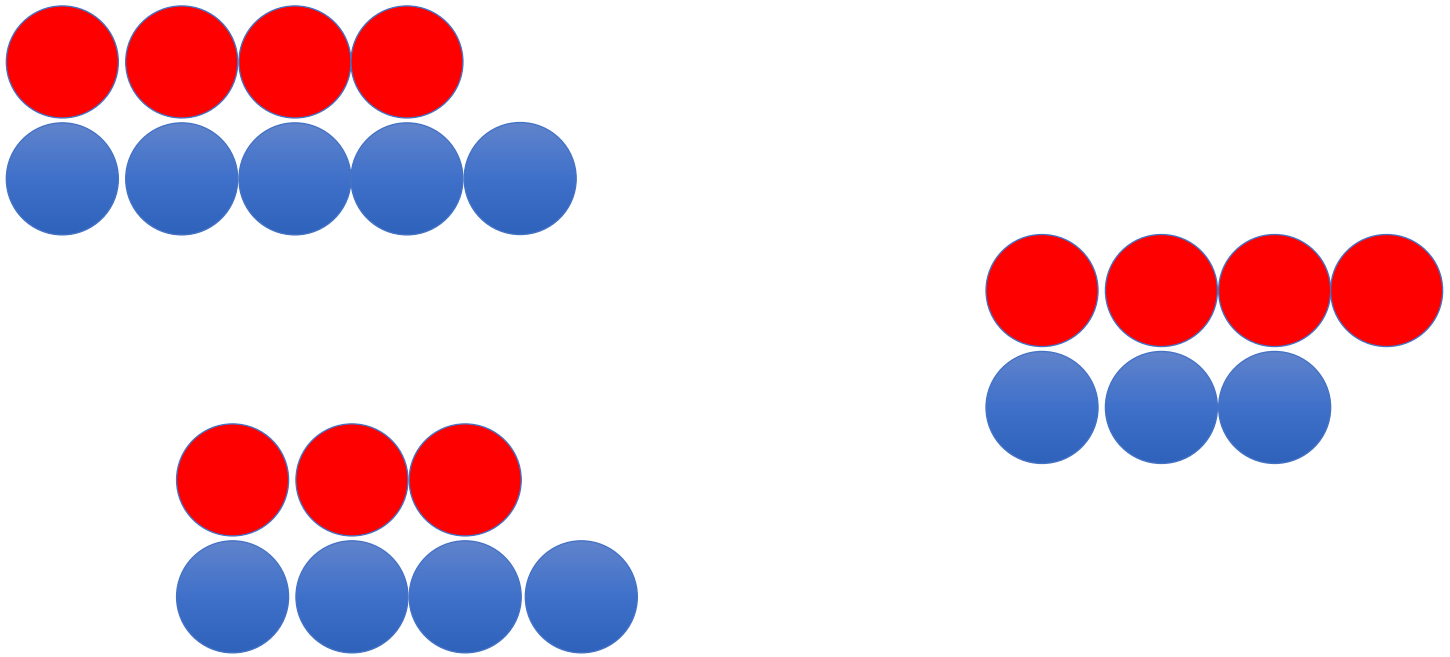
Variation for Grade 1

- Why are the numbers of counters always 8, 11, 14,… and nothing else?

Variation for Grade 3

- You have a bunch of counters.
- Almost half are red.
- How many counters of each colour might you have?

For example



My questions

- Does the number of counters have to be odd or could it be even?
- Could there be, e.g. 3 more reds than non-reds?

A Grade 8 task

- You are multiplying two fractions and the answer is close to one of them.
- What could the fractions be?

A Grade 8 task

- How do I know one of the fractions must be close to 1?
- Do I know if it’s bigger or smaller than 1?
- Do I know anything about the other fraction?

A Grade 10 task

- A field was measured in both yards and metres.
- One of the values was 10 more than the other.
- How long was the field?

Questions

- Was the metre number or yard number bigger? Why?
- How do you know the field can’t be really short?
- How do you know it can’t be super long?

So I wonder?

- Are your teachers being intentional in choosing activities?
- What criteria are they using?

Part 2:

Finding Out Where You Are

Part 2

- An important early activity is to find out what the whole staff, as a group, believes about the teaching of math

- Let’s do a little survey you might use.

Part 2

- It might be good to use Poll Everywhere to ensure anonymity, but still see what others think.

Part 2

The big focus in math instruction should be on applications.

Vote: https://goo.gl/emk5kP

Results: https://goo.gl/mjSZ9L

Part 2

Covering curriculum matters more than making the math interesting to students.

Vote: https://goo.gl/ZpBcgn

Results: https://goo.gl/2xQq4W

Part 2

Math is mostly about developing computational and algebraic skills.

Vote: https://goo.gl/RWFt9h

Results: https://goo.gl/eLqTAi

Part 2

Most of my teaching time in math should focus on problem solving.

Vote: https://goo.gl/BLQ4ox

Results: https://goo.gl/y2nZWA

Part 2

Math is more about procedures than concepts.

Vote: https://goo.gl/ULkxuk

Results: https://goo.gl/3BXPQD

Part 2

Most math teaching should be direct instruction, with some guided and some exploratory work.

Vote: https://goo.gl/eBFGQ2

Results: https://goo.gl/LjTNs8

Part 2

The currently weakest students in my class might improve, but really can't be expected to achieve top levels.

Vote: https://goo.gl/3CYiLu

Results: https://goo.gl/7DJLPC

Part 2

Open-ended problems should be used rarely since they are too hard to give a mark or level to.

Vote: https://goo.gl/MnJt1i

Results: https://goo.gl/vQhJqV

Part 2

- Now we need to engage in a conversation.
- How much do we agree?
- Do we need to agree? On which points?

Part 2

- The other way to find out where you are is to use common tasks across panels.
- My friend Doug, for example, used these.

Part 2

- Subtraction
- Choose one of these. Show how to get an answer at least three different ways.
- 10 – 3
- 50 – 29
- 4.1 – 1.78
- 8/3 – 2/5

Part 2

- Or proportional thinking
- Choose one of these. Show how to get an answer at least three different ways.
- **Choices:**
- What is 25% of 396?
- If 8 batteries cost $3.76, how much should 6 of those same batteries cost?
- You drive 48 mph. How long will it take to go 588 miles?

Part 2

- Or algebraic thinking
- Choose one of these equations. Show three ways to figure out a solution:
- $\frac{1}{2}x - 2/3 = \frac{3}{4}x - 2$
- $3x^2 + 19x - 14 = 0$
- $-4x - 17 = 2x + 8$
- $x^2 - 16 = 36$

Part 2

- Looking at student work tells the tale.
- Are students other than procedural?
- Do they use lots of models? Appropriate ones?
- Does the thinking get more sophisticated, without prompting, as students get older?

Part 3:

Look Fors

Part 3

- As a leader, you need to know what it is you want to be happening in the math classroom.
- There are so many “lists”, but what are the biggies?

Part 3

Let’s look at Look For List 1.

Part 3

- A debate in Grade 1 might be whether the number 15 is more like 20 or more like 10.

- A debate in Grade 5 might be: Do you think you are more likely to get a 2-digit answer or a 3-digit answer when you divide a 3-digit number by a 1-digit number?

Part 3

- A debate in Grade 9 might be whether lines with higher slopes are always steeper.

Part 3

Or there could be an open question like:

- Are there numbers that are HUGE that don’t take a lot of words to say?
- Are there numbers that are SMALL that do take a lot of words to say?

Part 3

Or there could be an open question like:

- Are there irrational numbers that are very little?
- Are there irrational numbers that are very big?

Part 3

Or, instead of:

- Show me 456 with base ten blocks

You hear:

- How could you show 456 with more than 15 blocks?

Part 3

You would be asking questions of children like:

- Do you like to talk about math or would you rather just do it on paper?

You could be facilitating conversation by providing dry-erase paint for tables or multiple white boards so kids can communicate collaboratively.

Part 3

Notice the parallel on the second page in terms of your work with teachers.

Part 3

Your actions:

1. You cannot delegate this if you are a principal or school leader. You must get in there. (I know many of you are VPs, but I think the P needs to be highly involved.)
2. You must make a math change a singular focus and a very visible focus.

Part 3

Your actions:

1. Provide full group and personalized pd based on student data.
2. Use positive change to garner more buy-in.

Part 3

Let’s look at Look For List 2.

Part 3

- This is HARD for teachers to do on their own.
- That is why we need collaboration with coaches, math leads, colleagues, and the right resources.

Part 3

- Resources teachers use:
- Why I am nervous about Pinterest, Teachers Pay Teachers, etc.
- Why resources need coherence within grade and across grades

Part 3

So, for example, you want to see:

- Problems that lead to generalizations
- A focus on understanding
- Attention to both extending strong students and supporting strugglers
- Attention to the important ideas in math
- Consolidation focusing on important ideas

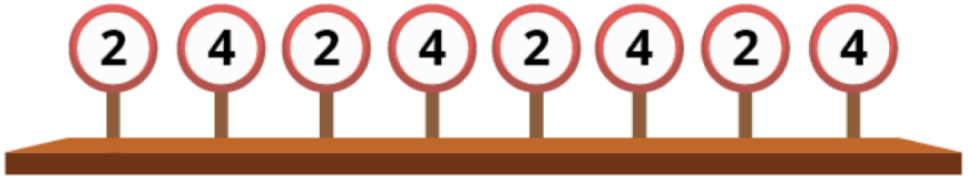
Part 3

Problems that lead to generalizations

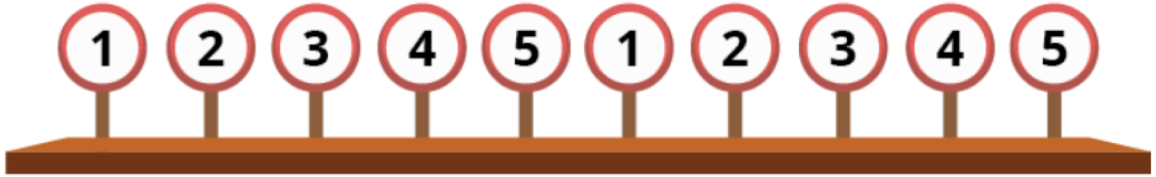
Part 3

For which pattern would you rather predict the 50th term? Why?

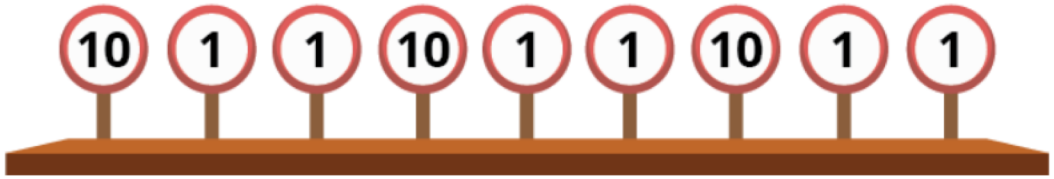
Pattern A



Pattern B



Pattern C



Part 3

A focus on understanding.

Part 3

2/3 of one number (call it A) is less than 1/3 of another number (call it B).

What do you know about A and B?

Part 3

Attention to both extending strong students and supporting strugglers.

Part 3

Suppose the thrust of a lesson in Grade 5 is on recognizing how subtraction of decimals relates to subtraction of whole numbers.

The main task might be:

Part 3

Create two problems.

Problem 1 is solved by subtracting 42 from 105.

Problem 2 is solved by subtracting 0.42 from 1.05.

How are the problems similar and different?

How are the answers similar and different?

Part 3

For struggling students:

You might need to change the numbers to, e.g. 42 and 64 and 4.2 and 6.4.

For strong students:

You might need to ask about 0.42 and 1.5.

Part 3

Attention to the important ideas in math.

Part 3

- Each lesson describes the related essential understanding.

Part 3

ESSENTIAL UNDERSTANDINGS

MEASUREMENT

M–1 Using units when describing a measurement makes it easier to describe and compare it to the measurements of other objects.

M–3 The choice of a measurement unit is affected by many factors, including the precision desired, the user's comfort in making sense of the resulting number of units, and if comparing a measurement with a known measurement, the unit used for the known measurement.

M–4 When two objects are measured using different units, the measurements can still be compared if the relationship between the units is known.

M–5 Estimating is a useful part of the measuring process. Estimating is facilitated by using familiar benchmarks.

M–6 Some measurements of an object are independent of other measurements of that object, but some are related.

Part 3

Consolidation focusing on important ideas.

Part 3

For a lesson focused on mental addition and subtraction.

You present a realistic situation that calls for the use of mental addition and mental subtraction.

Then….

Part 3

After some small group sharing:

1. What two-digit numbers are easy to calculate using mental strategies?
   Explain your choices.

2. a) When did you use a strategy where you broke a number into parts?

   b) Explain why the strategy works and why it is helpful.

3. Did you ever use both addition and subtraction in a calculation?
   If so, describe what you did.

4. Is there always more than one way to add or subtract mentally?
   Explain your thinking.

Part 3

Questions 1 and 3 remind students that there is always a variety of strategies that can be called upon, including mental math.

Question 2 encourages students to reflect on Essential Understanding O–7 (the value of decomposing and recomposing numbers to operate with them).

Question 4 asks students to reflect on Essential Understanding O–10 (there are always many strategies for performing a calculation).

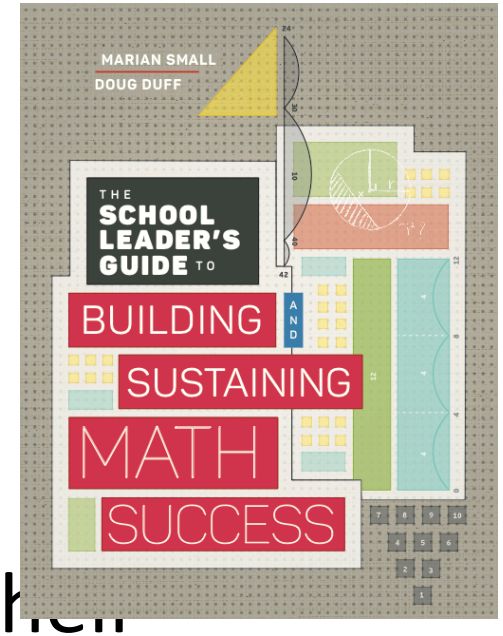
Part 3

- Let’s look, one more time, at Look For List 2.
- Again, there are actions about teachers working with students, but also actions about principals working with teachers.

Part 3

- You also might use “audit tasks” to look for improvement.
- These are tasks quite similar to your common tasks, where you should see growth.

Part 3



- Just so you know-
- Doug Duff and I have written a book for ASCD out in July focused on the role of the principal in changing the math culture and performance in their school.
- Doug is also producing an online program through Rubicon Publishing to support principals.

Part 4:
How Should Lessons Look

Part 4

- The teacher has a learning goal that fits the nuts and bolts of the curriculum but reaches beyond skills toward critical thinking or at least thinking!

Part 4

- For example:
- The goal is not just about multiplying 3-digit numbers by 1-digit numbers, but is about helping kids see how decomposing numbers thoughtfully helps us deal with computations.

Part 4

- The learning goal should derive from bigger ideas or essential understandings.
- The learning goal should help a teacher choose an appropriate task and help them know what to ask in consolidating.

Part 4

- The main problem engages students with interesting problems that pique curiosity, but I do not believe they have to always be real-life.

Part 4

- Or

I might ask kids:

- Is it true that whenever the numerator and denominator of a fraction are closer together, the fraction is bigger?
- And they explore that conjecture.

Part 4

- The consolidation:
  - There needs to be a meaningful consolidation.
  - Its focus is NOT just to share work.
  - Its focus is to evoke the important ideas of the lesson using the children’s work and thinking.

Part 4

- Let’s look at a Grade 2 example.

Part 4

- Getting ready: Show me 27 with base ten blocks different ways.

Part 4

- Main problem:
- Determine 3 numbers to fit each rule.
- Determine 3 numbers that do not fit each rule.

- Rule 1: The number of ten rods is more than the number of unit cubes.
- Rule 2: There are exactly 3 more one cubes than ten rods.

Part 4

- To consolidate work on Rule 1: The number of ten rods is more than the number of unit cubes.
- Who thinks they have one of the smallest numbers in the room?
- Could it be smaller? Why or why not?
- Who thinks they have one of the greatest numbers in the room?
- Could it be greater? Why or why not?

Part 4

- Suppose a number worked. Would the number with switched digits work? Explain.
- Are most of your answers on the left side or right side of the hundreds chart? Explain.

Part 4

- Having seen what I've done, how would you consolidate Rule 2 (There are 3 more ones blocks than ten rods.)

Part 4

- Let’s look at Grade 8 and focus on the division of fractions.
- I might decide that division makes more sense if I think of a ÷ b as how many b’s fit into a.

Part 4

- So I might get started by:

- There are 10 copies of ____ in _____.
- What could the numbers be if at least one is a fraction?

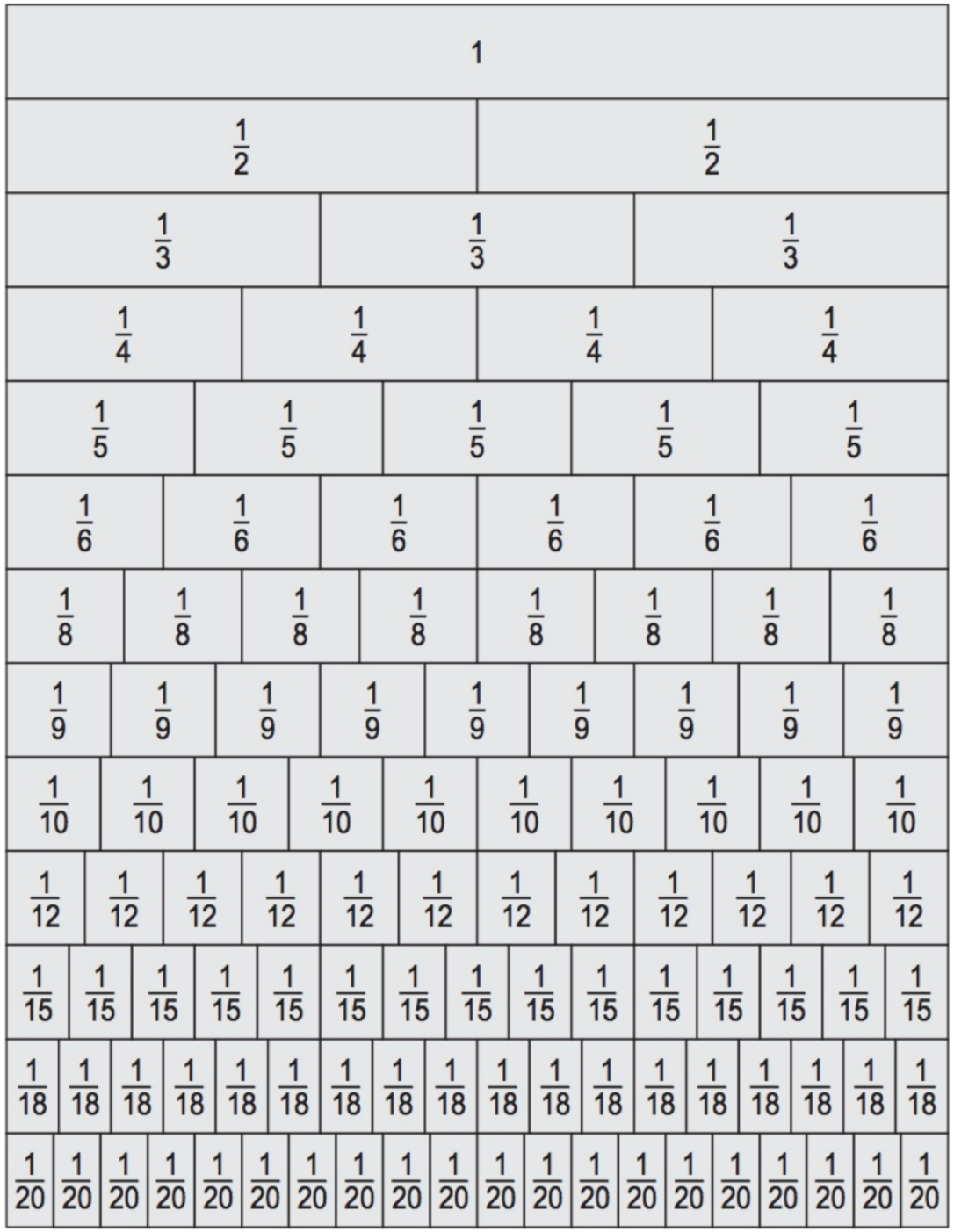
Part 4

- Main problem:
- Use the fraction tower I gave you.
- Name a fraction that fits into another one this many times:
- 2 times
- 3 times
- 1.5 times

2.5 times

1 1/3 times

Part 4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1/3 1/3 1/3
1/4 1/4 1/4 1/4
1/5 1/5 1/5 1/5 1/5
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Part 4

- To consolidate:
- What fraction might fit into 6/10 two times? three times?
- Why does 1/3 fit into ½ more than 1 but less than 2 times? How many times?
- How many times does 2/10 fit into 3/10? 2/8 into 3/8?
- How many times does 3/5 fit into 4/5? Why? 3/10 into 4/10?

Part 4

- How many times will 5/[] fit into 9/[]? Why?
- Does the value of [] matter?

Part 4

- What you are seeing is being intentional and linking to ideas, not just answers.

Part 4

- What role do admin or coaches play?
- You need to help teachers see the difference between learning goals about doing and learning goals about understanding.
- You need to help teachers see the difference between consolidations that just share and consolidations that bring out ideas.

Part 4

- You need to help teachers look at the difference in student work, particularly on understanding questions, when this becomes the normal approach.

Part 4

- You need to help teachers see that without a focus on meanings, models and particularly decomposition with respect to number, what you want to happen probably won’t happen.

Part 5:
Your Questions

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