Revealing the Patterns
The Practice of Analyzing and Interpreting Data

Eve Manz

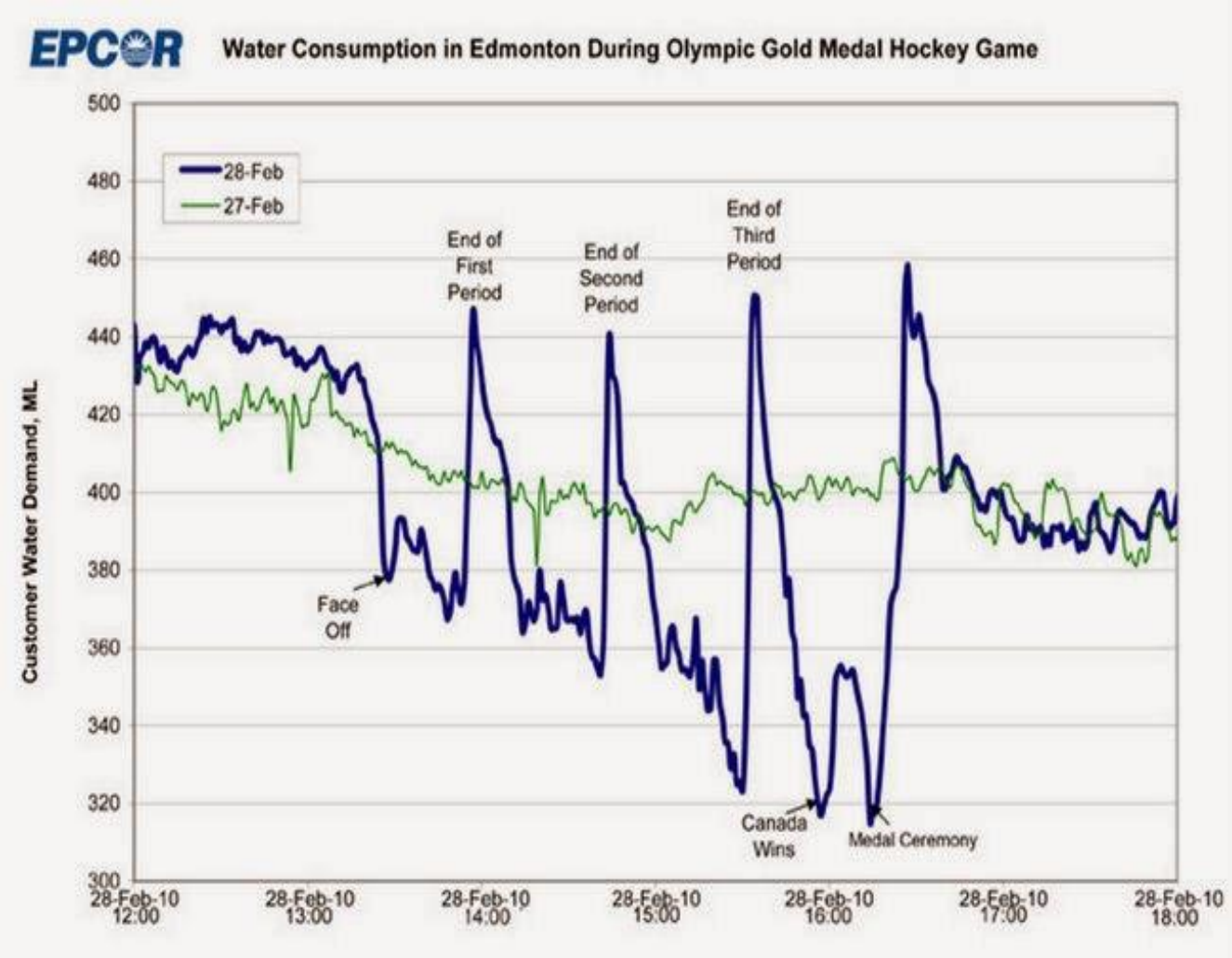
Boston University

February 25, 2016

BOSTON UNIVERSITY

Analyze and Interpret this Data

What's the story here?



2016 MA Science and Technology/Engineering Standards

PreK-2: **analyze data to identify relationships** among seasonal patterns of change; **use observations to describe patterns and/or relationships** in the natural world and to answer scientific questions

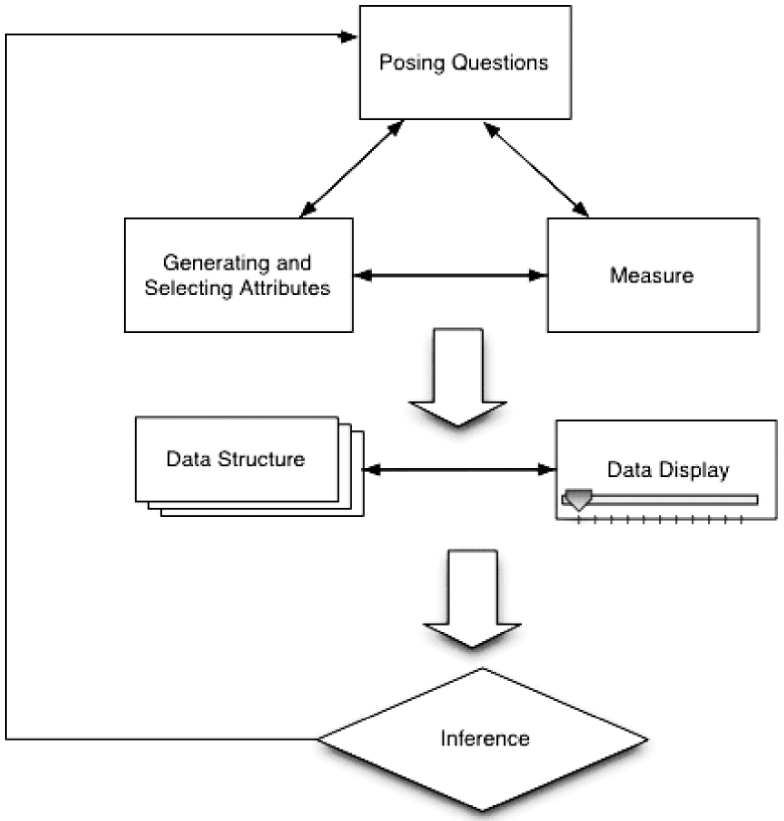
3-5: **use graphs and tables** of weather data to describe and predict typical weather during a season; **analyze and interpret maps** of Earth's physical features; **use data to evaluate and refine** design solutions; **graph and describe** the amounts and percentages of fresh and salt water in various reservoirs

6-8: **examine and interpret data** to describe the role human activities have played in the rise of global temperatures over time; **construct, analyze, and/or interpret graphical displays** of data and/or large data sets to identify linear and nonlinear relationships; **distinguish between causal and correlational relationships** in data; consider limitations of data analysis

Agenda

- What are some consequential understandings about data that we can develop with children?
- What are some teaching strategies for helping them develop these understandings?
- How can informal educators problematize data and support these understandings in your work with students?

How do we define the practice?

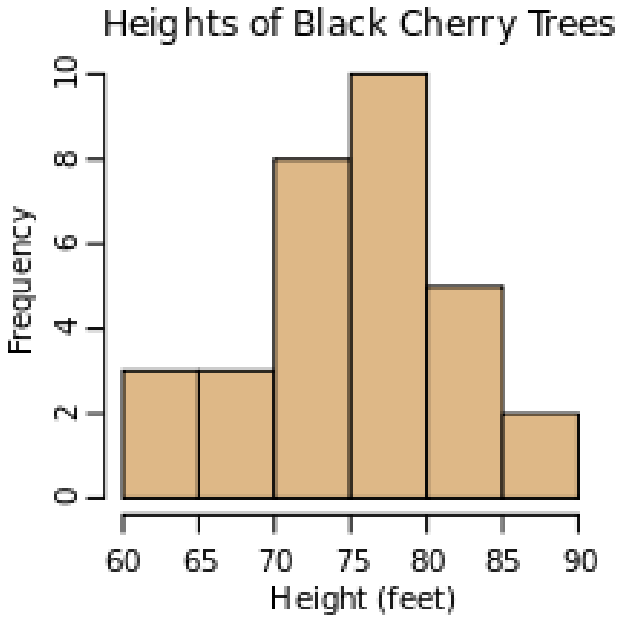


Lehrer, R., & Schauble, L. (2004). Modeling natural variation through distribution. *American Educational Research Journal, 41*(3), 635-679.

How do we teach students?

- It's important that students understand the *why* behind a practice
- Teaching procedures does not guarantee this understanding
- Instead, we have to problematize and unpack the practice with students

Example: Central Tendency



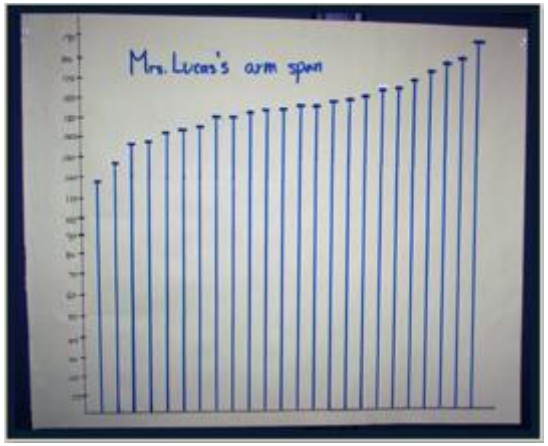
The mean height of a black cherry tree is 73 feet.

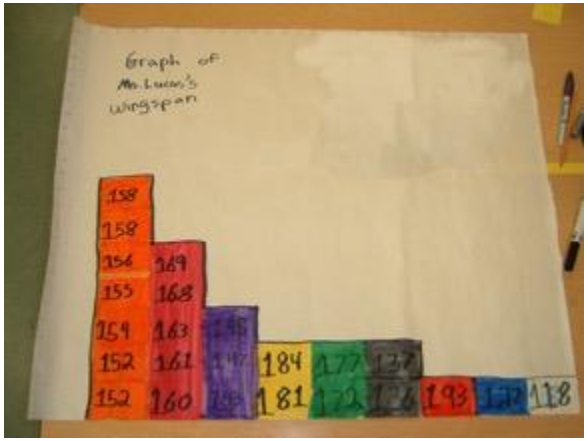
Wingspan Task

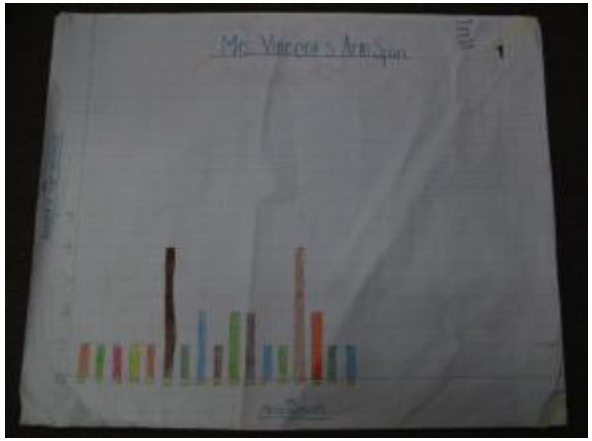
Students:

1. measure the wingspan of their teacher
2. view the unorganized measurements and discuss what they notice
3. work in groups to create a display that shows all the measurements “at a glance” and allows someone to see a pattern in the measurements

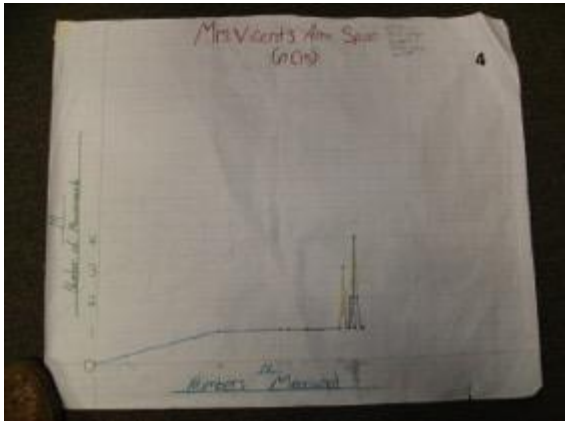
Wingspan Task

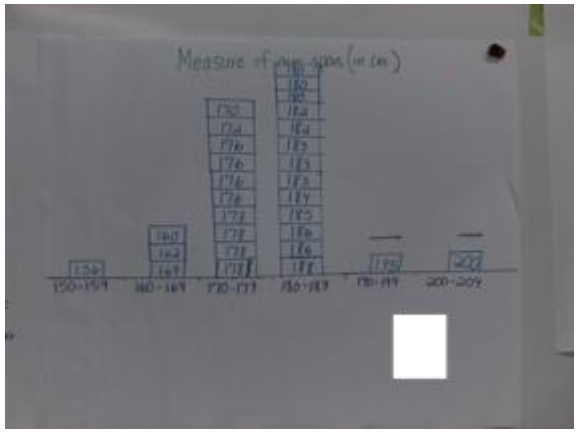




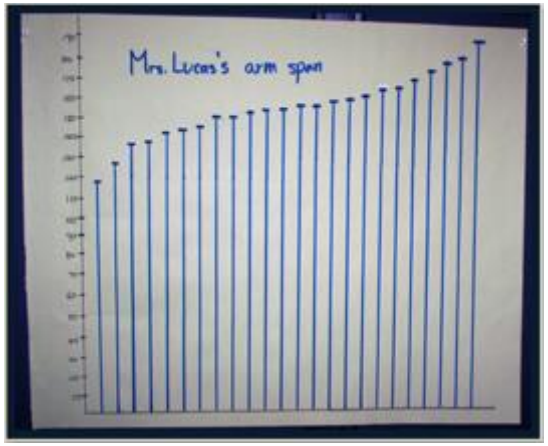


What does each display show? What does it hide?
What do the students understand about data display?

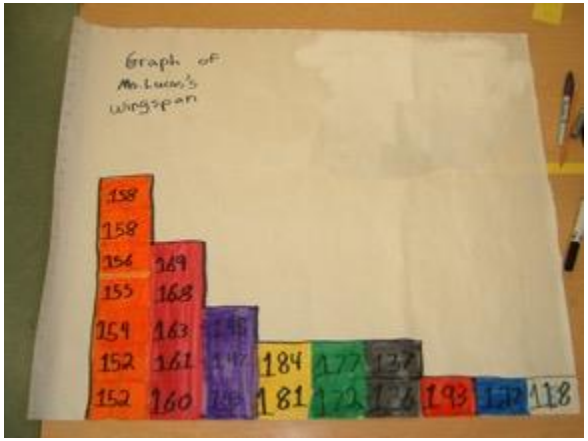




Wingspan Task

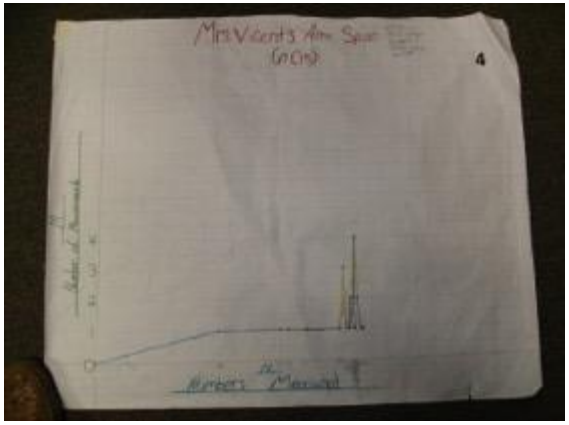


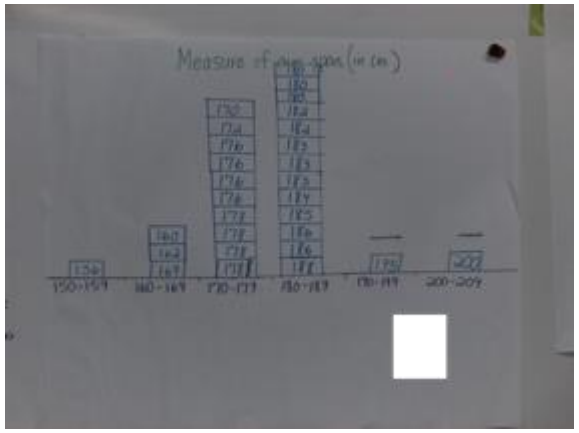
Order & Magnitude



Clumps – where most values are

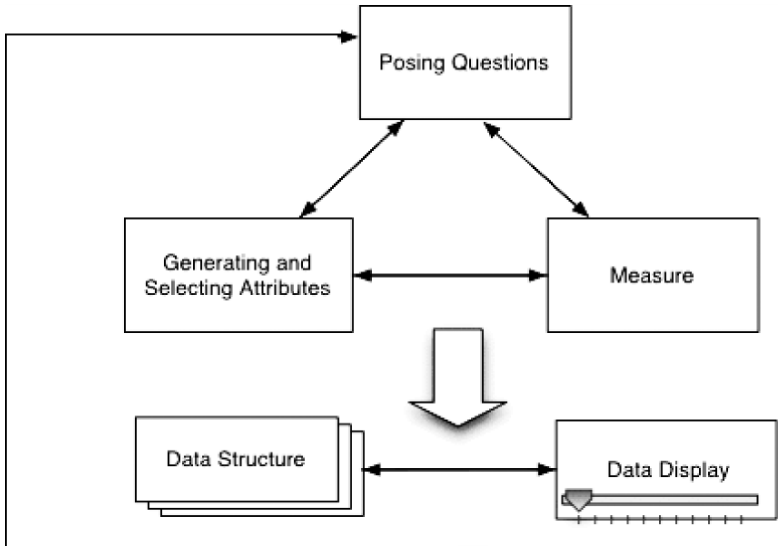
Shape– use order of data





Use order and scale of axis to show shape of data – can see clumps and gaps or outliers

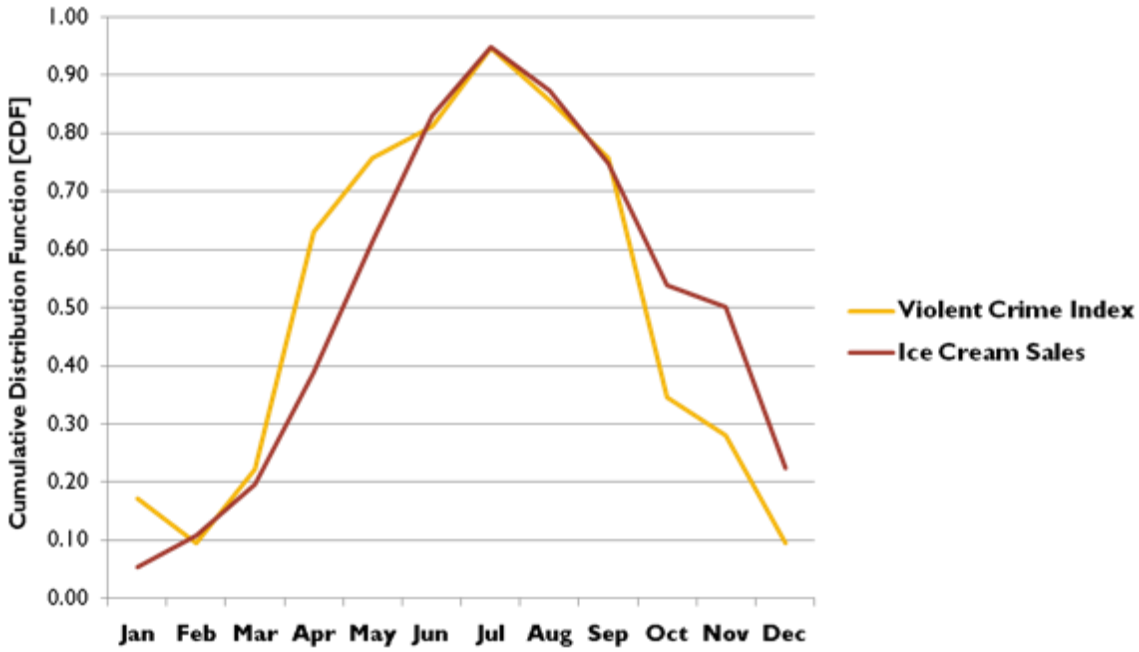
Proficiency with Data



- Choosing attributes to answer a question
- Understanding qualities of measures: replicability of process, reliability, precision, unit
- Choosing what aspects of data to show and relate
- Making use of order, magnitude, scale, color, and other display tools
- Considering attributes of a set of data: spread, holes, outliers, clumps, shape
- Using statistics as measures to support inferences about a set of data (median, mean, range)

Proficiency with Data

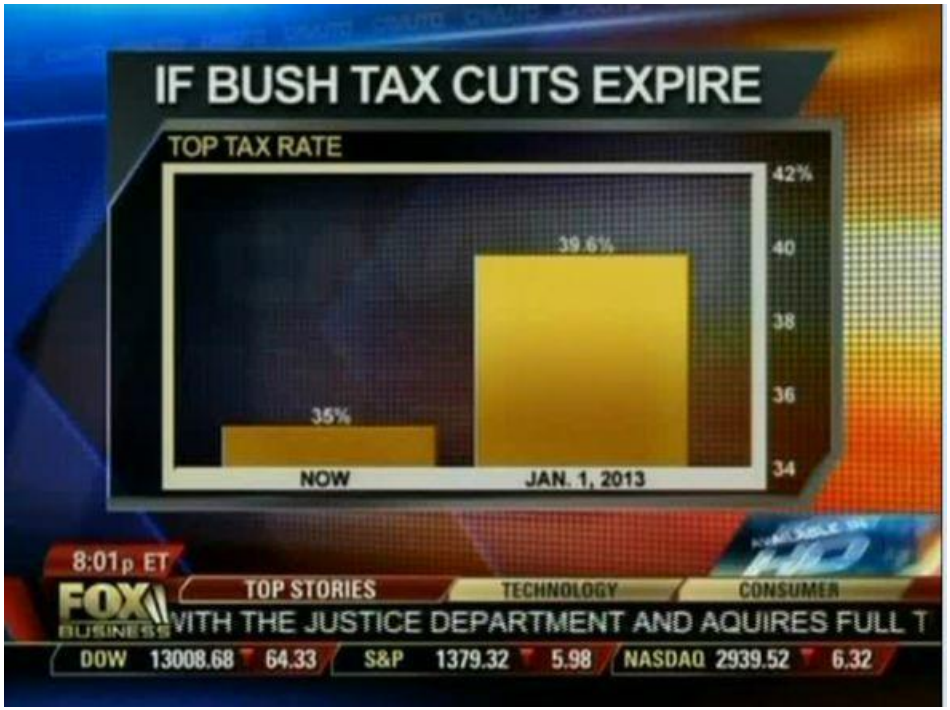
People are more violent when they eat ice cream.



What's shown/data structure: what about temperature?

Proficiency with Data

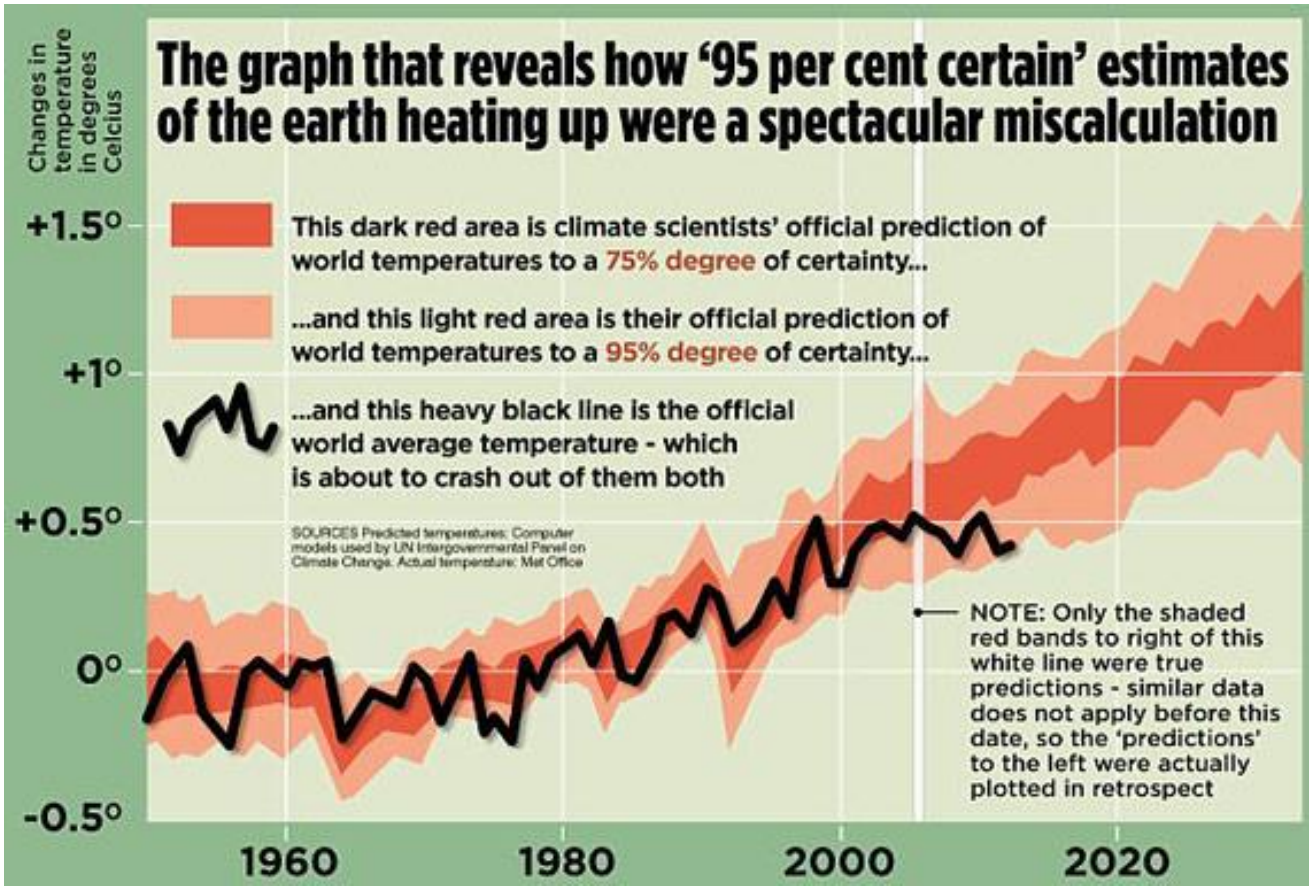
The percentage of your salary you pay in taxes will increase dramatically if the tax cuts are allowed to expire.



Misuse of scale!

Proficiency with Data

Scientists are wrong about global warming occurring.



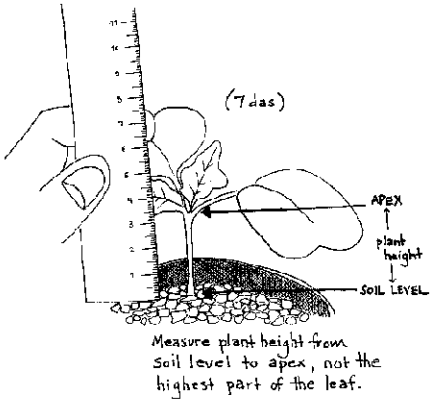
Scale, values hidden (scale of time, outcome of focus), confidence interval vs. rise in temperature

Four Teaching Strategies for Unpacking Data

1. Student invention
2. Contrasts
3. Outrageous examples
4. Explicit discussion

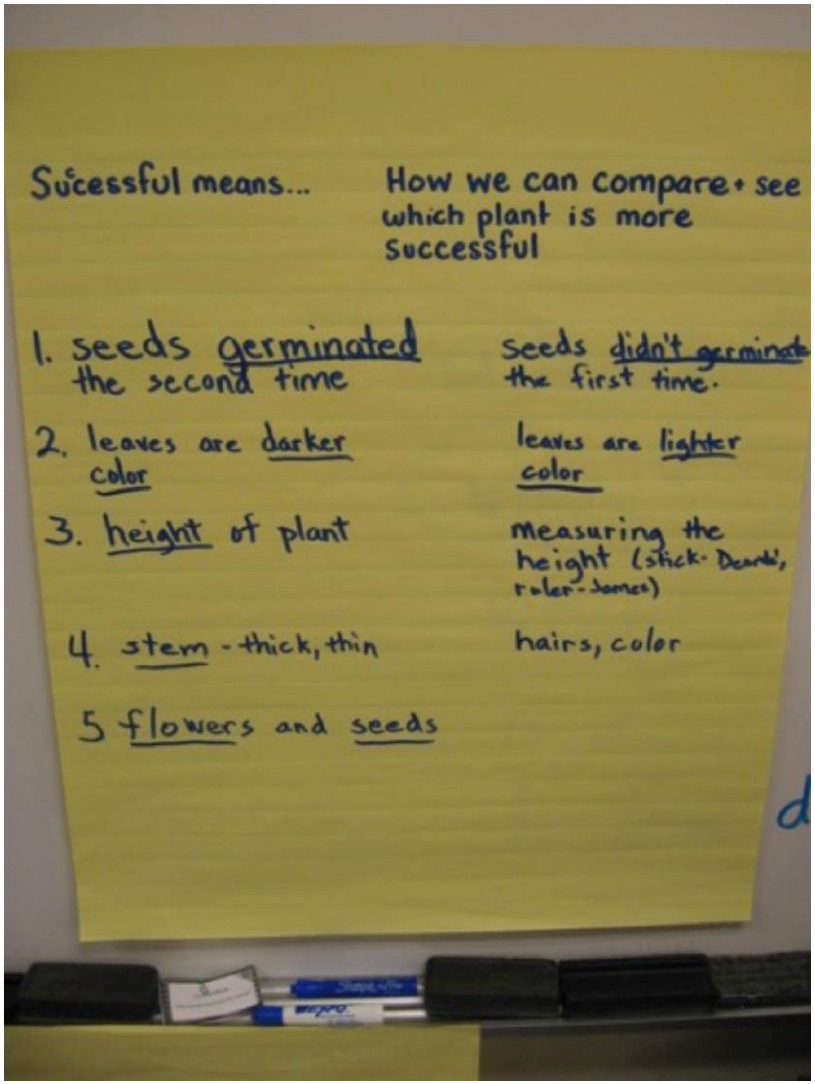
Wisconsin Fast Plants Work
3rd Grade

- count and record the number of leaves and flower buds on each of the plants
- measure and record the height of the plant.
- notice the change in the distance between the leaves (internodes).



das	Character	Plant Measurements							
	Students:	**Student 1**		**Student 2**		**Student 3**		**Student 4**	
3	**# seedling emerged & germ %**								
	Plant Number:	**1**	**2**	**3**	**4**	**3**	**4**	**4**	**5**
7	plant height cm								
11	plant height cm								
11	number of leaves on stem								
14	plant height (cm)								
14	# of hairs on leaf margin								
17	plant height (cm)								
17	number of open flowers								
	days to first open flower (das)								

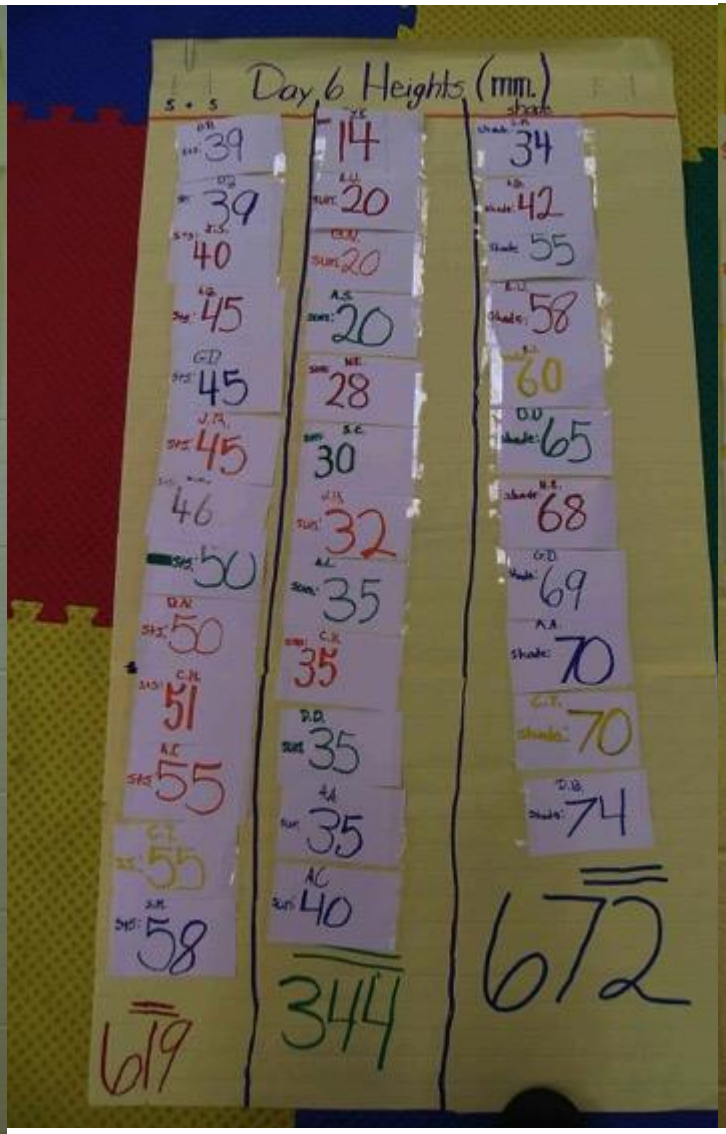
Unpack What To Look at



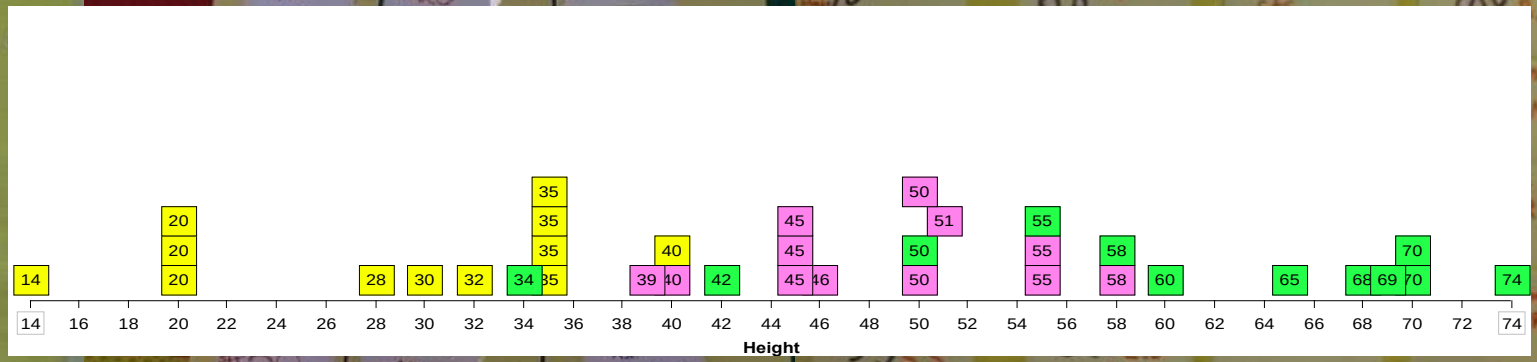
Unpack How to Measure It

(Video Removed)

Unpack How to Display Data



Unpack How to Display Data



Introducing a contrast

Invention Teaching Structure

- Set task that will involve some variability in what students choose to represent.
- Present task and help students understand basic structure of it (why they need to organize the data, idea of helping someone else see what they see since we're not all looking at the same thing).
- Move around during student work to look for particular features. Select a few students to present that showcase different strategies.
- Have other students restate, talk about what each shows and hides. Add another option if necessary.

Questions for Unpacking Displays & Inferences

- Which display helps you see at a glance (answer to research question). What are you looking at that tells you that?
- What does X show? What does X hide?
- This X doesn't show that Y. Is that OK? (Yes, because that's not what we're asking about)
- What did Student X do that helped you see right away (answer to research question)?
- This part here (on one display) shows where most of the values are. How do I see that on this display?

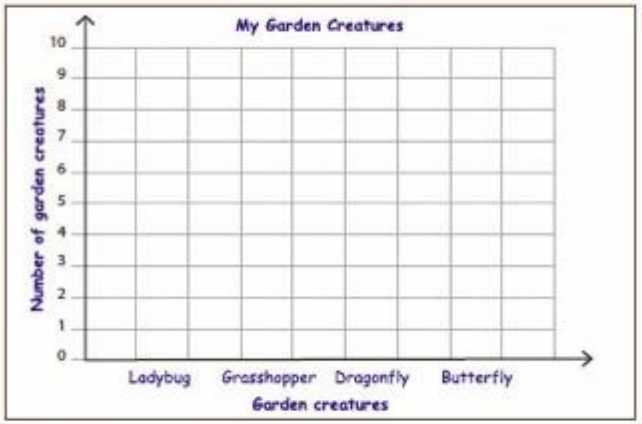
1st Grade Bar Charts

Name : _____ Score : _____

Bar Graph - Garden Creatures

Lily collected a data of garden creatures that she saw while walking through her garden. Help Lilly to draw a bar graph to represent the data.

Ladybug	Grasshopper	Dragonfly	Butterfly
7	3	5	9



1) How many grasshoppers did she see? _____

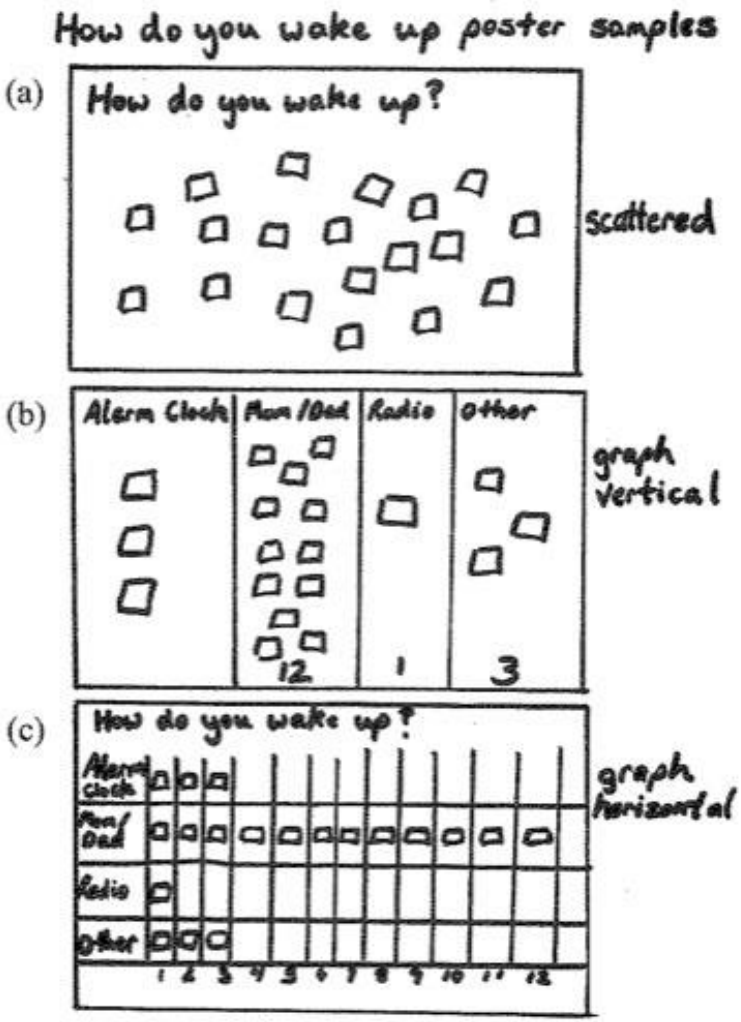
2) Did she see more ladybugs or dragonflies? _____

3) Which creature did she the most? _____

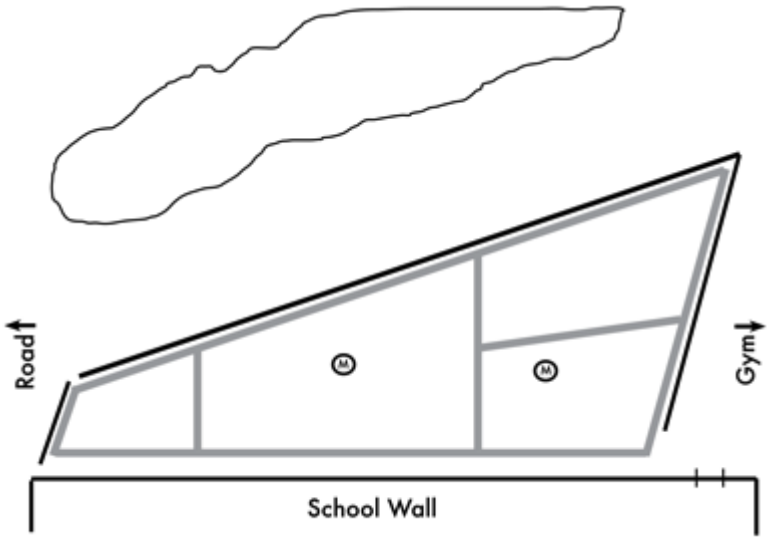
4) Name all the four garden creatures.

_____

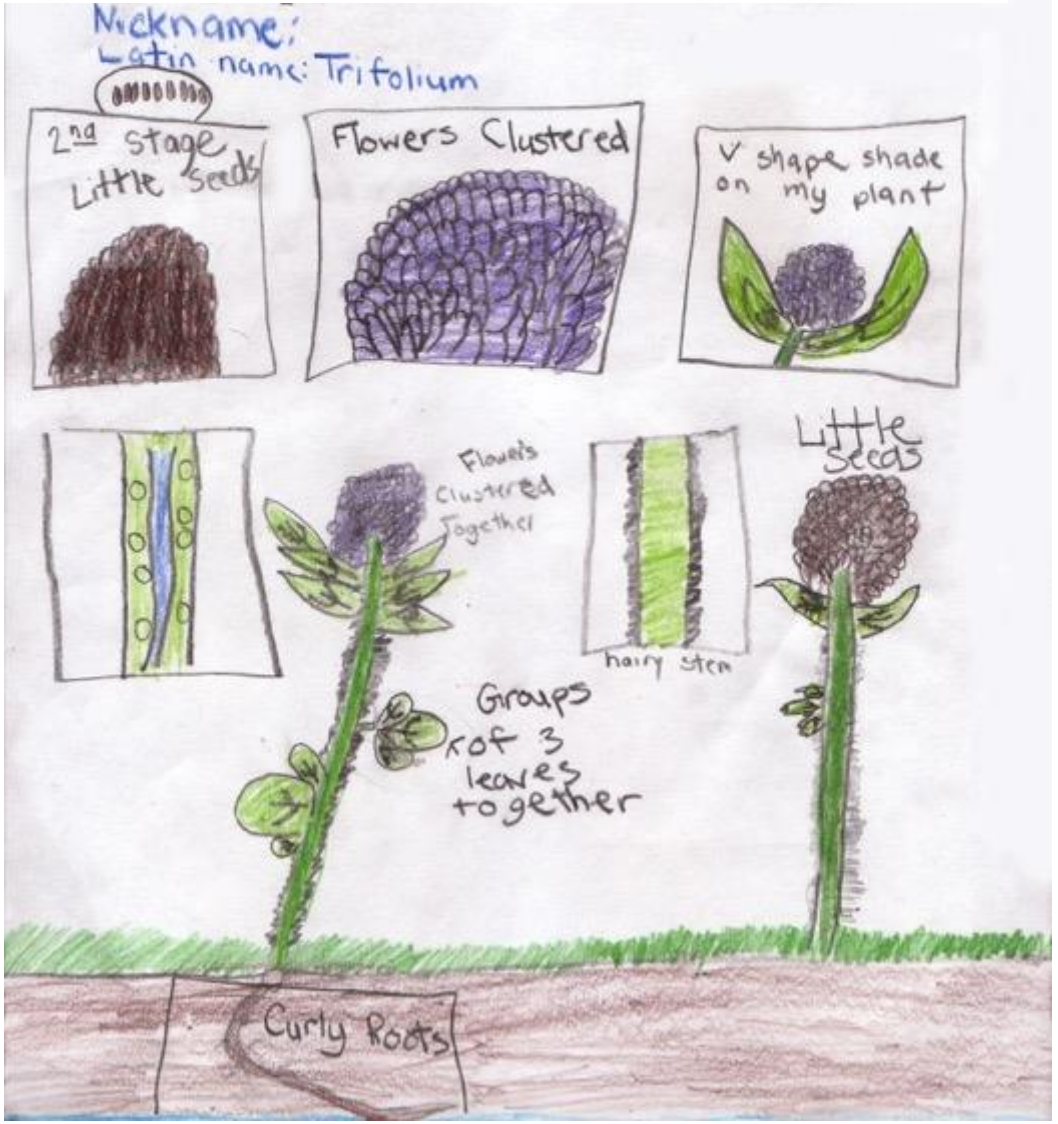
Printable Math Worksheets @ www.mathworksheets4kids.com



3rd Grade Maps



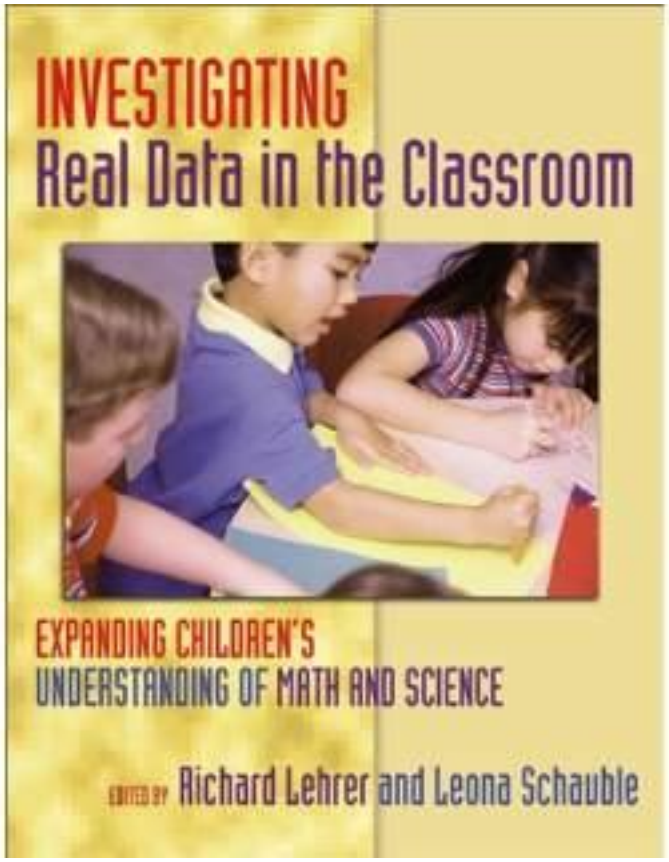
3rd Grade Drawings



Working with your Colleagues

1. What is one program that you facilitate that uses data?
2. How could you open up students deciding what data to collect, defining the data, displaying data, or interpreting data?
3. What teaching tools might you use?

Resource



eimanz@bu.edu