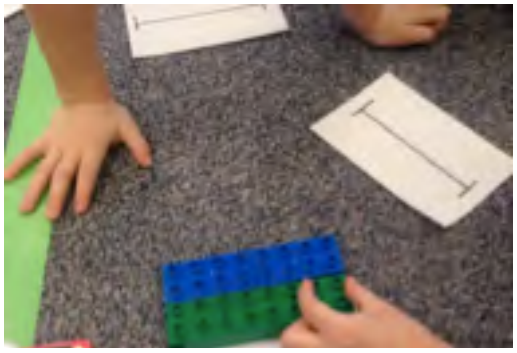
Kawartha Pine Ridge District School Board
"401 Team"

Math for Young Children Lesson Study

March 26, 2014



Focus:
A spatial approach to teaching linear measurement

Research Questions:

- What strategies are students using to see/discover proportional relationships between quantity and length?
- How do use what they know about length to find halving/doubling quantity to find length?

Teaching Team: Lisa Elliott (JK/SK), Bacall Hartt (JK; Grade 1), Virginia Cole-Campbell & Amanda Steven (JK/SK), Heather Cordukes (Grade 1/2, Susan Blue (Grade 2), Heather Taylor (, Andrea Hunt-Schmoll, Debbie Kroesen, Laurie Moher,

Trent University: Cathy Bruce, Tara Flynn, Sarah Bennett, Rich McPherson

Discussant: Claire Mooney, Mathematics Educator, Trent University

AGENDA

10:00-2:00:
– Introductions and background provided by the planning team
– Research Lesson
– Working Lunch
– Debrief: i. teachers who taught lesson, ii. observations from teacher planning group, iii. comments from guests, iv. Discussant

Table of Contents

BACKGROUND

This team has been working on a Lesson Study cycle from October 2013 through to March 2014. In this time, we investigated the curriculum area of measurement, particularly a spatialized measurement approach.
The progression of our inquiry began with questions about area measurement, but the team quickly moved to linear and became interested in proportional reasoning connected to linear measurement.

WHY FOCUS ON MATH?

- Duncan et al. (2007, 2009, 2011) identified early math skills as best predictor of school success in math, language and social studies (very large scale studies)
- Math is a better predictor of language skills than early reading is …of later language skills!
- And a good predictor of overall credit accumulation (Ontario data)

Early Intervention matters:

- The link between socioeconomic status (SES) and school success is well established.
- Low SES differences show up as early as age 3 (Blevin, 1996 & 2008; Lefevre et al., 2009)
- Without early intervention, children of low SES and/or with math difficulties will experience a "cascade of mathematics failure" from which it is extremely difficult to recover (Jordan & Levine, 2009).

WHY FOCUS ON MEASUREMENT?

- Students are typically focused on tasks that develop only on skills for measurement, without linking to conceptual understanding
- Measurement is often taught in a procedural way that is simplified and doesn't build flexibility of strategies, or a use of a range of tools or connections to real life
- We noted that we have typically underestimated children's abilities to develop visual estimation skills
- We noticed that students were not paying attention to the units they were using to measure: for example students measuring length with paper clips would state "It is 3!" When asked "3 What?" Students said "3 miles!" or "3 kilometers" or "3 feet!"
- Students needed structures to help them make comparisons between objects and quantities
- Students were also struggling with the language for measurement, including comparison words and they struggled to connect size of units to number required for a given length
- Rather than just measuring as an exercise "to measure", we explored complex measurement scenarios that engaged students in reasoning and sense making connected to measurement ideas

References:

Dietiker, L. C., Gonulates, F., & Smith III, J. P. (2011). Understanding linear measure. Push your instruction beyond procedures: Enhance student tasks and offer better opportunities to develop conceptual understanding. *Teaching Children Mathematics*, 18(4): 252-259.

McCool, J. K., & Holland, C. (2012). Investigating Measurement Knowledge: Collaborating with a researcher, this teacher uses two fifth graders' assessment results to inform her whole-class instruction and gain insight into all her students' conceptual knowledge. *Teaching Children Mathematics*, 18(9): 542-548.

Tyminski, A. M., Weilbacher, M., Lenburg, N., & Brown, C. (2008). Ladybug lengths: Beginning measurement. *Teaching Children Mathematics,* 15(1): 34-37.

Some of the KEY Measurement IDEAS we encouraged through exploratory lessons were:

1. When measuring length, we need to use the same unit of measure for the whole length.
2. When measuring length, we need to make sure there are no gaps, no overlaps and the units are end-to-end.
3. Normally, we start measuring length at zero or at the start of an object.
4. The larger the unit, the smaller the numerical value is. The smaller the unit, the larger the numerical value is.
5. Estimations, justifications and precision in measuring are important processes in measuring.
6. Using the language of measurement (such as naming the units and using comparative language) to build measurement understanding.
7. When measuring, we can take advantage of proportionate relationships to solve measurement problems.

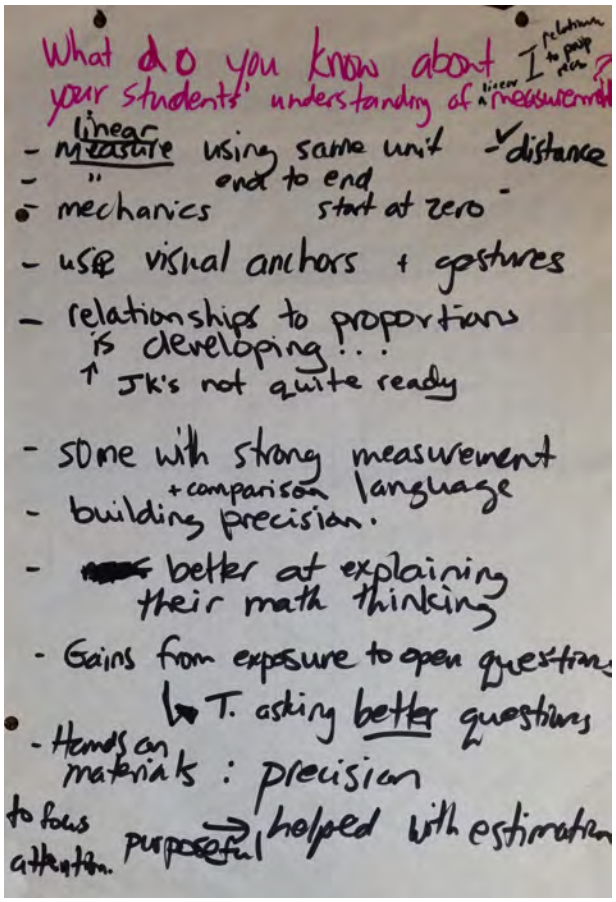
This built toward the following central research question:

What strategies are students using to see/discover proportional relationships between quantity and length?

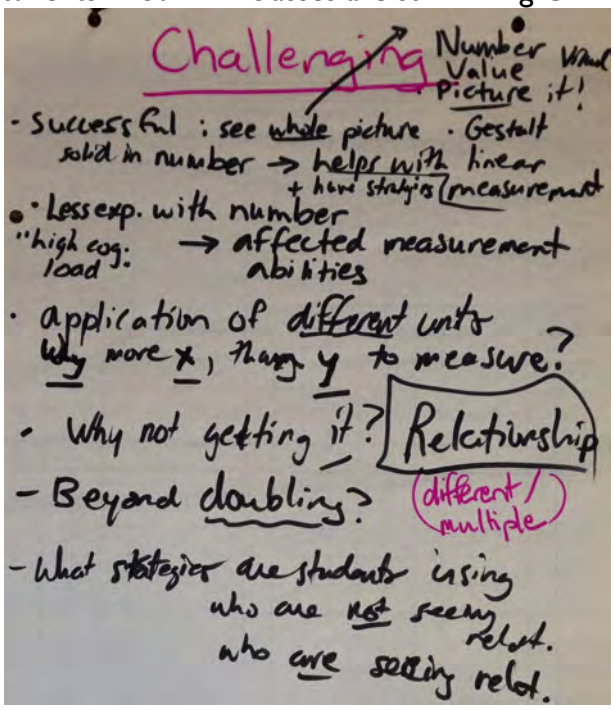
During the explorations, we have considered these questions:

How do they think about halving/doubling quantity?
How do they think about halving/doubling length?
How do students use what they know about halving/doubling length to find a proportionate quantity?
What are students struggling to understand?

After a series of lesson explorations we concluded that the students know the following about measurement:



We also summarized what students in our K-2 classes are still finding CHALLENGING:



Therefore, in the Research Lesson we are focusing on the following:

How do use what they know about length to find halving/ doubling quantity to find length?

We also wanted to build student abilities to visualize and estimate lengths and quantities. We borrowed "the three V's" from the Northumberland Lesson Study (2010) Team, which are:

Visualize, Verbalize & Verify

We intend to focus on these processes during the research lesson.

CLINICAL INTERVIEWS

Selected students participated in one-to-one task based interviews with researchers. The interviews were video-taped and used for discussion with the team.

Tasks were:
Number Knowledge (to assess basic number understanding)
Peabody Vocabulary Test (to control for language)
Measurement tasks: Conservation of Area; Number tasks with missing values and proportional reasoning; Determining length when object starts at different locations on the number line.

These tasks will be repeated with the same students after the public research lesson day, to look for changes in understanding.

EXPLORATORY TASKS

We designed a series of tasks to explore our central research questions

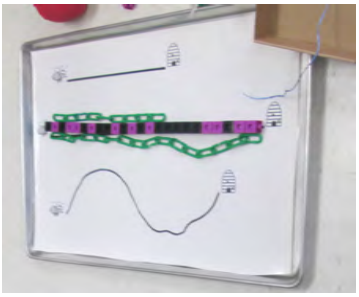
Exploratory Task 1: The Messy Box

Overview:
Create three (3) different pathways from home to school.
Path 1: Short straight line
Path 2: Long straight line*
Path 3: Long squiggly line*

**Paths should be the same length, see if students make this connection when they actually measure*

We need to find out how long these paths are. What could you use from this box to find out? Show me!

Goals:
1. To see what students already know about measurement
2. To get us thinking about measurement



3. To identify strategies (physical/gestures, communication/words, counting, comparisons) students are using/are not using
4. To document anything that surprises us
5. To observe what students do with the task (e.g., do they measure end-to-end?)

Observations:

JK/SK	Grade 1	Grade 2
- Wrapped string around the lid 4 times – "it's 4" - "5 inches", "5 feet" - Heard a lot of comparing language (e.g., longer) - Gesturing, tracing the line - Described paths as "big, short, curvy, straight"	- Used a ruler, but counted by imaginary numbers - Got to 16 on ruler, "it's 16 feet" - Using lego – noticed it was a messy length (9, with left-over; predicted 2 more pieces and were accurate) - Mixed units within one measurement	- Paths to school - Measuring with lego pieces and popsicle sticks - Some straight to a ruler - A lot didn't pay attention to the curve

Exploratory Task 2: Snakes

Overview:

Challenge 1 (Activation): *Direct concrete comparison* – 2 pieces of string snakes
One coiled, one straight
Key Question: Which do you *think* is longer? [estimation]
Students make an estimation and justify their explanation.
Key Question: How can you find out which one *is* longer?
Students investigate
Key Question: What did you find out?

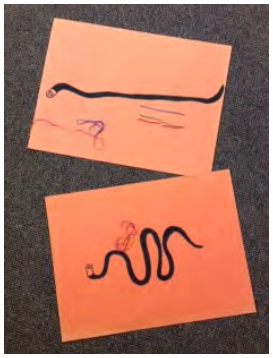
Challenge 2: a) *Indirect comparison; then b) Direct comparison* – Fixed – two lengths, one coiled, one straight on a sheet
"Sometimes we can't uncoil things"
Here's some string.
Key Question: What can you do to compare the length of these snakes with the string?
Students make suggestions.
Key question: Which do you *think* is longer? [estimation]
Students estimate and justify their predictions.
Key Question: Which one *is* longer? What did you find out?

Challenge 3a: *Indirect measure,* using units to measure and compare the same pictures
Estimate, then measure, and prove it!
Say the unit: "We are going to measure using _____" (e.g., *wikki stix*)
Key question: What do you think is the exact length of these snakes using the "blue" *wikki stix*? [estimation]
Students estimate for both snakes and justify their predications.
Now find out for sure/ Prove it!
Key Question: How many *wikki stix* long is the curvy snake? What about the straight snake?

Challenge 3b: Use something bigger (double the length) than the original unit: "Now we are going to measure using _____ … (*wikki stix* for example of another colour).
Key Question: how many _____ long do you think the snake will be?"
What makes you think that? / Explain your prediction.

Focus:

- Create a stimulating task by presenting a series of challenges
- Make predictions: which one is longer?
- Make estimation: indirect measuring
- Predict, estimate and verify lengths using different measurement strategies
- Reinforce the idea that measuring something curvy requires verification (can't just be eye-balled).
- Introduce proportional reasoning (doubling)



After trying the task with small groups of students, we made a couple of key observations:

- ✓ It was important to include the unit in key questions: eg., how many *wikki stix* long is this?
- ✓ It was important to show both units side by side (when introducing the bigger/smaller unit) for comparison and to foster proportional reasoning

Observations:

JK/SK	Grade 1	Grade 2
- Measuring with wool was great - Measured rug with proportional wood blocks (noticed a big piece equals of 2 medium pieces and 4 small pieces)	- Did a fantastic job of measuring "a-butt" (end-to-end) - Created an anchor chart about what makes you a successful measurer - Becoming successful with measuring end-over-end - Selecting appropriate units to measure	- Made own rulers with alternating colour squares - Used "butt-up" for end-to-end - Used appropriate name of unit - Estimating length getting more accurate

Exploratory Task Set 3:

These tasks were developed to match the grade level continuum and focused specifically on how students measure and on proportional reasoning.

3A: Playdough Worm – Longer, shorter, same

Objective:
Measure a created object (a playdough snake) against a fixed measure and compare/sort using relational words; e.g., shorter, same, longer.

Contexts:

1) We are going fishing and we need to make some worms! (*Decision made by the group to use a story context, but create a very simple context for making worms.*)
2) Hot dog and hot dog buns: we have buns that are this long. Will your hotdog fit (be the same), or be longer, or be shorter?

Goals:

1. Learn to make snakes out of play dough: rolling out the play dough, noticing shorter and longer snakes and sharing, e.g., "I made mine long and skinny!" "I made mine short and fat!"
2. Compare against fixed-length object (14 cm in length).
3. Track: Organize/track these using the charts for comparison in 2 ways (can be over several days).
    a. First a straightforward concrete sort using a "mat" that has the different categories (shorter, same, longer).
    b. Then a representational sorting chart ("other people want our play dough so we need to use another material to show how long our snakes are") – use yarn, straws, ink pad (stamp the actual snake itself and transfer to paper), interlocking cubes, wikki stix, strips of construction paper.

Focus:

Key questions:

How do you know your worm is the same, longer or shorter than this length (blue strip)?

What are we observing for?

- ✓ Are students lining up the ends of their worm with the standard in order to accurately compare lengths? What ways other than direct comparison will students use to determine if their worm is longer, shorter, the same?
- ✓ Need to make sure they are laying them straight.
- ✓ Do students make estimates before they make their worms? For example, do they aim to make one longer or shorter or the same and then execute it?
- ✓ Will students aim to make snakes for each category? Or will they consistently make longer worms? If they consistently make only one category then we could say that "we need worms of all different sizes" to encourage variety…
- ✓ Will students say shorter and longer? Or other terms like fatter, bigger, smaller? Encourage accurate relational vocabulary for this task: shorter, longer, same.
- ✓ Will they combine worms to one that is longer? Or will they cut apart a longer snake and put the extra bit in the shorter category?

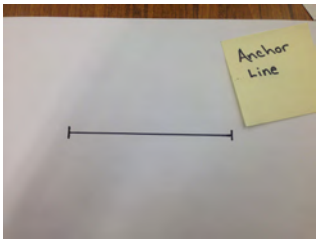
Observations:

JK/SK	Grade 1	Grade 2
- No problem seeing longer and shorter, for the most part - Doing a lot of hand gesturing - Lots of energy into making the snakes - Everyone wanted to make the longest snake possible	- Challenging to make worm - Gravitating to standard units of measure (miles, inches) OR my worm is "7" - Hot dogs instead of worms - Good handle on shorter, longer, same - Using measurement, but applying it to a real situation	- Easy - One student noticed hers was "longer because it was over on both edges" - Mostly left-to-right measurement against anchor

3B: Duplo Tasks/Bridges

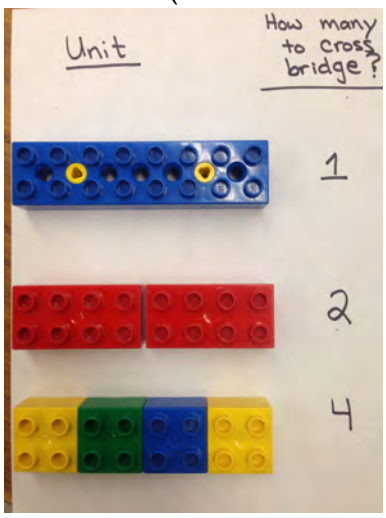
Objective:

- Measure a set length using proportional units (e.g., lego, duplo, blocks, cuisinaire rods)
- Anchor line (fixed length)
  - Different levels of Entry: could be 1, 2, or 3 of the longest piece
- Possible context: we are building a bridge to cross over this river (anchor line)
- Part 1: I am going to order logs in this size (longest unit of measure)
  - How would I decide how many of these *logs* I need to cross the river?
- Part 2: I just called the log company. This size of log (the largest) is not available! Now this is the only size of log they can give us (medium unit of measure block/log)
  - How would I decide how many of these *logs* I need to cross the river
- Part 3: Oh no! The log company called back. This size of log (the medium is not available either! Now this is the only size of log they can give us (smallest unit of measure)
  - How would I decide how many of these *logs* I need to cross the river (smallest unit of measure)?



Look for:

- ✓ What measurement strategies are students using?
  - Are they moving the blocks to measure?
  - Counting the number of pips?
- ✓ What language are students using?
  - We need more of the smaller ones
  - It doubled
  - The smaller one is half of the larger one – I would need twice as many



Focus:

- Size of units & proportions
- Proportional reasoning between different units and measuring a fixed length
- The larger the unit that is being used, the fewer the number of unit objects you need; The smaller the unit that is being used, the more of the number of unit objects you need
- You can measure the same length with different units to describe thinking
- Doubling and halving

Observations:

JK/SK	Grade 1	Grade 2
- Mixed units within a measurement - Comparing block sizes to each other	- Bumps on blocks make them think (doing area and multiplication with dots) - Stronger students really good at predicting (choice of pieces)	- Measuring from left to right - Picked up on number of dots/relationships (8 of these, 4 of these, 2 of these)

	- Consistently used same unit - Counting dots of blocks ("that's a 4, 4 and 4 is 8") - Weaker students' predictions more off the mark	

3C: "The Leftovers" and Messy Lengths

Objectives:

- Recognize "the bit"
- Find strategies to describe the leftover length (strategies may include proportional reasoning, using a ruler)

Challenge 1:
Provide piece of paper with an icicle that is 2 and a half "A" units long
Provide only unit A to measure

Challenge 2:
Provide piece of paper with an icicle that is 3 and a quarter "B" units long
Provide only unit B to measure

Key Questions:
How much do think is leftover?
How can we find out?
What can we call the leftover bit?
How could we find out exactly how long the icicle is?


A = 8x2 dot lego piece


B = 4x2 dot lego piece


C = 2x2 dot lego piece


D = 1x2 dot lego piece

Focus:
Can they measure end-over-end? End-to-end?
Do they ignore the quarter bit?
How precisely are students measuring (start at end)?
Are students confortable with approximate measurements?

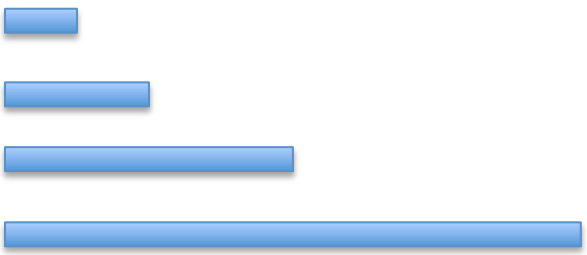
Observations:

JK/SK	Grade 1	Grade 2
N/A	- If measurement was 2 and a half, said "one, two," noticed the half, but answer became "3 and a half" - Knew if used smaller blocks, it would work (10 small, 5 medium, 2.5 large)	- All students measured end-to-end - Some talked about quarters, seeing half - Most had it to the half, but didn't know how to describe to quarter

3D: The Phasmabugs from Planet Phasma

Objectives:

- Proportions can be considered in different ways: number and length can both be proportionate in relation to one another. In this scenario, as the length doubles, so does the number of dots.
- Use length information to make estimates about quantity OR to use quantity information to make length estimates.
- Use doubling and halving strategies to solve proportional reasoning problems.
- Use strips of paper in doubling proportions (e.g. length of 1, 2, 4, 8, 16) – each have own set of 4 strips for Phasmabugs and a bowl of counters for pellets. Do NOT label the strips, they should appear blank. Teacher also needs a (hidden but) complete set of the Phasmabug lengths.



1. Set context:
Phasmabugs are imaginary creatures from the planet Phasma. They are long and sticklike.
They can grow quite large. Sometimes, they do tricks.
But… they need magic pellets to help them do tricks.

"Here are two of the Phasmabugs.
This one is called Midi and this one is called Teeny."
[Show Midi and Teeny]
KQ:
"Look at these two Phasmabugs, what do you notice?"
"How would you describe their lengths?"
IF a student identifies 'half', ask "how can you prove Teeny is one half the length of Midi?"
How many Teeny's would cover Midi?
IF half does not come up, ask "I am thinking that Midi is double the length of Teeny. Do you agree?"

2. The Phasmabugs do flips for pellets.
Teeny needs 2 pellets to do a flip. (energy?)
How many pellets might Midi need to do a flip?

[Let students make conjectures and explain their thinking. Be open to their suggestions during this discussion. Listen for language of doubling and halving, bigger, smaller, etc].

State: In fact, Midi needs double the amount of pellets that Mini has, to do a flip.
Show how many pellets Midi needs (put the pellets on Midi).
[Try not to take up the question, but instead have students answer at their own speed by putting the pellets down on Midi]

3. "Now I'd like to introduce you to Mega." Pass out Mega strips.
"I wonder, how many pellets Mega needs to do a flip?"
[Take up student predictions, and have discussion]
KQ. What is your prediction?
Why do you think it will be #?
Draw attention to: Length of Mega and how that might relate to quantity of pellets.
Encourage generalizations: Every time the length of the Phasmabug doubles, so does the number of pellets. OR I notice a pattern. It goes 2, 4, 8… It goes long longer longest….
How many Midis would cover Mega?
How many Teeny's would it take to cover Mega?

Now show how many pellets you think Mega needs to do a flip.

Pick someone who has 8 to consolidate this proportion: "X, tell us how many pellets you think Mega needs and why you think that."
Explore.
"Y got 8 as well. Y can you tell us about how YOU got 8?"

4. I'd like to introduce you to Baby. She's really little.
Using what you have learned about Phasmabugs, I want you to put down the number of pellets you think Baby will need to do a flip.

Now,
How many pellets do you think Baby needs to do a flip?
How do you know?
[Encourage length language, quantity comparisons, etc]

5. I have heard that explorers on Planet Phasma have found a Giant Phasmabug.
What should his name be?
Settle on a name from students such as SuperMega, Mr. Giant etc.

OKAY, Scientists have discovered that he needs 16 pellets to do a flip. I wonder how long he is….
[Send pairs off to make The Giant Phasmabug]. They need all materials used so far, plus construction paper to make the length of the Giant. [Note, the longest strip is cut, but it is too long. Students will need to cut down the longest strip to make The Giant. It is the strategy they use to make Giant that we need to attend to.]

Anticipation:
Students may use both Mega's end-to-end to make one Giant.
Students may use one Mega and end over end measurement.
Students may have difficulty cutting, and can get help – cutting is not the goal – as long as they 'do the math'.

Focus:
What should we be observing, paying attention to, anticipating?

1. Language: Are students using the language of double, half, more, less, length vocabulary?
2. Strategies:
   a) Are students using end-to-end measurement or end-over-end measurement?
   b) Are students counting? Or Multiplying? to arrive at quantities?
   c) Do students estimate or measure with other lengths to get to the Giant Phasma?
   d) Are students using visual estimations of proportions or numeric estimations?
   e) How are students using proportional reasoning to justify their thinking?

Observations:

JK/SK	Grade 1	Grade 2
- Most successful when given 4 sizes of paper and asked about how they were related – figuring out long and short - Entry points for JKs	- Higher level thinkers got it - Language not coming out naturally, nervous? - Rich lesson - Strong student using multiplicative thinking, gestures, verbalizing thinking, good predictions - Not as strong students – additive reasoning, not using as many gestures, focusing on fairness (didn't matter about the size of the bugs, everybody should get same amount)	- Wanted to measure how many pellets fit across - Using fingers to measure length

Exploratory Task 4: Fixed Length

Overview:
Measure a fixed length with different units (using your chosen scenario). Some of the lengths could be "messy," if you choose.

Contexts:

- Jewelry store: making bracelets, necklaces
- Towers of proportionate length
- Carpet for phasmabugs
- Various-sized vehicles for phasmabugs

Materials: proportionate objects (e.g., straw beads cut to different lengths, duplo, pieces of paper, foam squares)

Focus:
Observe and document estimations, predictions and gestures
Prompt students to *visualize, verbalize and verify* throughout the task

Observations:

JK/SK	Grade 1	Grade 2
- Fire station context - Pick one of the 3 duplo sizes to measure, estimate, why? - JKs not really attending to proportion, just distance; SKs able to recognize proportions, really getting it - Number sense was there, but relationship between the sizes not as strong	- Bracelet context: straws cut at proportional measurements (3 lengths) - Length, not colour, the emphasis (had to describe by length) - Non-standard (looking at straw pieces and holding length between two fingers to measure/compare to other lengths) - After doing full-length bracelet, very accurate at predicting number of long long and short for half length - Double length was harder	N/A

OVERVIEW

What do you know about your students' understanding of measurement?

- Linear measure using the same unit
- Strong with distance
- Measure end-to-end
- Large group of students know the mechanics (start at 0, end-to-end)
- Use visual anchors and gestures
- Developing relationships to proportions… JKs not always ready
- Some with strong measurement and comparison language – building precision
- Getting better at explaining their thinking, more comfortable with using mathematic langauge
- Gains from exposure to open questions (T. asking better questions)
- Hands on and purposeful materials: precision, helped with estimation (proportionate objects), focus on content at hand

Challenging

- Successful students: see <u>whole</u> picture, number, value, Gestalt
- Solid in number – helps with linear measurement and have strategies
- Students with less experience with number – affected measurement abilities ("high cognitive load")
- Application of <u>different</u> units = why more x than y to measure?
- Why not getting <u>it</u>? It = RELATIONSHIP
- Beyond doubling?
- What strategies are student using (who are <u>not</u> seeing relationships/who <u>are</u> seeing relationships)

RESEARCH LESSON: GROW, FLOWER, GROW!

Grade 1
5 pairs

Learning Goal: students explore and apply strategies to see relationships between quantity and length and visualize, verbalize and verify (to explain their meaning)

Research question: what strategies are students using to see/discover proportional relationships?

KEY POINTS OF OBSERVATION:

How do they think about doubling and halving quantity?
How do they think about doubling and halving length?
Will students connect the doubling of quantity to the doubling of length?

Scenario: plant stems and food pellets

Materials:
- strips of green paper
- gems for food pellets
- basket of tools (like the messy box, containing scissors and measuring tools etc: 5 pair of scissors, tape, pencils)

Sequence:
At carpet (intro to lesson, thinking and visualization time):

1. I have 6 food pellets. [show the first strip] And when I fed my seed it grew *this* tall...

   …I have 12 food pellets [show the strip that is double the length] and my seed grew *this* tall…

QUESTION:
Let's think about it individually/quietly for a minute… What do you picture in your head? What do you notice?

Now that we've thought about it, let's talk about it! What were people visualizing in their heads?

Anticipated student responses: bigger vs. smaller, bigger one needs to eat more, the more they ate the bigger they got, I think it's going to take two small flowers to make one big flower…
Encourage students to visualize, then verbalize/verify, reinforce words *doubling, halving: "what I'm hearing is that you think this is double?/ half? Etc…..*)

"I noticed that this one is double the length of that one…"

Invite students up to compare…we want them to see/prove that they are double/half

2. Now if I have 3 food pellets, how tall will my flower grow?

VISUALIZATION (BEFORE ANY MATERIALS GO OUT): Let's be really quiet for a minute and see if we can picture this in our heads…there's my flower with 6, there's my flower with 12, how tall will my flower with 3 pellets be?

Look what I have on the tray…every pair is going to get a six and a 12…if there's any other tool you might need to find out…just ask…

Students break into pairs [each pair has the length of six and the length of 12 at the desk] to work on solution for 3…

1. Whole group discussion: What did you find out? What were you thinking?

Repeat with 24:

2. Now I have 24 pellets left. I wonder how tall the stem will be? What would the stem look like?

DISCUSSION: look what we found out…
DO WE SEE A RELATIONSHIP/IS THERE A RELATIONSHIP BETWEEN ALL FOUR STEMS…

QUESTIONS:
Do they take 6 and fold/cut in half to make 3?

OBSERVATION GUIDES

KEY POINTS OF OBSERVATION:

How do they think about doubling and halving quantity?
How do they think about doubling and halving length?
Will students connect the doubling of quantity to the doubling of length?

Observation Guide 1

Language (Math Language – Verbal and Non-Verbal)

Look For

- Use of Number Language – Counting, Doubling Skip, Counting
- Comparisons of Same/ Different/ More / Less /Longer / Taller /Shorter
- Hand Gestures

Observation Guide 2

Visualizing (Were they visualizing? How do we know they are visualizing?)

Look for

- How do they explain their visualizing?
- Do they gesture? (When? Who?)
- Do students connect quantity of pellets and length as a proportionate relationship?

Observation Guide 3

Measurement strategies that the students may use

- What strategies are students using? (Using a standard unit or benchmark to compare lengths; Comparing sizes, lengths, quantities in the flower stems and pellets scenario
- How do they verify their strategies?

KEY POINTS OF OBSERVATION:

How do they think about doubling and halving quantity?
How do they think about doubling and halving length?
Will students connect the doubling of quantity to the doubling of length?

Observation Guide 1

Language (Math Language – Verbal and Non-Verbal)

Look For

- Use of Number Language – Counting, Doubling Skip, Counting
- Comparisons of Same/ Different/ More / Less /Longer / Taller /Shorter
- Hand Gestures

KEY POINTS OF OBSERVATION:

How do they think about doubling and halving quantity?
How do they think about doubling and halving length?
Will students connect the doubling of quantity to the doubling of length?

Observation Guide 2

Visualizing (Were they visualizing? How do we know they are visualizing?)

Look for

- How do they explain their visualizing?
- Do they gesture? (When? Who?)
- Do students connect quantity of pellets and length as a proportionate relationship?

KEY POINTS OF OBSERVATION:

How do they think about doubling and halving quantity?
How do they think about doubling and halving length?
Will students connect the doubling of quantity to the doubling of length?

Observation Guide 3

Measurement strategies that the students may use

- What strategies are students using? (Using a standard unit or benchmark to compare lengths; Comparing sizes, lengths, quantities in the flower stems and pellets scenario
- How do they verify their strategies?