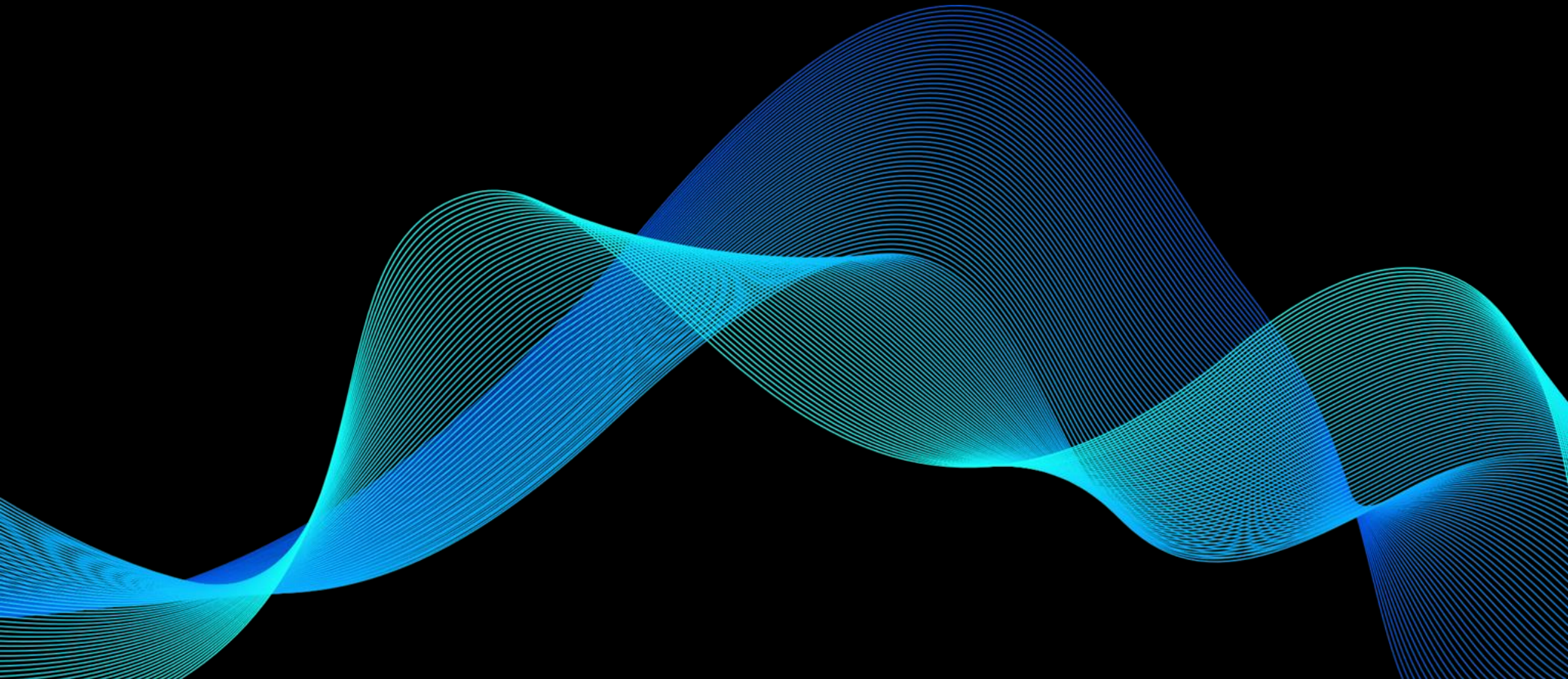
Brookline K-8 Science Program



Department Mission

The K-8 Science, Technology, and Engineering (STE) program develops and supports creative, coherent, and culturally responsive K-8 science curriculum which prepares students to be scientifically literate global citizens and provides them the foundation they need to be successful in ongoing science education and STEM careers. This program works to ensure that:

- All students have a deep, enduring understanding of how to think and work as scientists/engineers, as well as a foundation of key scientific/engineering concepts that have real world connections for them throughout their lives.

- All students are curious life-long learners, stewards of the environment, and responsible global citizens who are equipped with the skills they need to innovate and thrive in the 21st century.

WHAT WE TEACH:
NGSS and MA Science Standards

- In 2012, decades of research and collaboration on science education produced the a Framework for K-12 Science Education.

- A collaboration of 26 states released the Next Generation Science Standards (NGSS) in 2013 to meet the vision of the Frameworks.

- MA Science, Technology, and Engineering (STE) Standards were updated in 2016, and are closely aligned with NGSS.

Old Vs. New

Previous Standards	New Standards
• Focused primarily on knowing specific content. • Scientific method was taught as a separate linear process. • Very unclear developmental progression for concepts over the course of K-12 schooling.	• Focus on a combination of science practice, disciplinary core ideas and cross cutting concepts. • Evision science and engineering as iterative processes involving 8 different practices. • Shows clear developmental progression for concepts over the course of K-12 schooling.

Anchoring Phenomena

- Students are introduced to a puzzling scientific occurrence, called a “phenomenon.”

- Students generate initial models to explain what they think is happening and why.
- Students also generate questions about the phenomena that are used to drive the science learning.
- As students answer their questions and learn more about the topic, they revise and refine their models of the phenomena until they have a more complete scientific explanation.

Brookline Alignment

Strengths	Areas for Growth
• Strong culture of using scientific notebooks in instruction. • Students engage in scientific discourse regularly as part of science classes. • Teachers embrace hands-on exploration of science concepts.	• K-8 science curriculum was last updated between 2010-2015 and mostly does not align to the new standards. • K-5 teachers do not have professional training in new standards or using phenomena. • K-5 students have few opportunities to design investigations and analyze data.

Brookline Alignment

Standards Key:
red = standards missing now
orange = standards partially addressed now
yellow = standards addressed in different grade now

Grade	Current Units	Last Revised	Alignment Notes	Future Vision w/standards
2	Where does soil come from? Part 1: Life in a Rotting Log and Worm Composting	Dec. 2013	Little alignment, missing big ideas of comparing environments and diversity of life	Plant and Animal Diversity 2LS2-3(MA), 2LS4-1 (3rd grade currently)
	Where does soil come from? Part 2: Changes in Earth	Dec. 2013	Aligned, but currently rarely reached or taught (Prioritized in 20-21 school year)	Changing Landforms 2ESS2-1, 2ESS2-2, 2ESS2-3, 2ESS2-4(MA)
	How and Why do things move?	Dec. 2013	No alignment to grade 2, some alignment to K and 3rd grade standards. Missing materials and their uses, and chemistry standards	Properties of Materials 2PS1-1, 2PS1-2, 2PS1-3, 2PS1-4, 2PS3-1(MA), 2K-2ETS1-3
3	Human Made Structures	Jan. 2015	Some alignment, mostly aligned with grade 2 standards	Forces and Motion 3PS2-1, 3PS2-3, 3PS2-4, 3.3-5ETS1-1 3.3-5ETS1-2, 3.3-5ETS1-4(MA)
	Living Structures: The Skeletal System	Jan. 2014	No grade 3 alignment, some alignment to grade 4	Weather and Climate 3ESS2-1, 3ESS2-2, 3ESS3-1
	Mammal Detectives	Oct. 2010	Some grade 3 alignment, good alignment with grade 4	Life Cycles and Traits 3LS1-1, 3LS3-1, 3LS3-2, 3LS4-2, 3LS4-3, 3LS4-5(MA)

Time For Science

DESE Assumes the Following Time of Science by Grade Level:

Grade Span	Assumed Minutes per Day (Hours per week)
K–2	25 minutes/day (~2 hours/week)
3–5	35 minutes/day (~3 hours/week)
6–8	55 minutes/day (~4.5 hours/week)
9–12	65 minutes/day (~5.5 hours/week)

- Actual time spent on science varies by school, and is generally below these assumptions in K-5.
- Grades 6-8 are comparable to these assumptions.
- Several factors contribute to this situation, including length of school day, complexity of schedules, and variety of offerings in Brookline.

Addressing Areas of Growth

- We are starting the process of revising K-5 science units to align to NGSS and the MA 2016 STE standards, starting with a third grade pilot at Baker and Runkle this year.
- New units will prioritize opportunities for students to engage in ALL the scientific practices, including multiple opportunities for students to design experiments and engage in authentic data.
- New units will be mindful of diverse representations of scientists and scientific expertise.
- We have started professional development for K-5 teachers over the past two summers using BEF and ESSR funding. Additional summer and school year PD will be part of the teacher support around rolling out revised units in the coming years.

Integration

- Teachers are encouraged and supported to teach science in an integrated, project based approach.
- Coordinators work together to create a scope and sequence for the grade levels that aligns units to provide the maximum opportunities for integration.

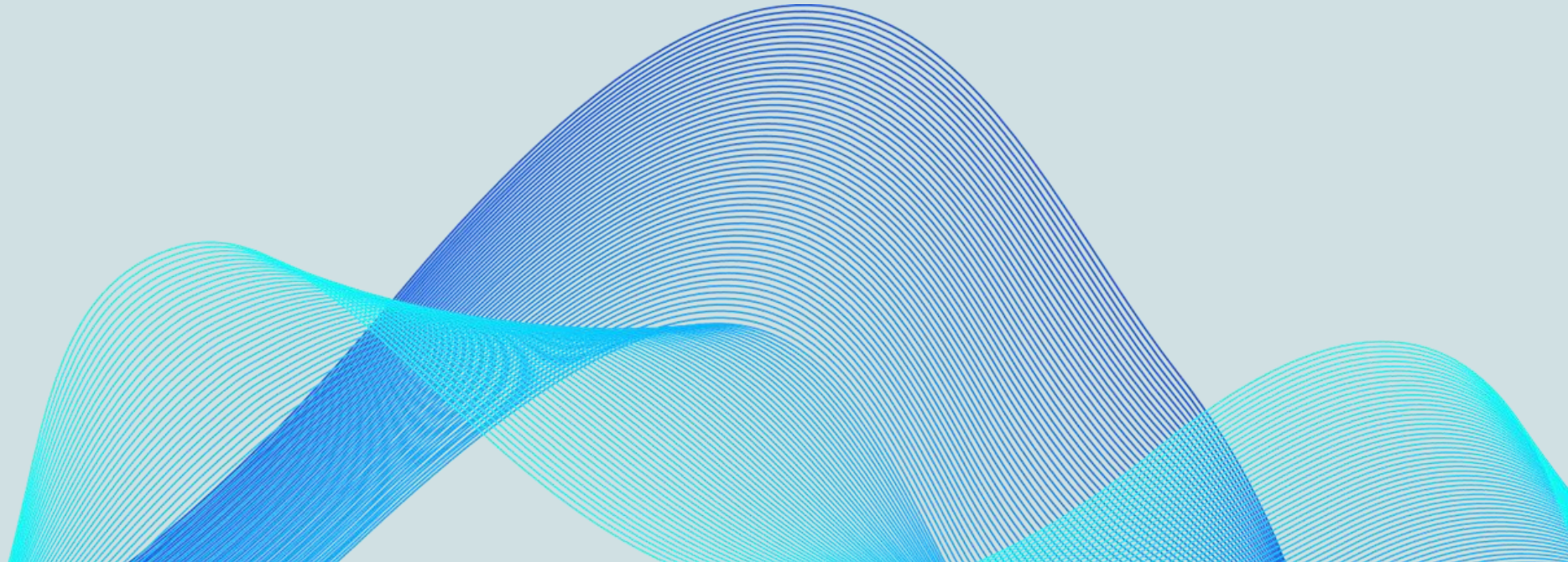
Some current Examples:

- 2nd grade Geography and Earth Science units are aligned to allow students to investigate landforms and maps from a social and scientific perspective.
- 5th grade Energy and Non-Fiction reading and writing units are aligned to support students in researching and writing about renewable and non-renewable energy sources.

Curriculum Options

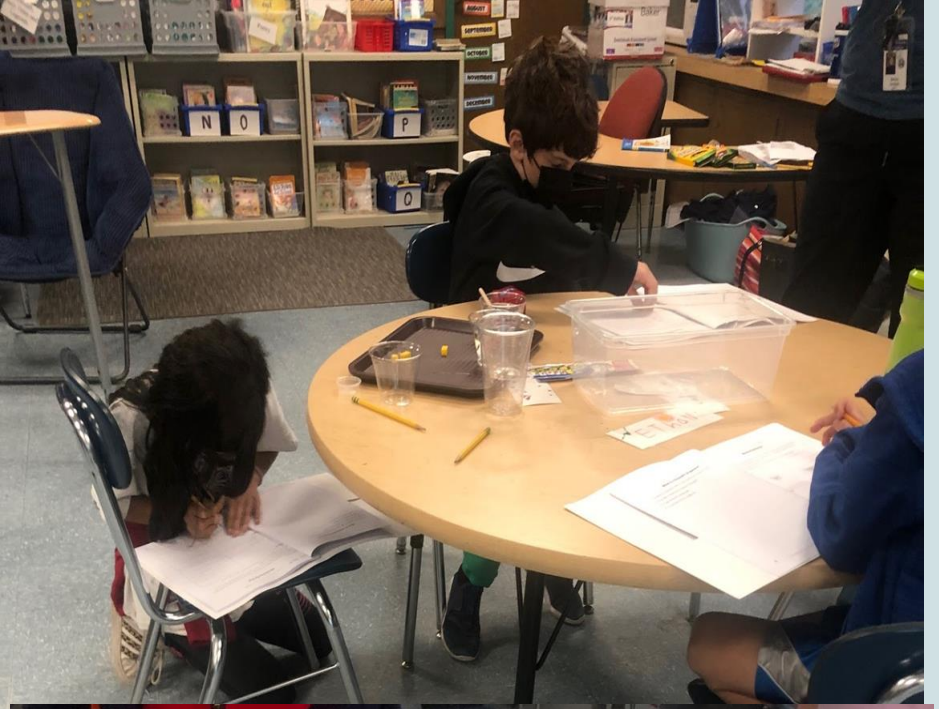
- Historical use of “home grown” units has benefits and drawbacks.
- Professional curriculum products allow coordinator to focus on supporting teacher implementation and allow teachers to focus on differentiation and personalization.
- Currently being piloted:
  - Open SciEd 6-8 (All units awarded NGSS Design Badge)
  - Amplify Science K-5 (Ed Report Review)

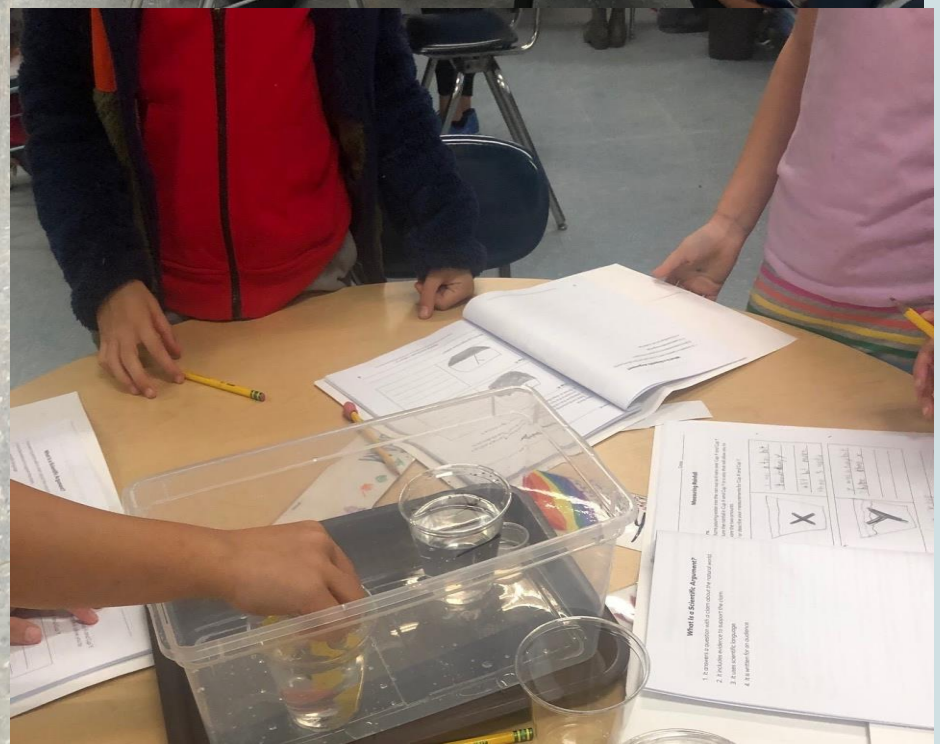
Bringing it All Together: Grade 3 Pilot



Overview

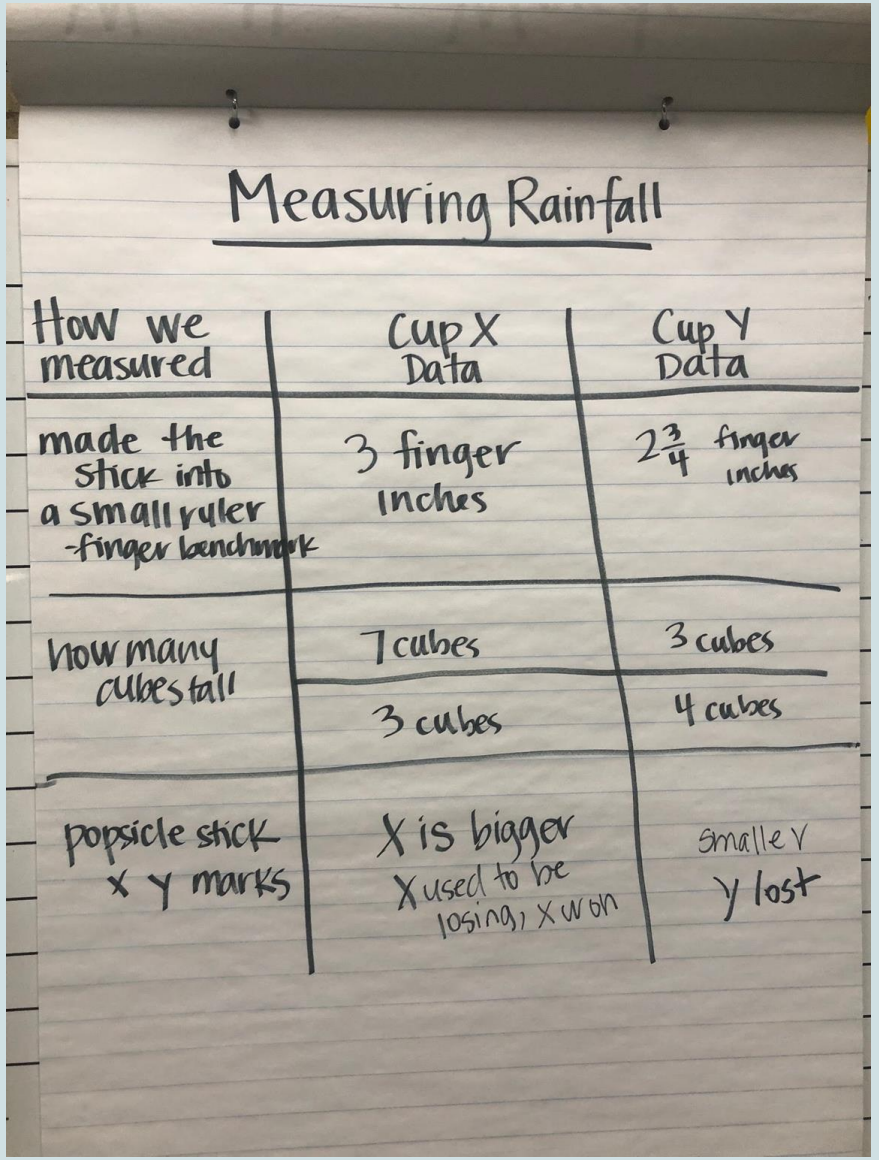
- Third grade is the least aligned grade K-8 and has two groups of standards that are completely missing from our K-5 sequence.
- This year (SY 22) 3rd grade teams at Baker and Runkle are piloting two new science units on Weather and Climate (from Amplify) and Life Cycles and Traits (homegrown).
- Between SY23-SY25 these two units, along with a new and improved Physics unit will be rolled out across the district.
- New units are being written to align with both the content and spirit of the new standards, providing students for ample opportunities to be scientists, integrate science with other disciplines, and get excited about what they are learning.





Weather and Climate

- Unit from Amplify Science. Students learn about weather and climate to choose the best island for an orangutan reserve.
- High engagement from both students and teachers.
- Aligned to math Modeling Data unit.



Measuring Rainfall

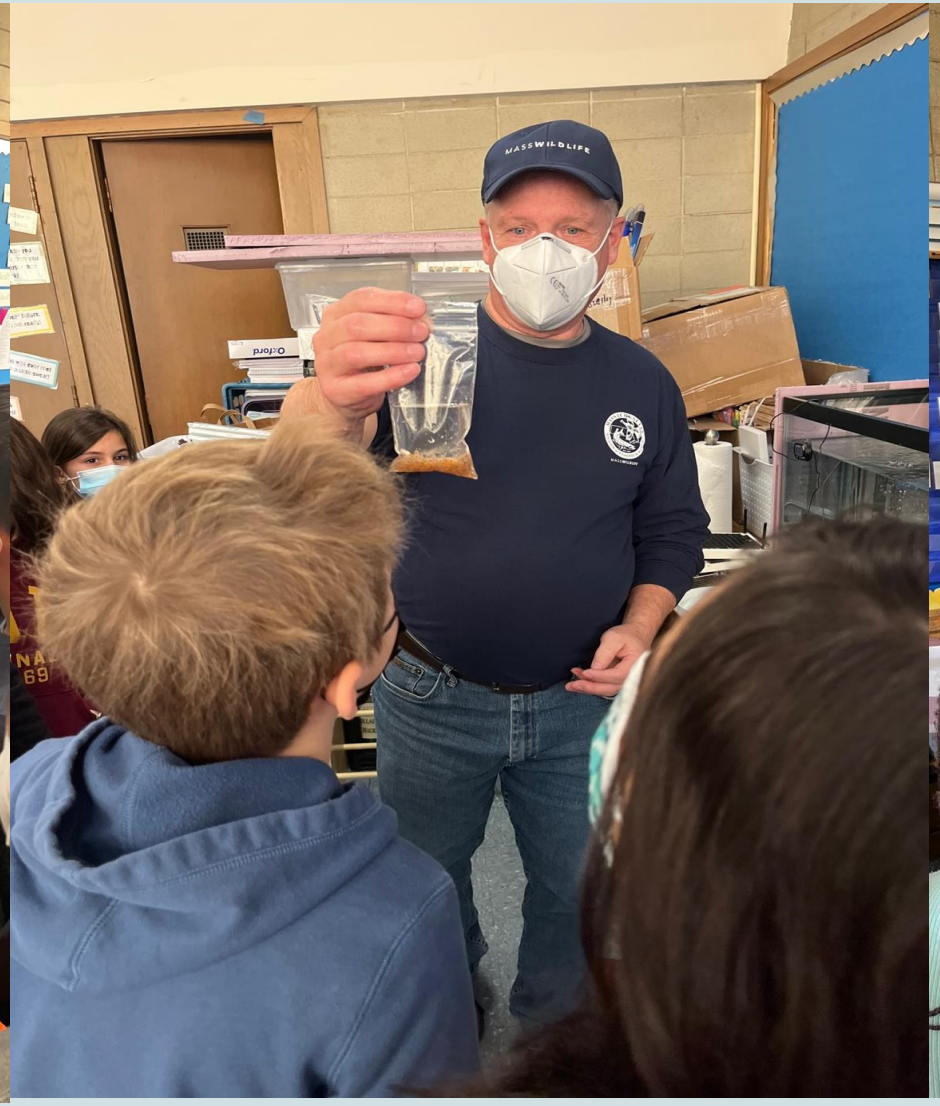
How we measured	Cup X Data	Cup Y Data
made the stick into a small ruler -finger benchmark	3 finger inches	$2\frac{3}{4}$ finger inches
how many cubes tall	7 cubes	3 cubes
	3 cubes	4 cubes
popsicle stick x y marks	X is bigger X used to be losing, X won	smaller Y Y lost

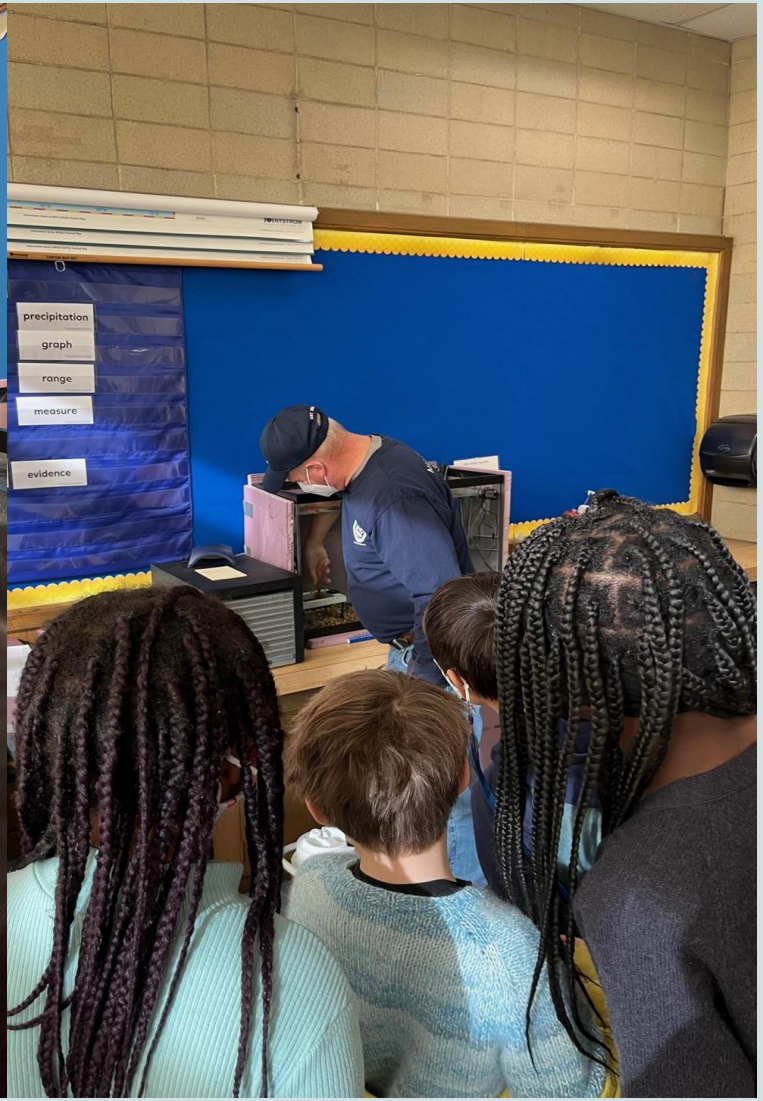
Life Cycles and Traits

- Unit written with pilot teachers. Students raise trouts and corn in the classroom.
- Trout in the Classroom is a national program run by State Departments of Conservation and Fish and Wildlife.

- Students investigate life cycles of model organisms and compare them to other living things.
- They learn that traits result from a combination of inheritance and interactions with the environment.

Arrival of the Trout






Questions?