Using Mathematical and Computational Thinking

BOSTON Public Schools
Focus on Children

Agenda

1. Defining Using Mathematical and Computational Thinking
2. Walking Stick Example
3. Graphing Data Activity
4. Video & Discussion
5. Questions to Ponder

Defining Using Mathematical and Computational Thinking

From the 2016 Massachusetts Science and Technology/ Engineering Curriculum Framework:

- In both science and engineering, mathematics and computation are fundamental tools for representing physical variables and their relationships. They are used for a range of tasks such as constructing simulations; solving equations exactly or approximately; and recognizing, expressing, and applying quantitative relationships.

- Mathematical and computational approaches enable scientists and engineers to predict the behavior of systems and test the validity of such predictions.

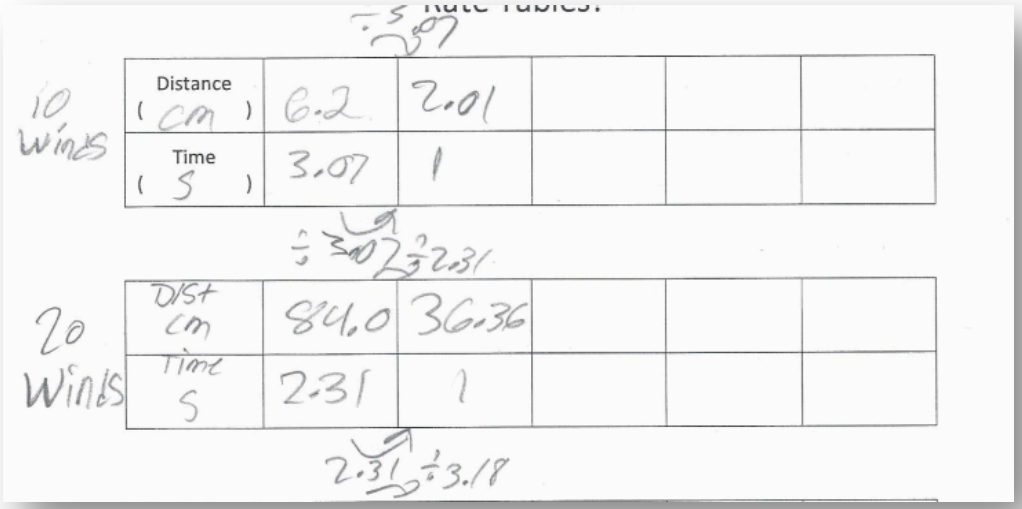
How Students Engage in this Science Practice

These are some ways that students might engage in Using Mathematical and Computational Thinking:

- Measuring (using traditional, and non-traditional unit)
- Graphing
- Creating a mathematical model
- Using and creating a scale
- Using equations to make predictions
- Comparing quantities
- Solving equations (e.g. physics equations)

Students observing and graphing the number and types of birds they see

How Students Engage in this Science Practice



10 winds	Distance (cm)	6.2	2.01			
	Time (s)	3.07	1			
20 winds	Dist cm	84.0	36.36			
	Time s	2.31	1			

Students using a rate table to calculate speed with data from a lab

Think-pair-share:

- What other examples can you think of?
- What are some ways that your students engage in this science practice in your classroom?

Walking Stick Example

The context of this activity:

- Comes from the *FOSS, Populations and Ecosystems kit*
- During the activity, students explore how walking sticks' ability to camouflage affects the population over time. Initially, walking sticks of three different colors are present in equal-size populations.
- Students go through five generations, during each of which they find and "eat" walking sticks. After each feeding the walking sticks reproduce proportionally until the population reaches 48 walking sticks again.

Walking Stick Example

- Watch the video below, which is of BPS middle school students engaged in the walking stick activity previously described
- After watching the video, discuss the following questions:
  - What did you notice in this video about how students used mathematical and computational thinking?
  - What challenges might your students encounter as they engage in this science practice?
  - How might you support your students as they use mathematical and computational thinking?

Graphing Data Activity

The task:

- Graph the changing populations of <u>all three colors</u> of walking sticks
- Graph the data in the way that makes most sense to you
- Make sure to only graph the initial population for rounds 1-5, ignoring the first “16” in each of those columns

Results

30 seconds to eat insects

generation	brown initial	brown eaten	brown survived	green-brown initial	green-brown eaten	green-brown survived	green initial	green eaten	green survived
starting population	16			16			16		
1	16	15	1	16	5	11	16	8	8
2	3	2	1	26	16	10	19	9	10
3	2	1	1	23	7	16	23	15	8
4	3	3	0	30	13	17	15	6	9
5	0	0	0	31	12	19	17	12	5

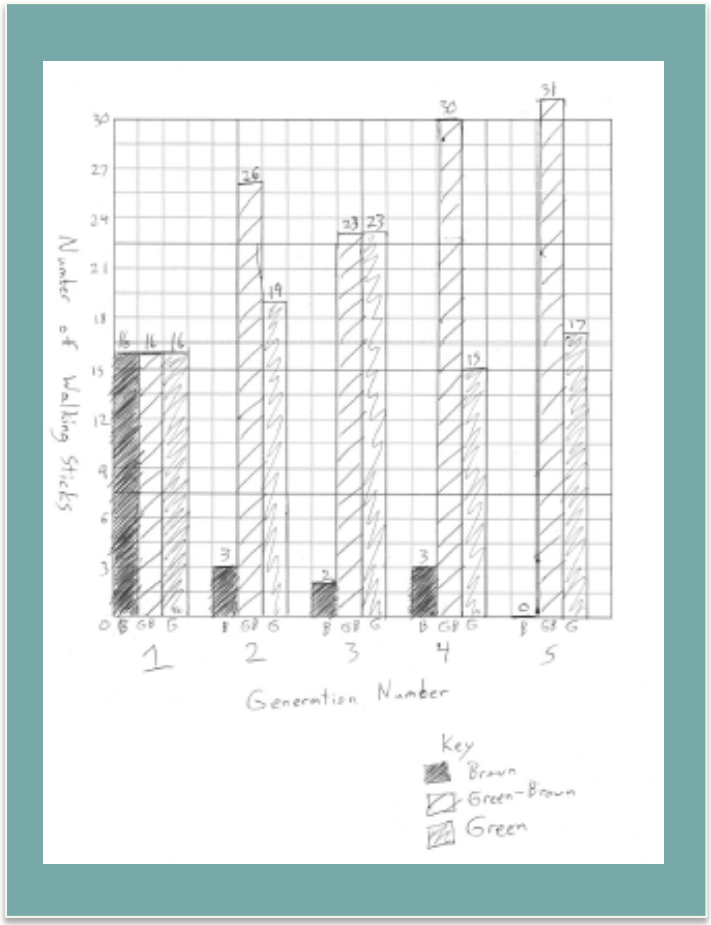
Which round of the game?

Initial number each round

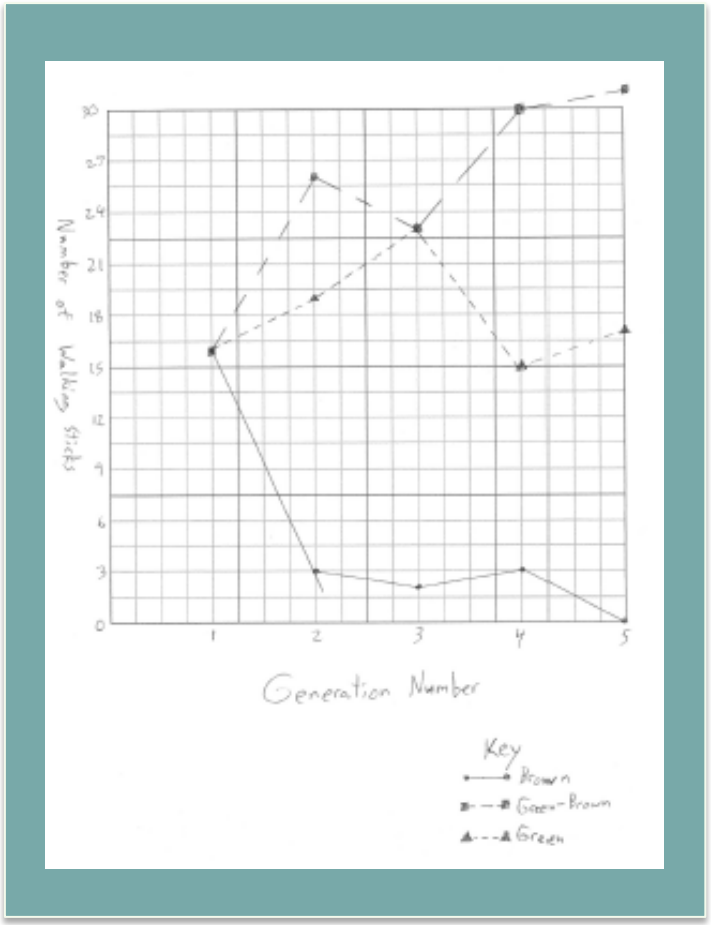
How many were “eaten” each round

How many survived each round

Sample Graphs of Walking Stick Data



Bar graph



Line graph

Graphing Data Activity

Discussion questions:

- What type of graph did you choose to make? Did everyone make the same type of graph?
- What does a line graph show well?
- What does a bar graph show well?
- What other choices did you make about how to graph this data? What impact did those choices have?

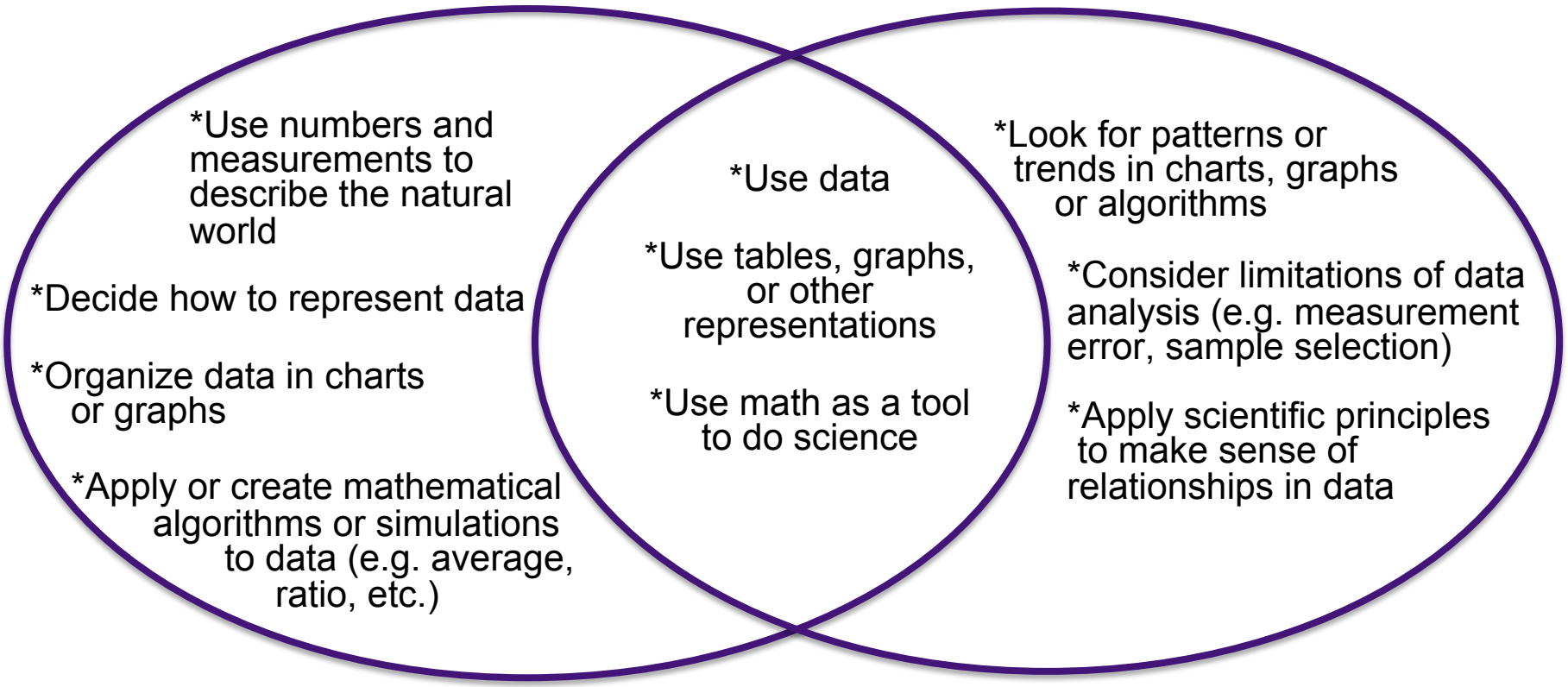
Video & Discussion

- Watch the video below called “Kids Should Measure a Lot.” The context of this video is that students were engaged in an activity around the question – *Why do some parachutes fall more slowly than others?*

- Discussion Questions:
  - How and what are students measuring in the video?
  - Why is it important for students to measure during science class?
  - How might you focus more on measurements in your classroom?

Questions to Ponder

- What are some ways that your students are already engaging in this science practice?
- After today, do you have any new ideas about how you might create opportunities for your students to engage in mathematical and computational thinking?
- How is engaging in “mathematical and computational thinking” similar/different from “analyzing and interpreting data”?



This is one interpretation of how these science practices overlap. What do you think of it? Do you agree? Do you disagree? Why?