DRL-1657218

Making ConnecTions: Engineering, Science, and Community

Kristen Wendell
Tufts University
McDonnell Family
Assistant Professor of
Engineering Education

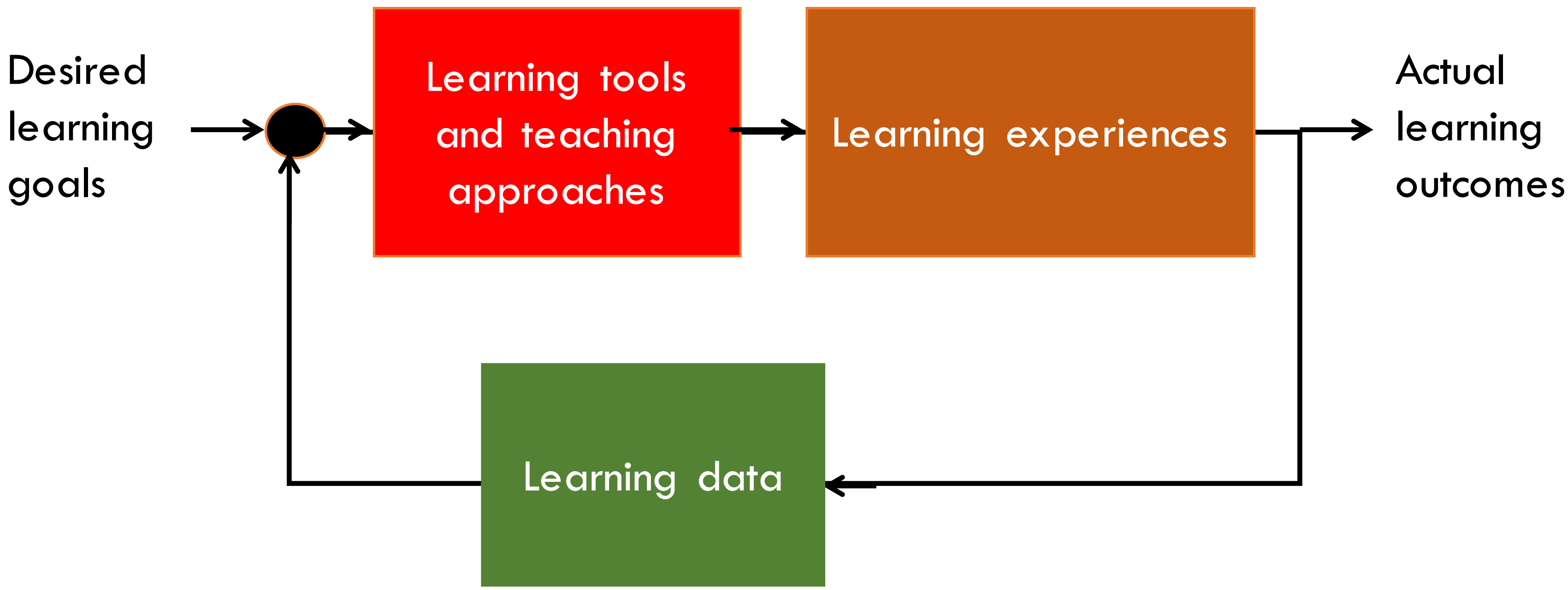
ConnecTions Project Team
Tej Dalvi
Chelsea Andrews
Nicole Batrouny
Fatima Rahman
Boston Public Schools
Marlborough Public Schools

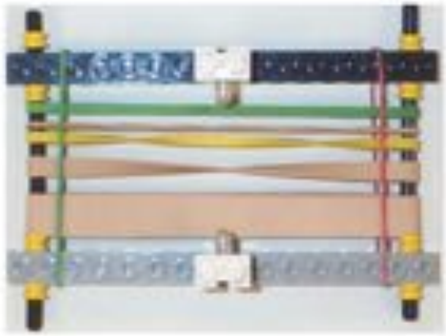
Center for Engineering
Education and Outreach

Agenda

- The CEEO Engineering Learning Systems Lab
- Background of the ConnecTions in the Making project
- ConnecTions curriculum development process
- Overview of the ConnecTions curriculum units
- ConnecTions pedagogy
- Q & A

Education research at the CEEO: Studying and innovating engineering learning systems





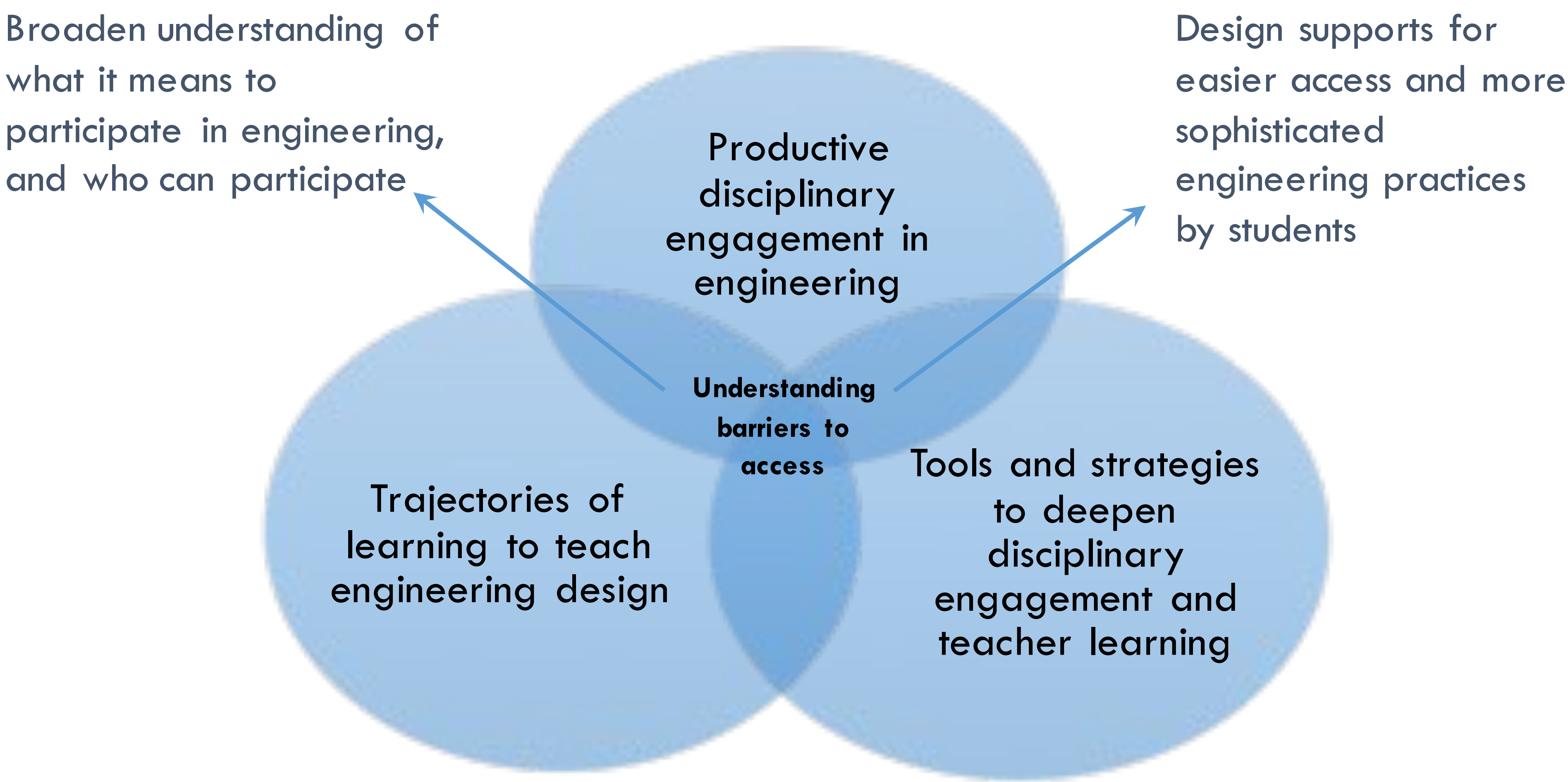
DESIGN A MUSICAL INSTRUMENT that can play at least 3 different pitches.

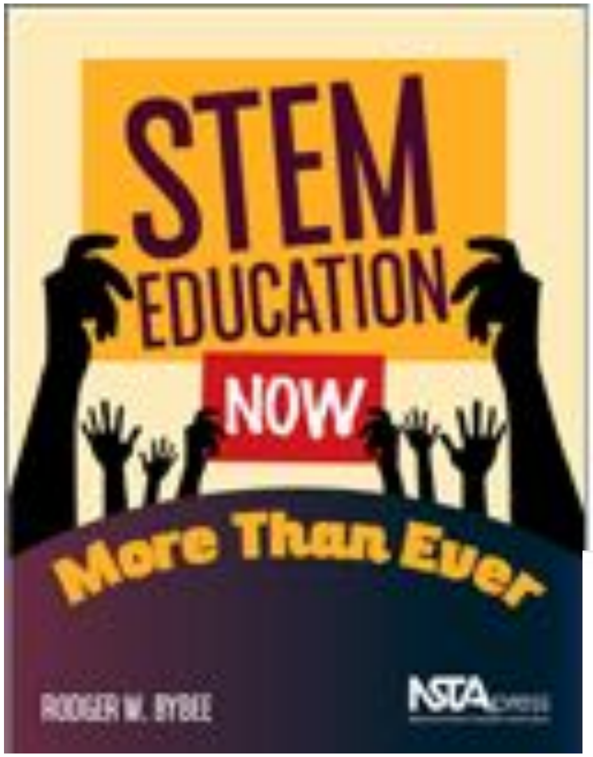
DESIGN A MODEL HOUSE that is stable, quiet, thermally insulated, and waterproof.

(Circa 2008)

DESIGN A PEOPLE MOVER: a complex machine that can move a LEGO figurine and load up and over an obstacle.

DESIGN AN ANIMAL MODEL: a mechanical model and a robotic model of a "newly discovered" animal that could survive in a tropical rainforest.


Broaden understanding of what it means to participate in engineering, and who can participate
Design supports for easier access and more sophisticated engineering practices by students
Productive disciplinary engagement in engineering
Understanding barriers to access
Trajectories of learning to teach engineering design
Tools and strategies to deepen disciplinary engagement and teacher learning



NEXT GENERATION
SCIENCE
STANDARDS

POWER OF
STEAM
SCIENCE TECHNOLOGY ENGINEERING ART MATHEMATICS

ART + science = PROGRESS

Uncovering relational work

B: (to Kristen) I don’t think A agreed.

(Kristen leaves)

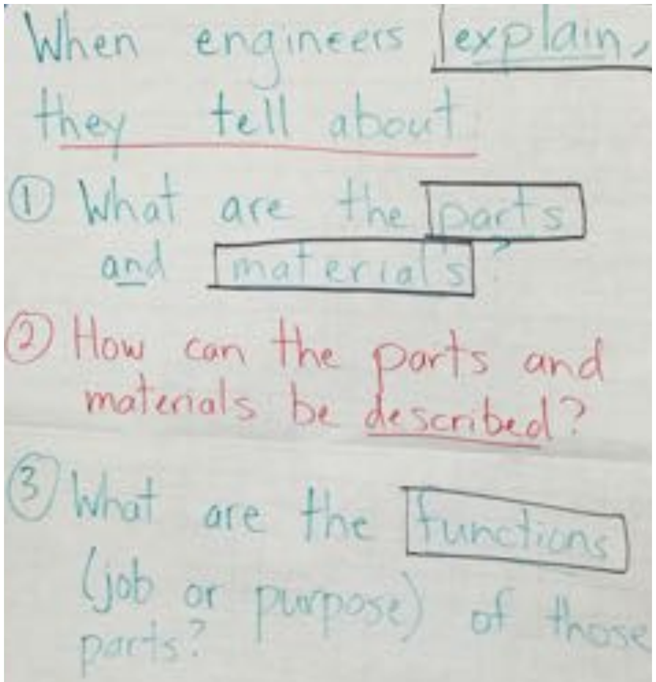
B: (to A) Which one do YOU want to do?

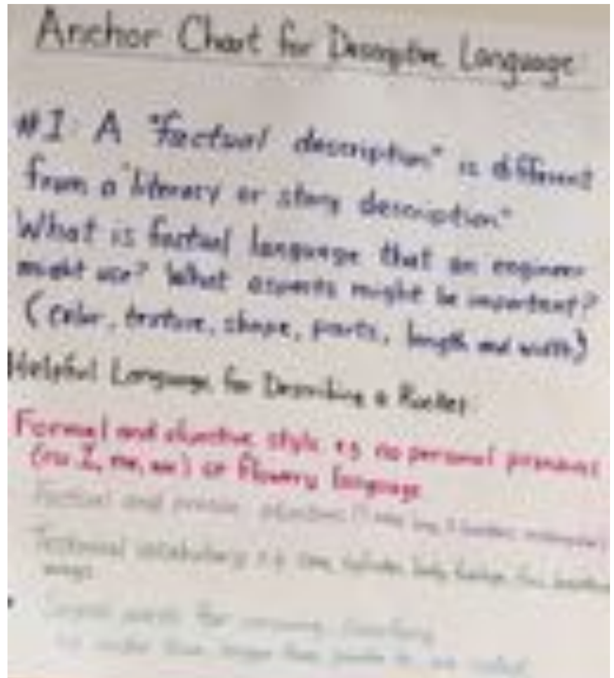
A: The lunch count because I wasn't here [yesterday], so the first one's easier for me.

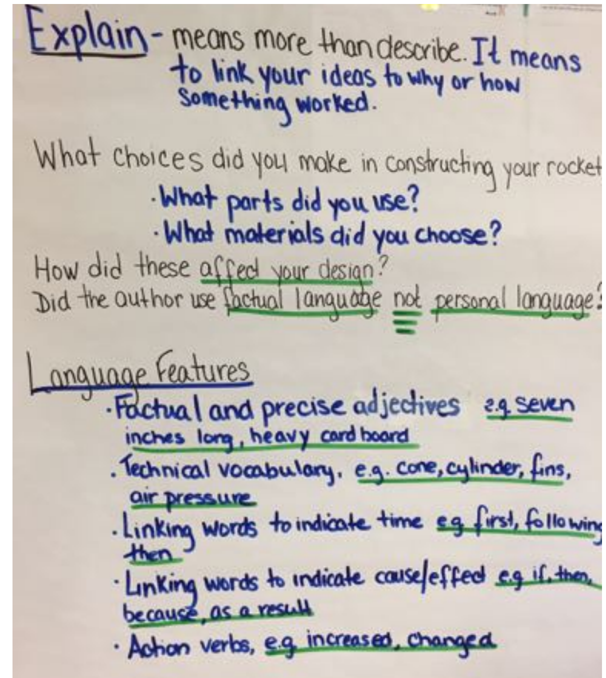
B: (to A) I already know if we don't do the lunch count [design], you're gonna be mad, so I'll just go with the lunch count cuz I don't have time to be mad, cuz somebody's mad. So we’re gonna do the lunch count [design].

Uncovering student reasoning

Learning to support engineering discourse

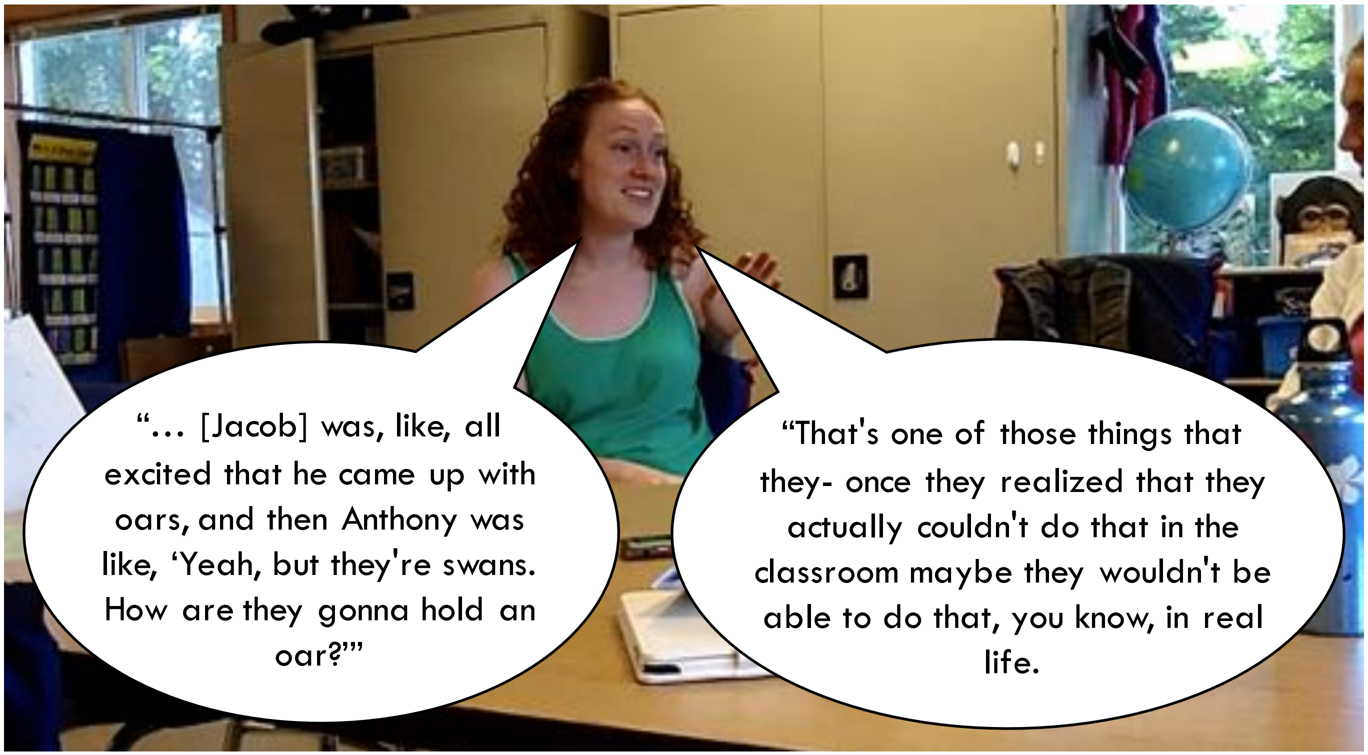






More language of engineering description and explanation → More mechanistic reasoning about the performance of their design constructions

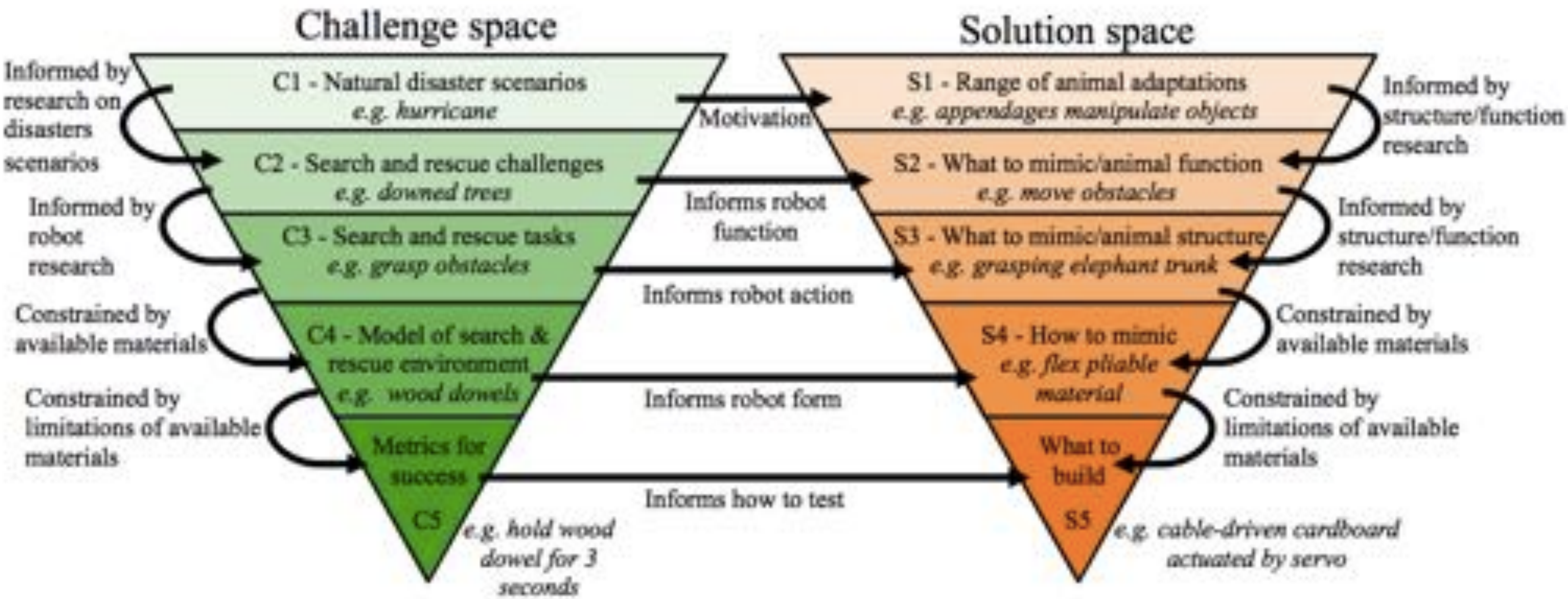
Developing teachers' "professional vision"



Designing Biomimetic Robots

- An interdisciplinary curriculum where students build biomimetic robots
- Biomimicry = context for learning biology, computational thinking, and engineering design
- In the *solution space,* students narrow the scope of their robot designs, informed by animal structure-function relationships.
- In the *challenge space*, they narrow the scope of real-world disasters by modeling them in the classroom.
- This dual problem scoping enables students to be active participants shaping the content of their learning.

Designing Biomimetic Robots



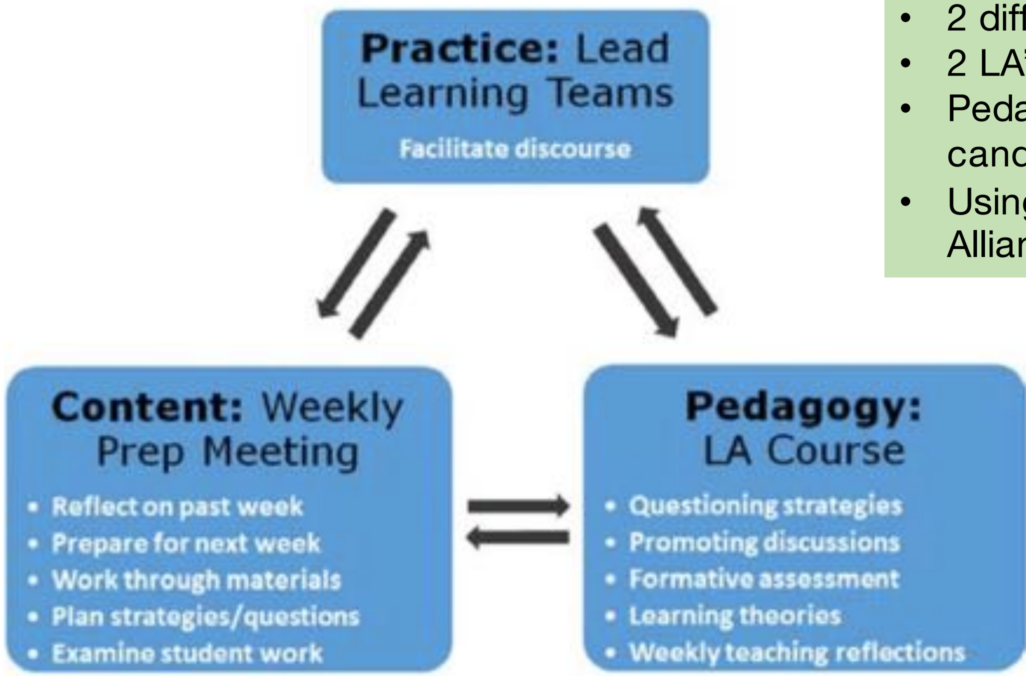
Problem scoping in the challenge space (left, green) and solution space (right, orange). Hurricane disaster example in italics.

Learning Assistants for College Engineering

Learning Assistants are undergraduate students who, through the guidance of weekly preparation sessions and a pedagogy course, facilitate discussions among groups of students in a variety of classroom settings that encourage active engagement.

Spring 2018 Pilot in Mechanical Engineering:

- 2 sections of ES 7 Thermodynamics
- 2 different faculty members
- 2 LA's – one junior, one senior
- Pedagogy seminar run by Jess Swenson, PhD candidate and CEEO researcher
- Using resources from the national Learning Assistant Alliance out of CU Boulder



<u>Faculty member</u> after first week using LA to enable peer-to-peer problem-solving during class time:

"I had fun yesterday!... I am actually really excited about this…went home last night and told my spouse about it."

ConnecTions in the Making: Community-Connected Science + Design

ConnecTions Teacher Design Squad at the Aquarium T Station. Boston and Marlborough teachers learn about community-based science and engineering challenges from the MBTA's Climate Change Resiliency Specialist.

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Tackling real world problems

Fifth graders worked on water pollution solutions

Posted March 7, 2018

Students at Marlborough's Whitcomb School have been participating in project-based learning that allows them to work on real environmental issues. As part of a collaboration with UMass Boston and Tufts University Engineering and Education Departments, Alison Hathaway's fifth grade science class has been studying the water cycle and the human impact on Earth's resources. It's part of a curriculum that is being developed based on the newly adopted state science standards.

Why study community-connected science + engineering education?

We know science and engineering can be meaningfully integrated with math, technology, and art in project-based learning experiences.

But there are still some crucial open questions:

- How to truly connect with young students from STEM-marginalized groups?
- How to create and sustain **effective** integrated **elementary** curriculum units that logistically fit into a district's existing matrix of science teaching resources, schedules, and expectations?

Making connections can seem daunting…

Interviewer: If you do new science and engineering, how likely are you to try to prioritize the community thing? Are you going to seek that out?

5th grade teacher: I'll be honest with you. I hadn't thought about it before, this idea. And now that we've done it, I do see how it's beneficial and it IS important. Now I know HOW to do it, too. And it doesn't have to be this deal that you think--you know when you hear 'community' you're like "How am I gonna do that? What am I gonna do? I have to get somebody in."

[But] this worked out so fine, just having the kids connect to the community, just the article and being able to see how it's a real world application right here in your own town. Yes, I would do it again. And I would find another way to connect.

ConnecTions Project Goals

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Support teachers in launching from existing district curriculum materials into integrated science and engineering units that are

- connected to communities and culturally relevant,
- supported by technological tools and STEM professionals,
- compatible with the rest of their districts' curricular resources.

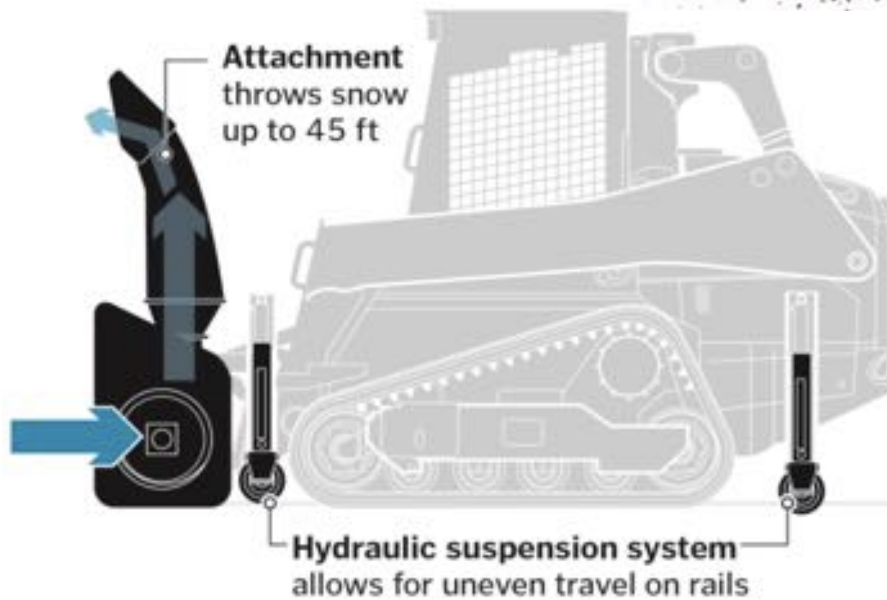
Study the influence of the units on upper elementary students' science and engineering ideas, practices, and attitudes.

Build capacity for students from historically STEM-marginalized groups to harness science and engineering for their own communities.

Why STEM community partners?

The Massachusetts Bay Transportation Authority (MBTA):

- It is a government organization that was created to serve the public interest
- It includes a specific charter to avoid a disparate negative impact on riders from historically non-dominant groups
- It will help us explore the opportunities and challenges of having students and teachers work with STEM professionals from an organization truly connected to a local community



Buffeted by snow, MBTA workers found a new way forward

The Community Connected Approach

Engineering Focus: Unpack the Problem

- Introduction to Digital Design Notebook
- Brainstorm initial thoughts on community-connected design problem

Science Focus: Investigate Related Phenomena

- Target relevant NGSS standards
- Begin to relate phenomena to design problem

Engineering Focus: Construct and Test Prototypes

- Support student prototyping with a curated Portable Maker Workshop

Integrated Focus: Explain and Redesign

- Refine design documentation
- Student Design Expo

Influences and Inspirations

Situated learning
(Lave & Wenger, 1991)

Place-based education
(Hammond, 2001; Semken & Freeman, 2008)

Asset pedagogies
(Gonzalez & Moll, 1997; Gutierrez & Rogoff, 2003; Ladson-Billings, 2014; Lee,2004; Rosebery et al, 2010)

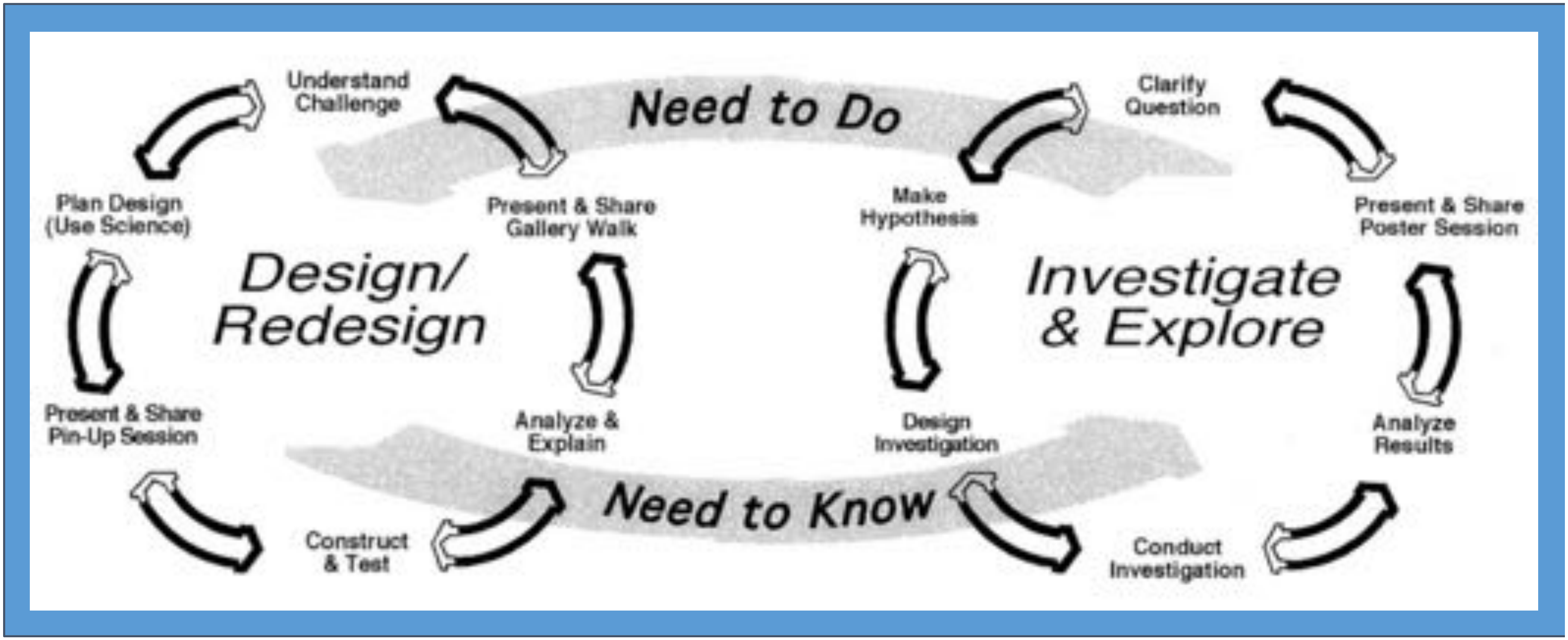
Science for social justice
(Barton, 2003)

Disciplinary productive beginnings and teacher noticing
(Levin, Hammer, & Coffey, 2009; Watkins, Spencer, & Hammer, 2014

Engineering's history of marginalization
(Tonso, 2006; 2008)

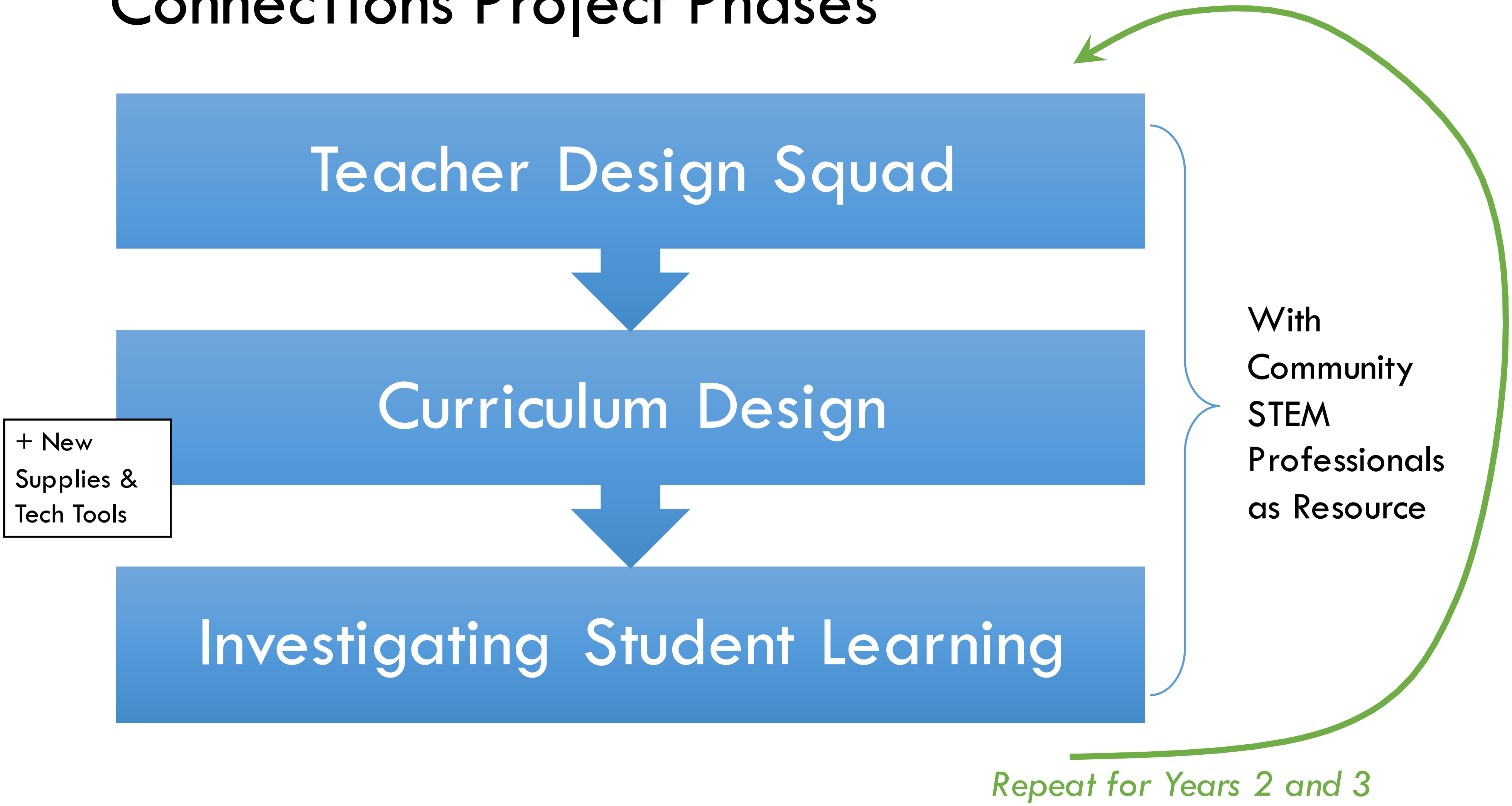
Influences and Inspirations

Influences and Inspirations



The Learning by Design Cycle. "Promoting transfer through case-based reasoning: Rituals and practices in learning by design classrooms" (Kolodner, Gray, & Fasse, 2003; Reprinted in Wendell & Kolodner, 2014)

ConnecTions Project Phases



ConnecTions Curriculum Development

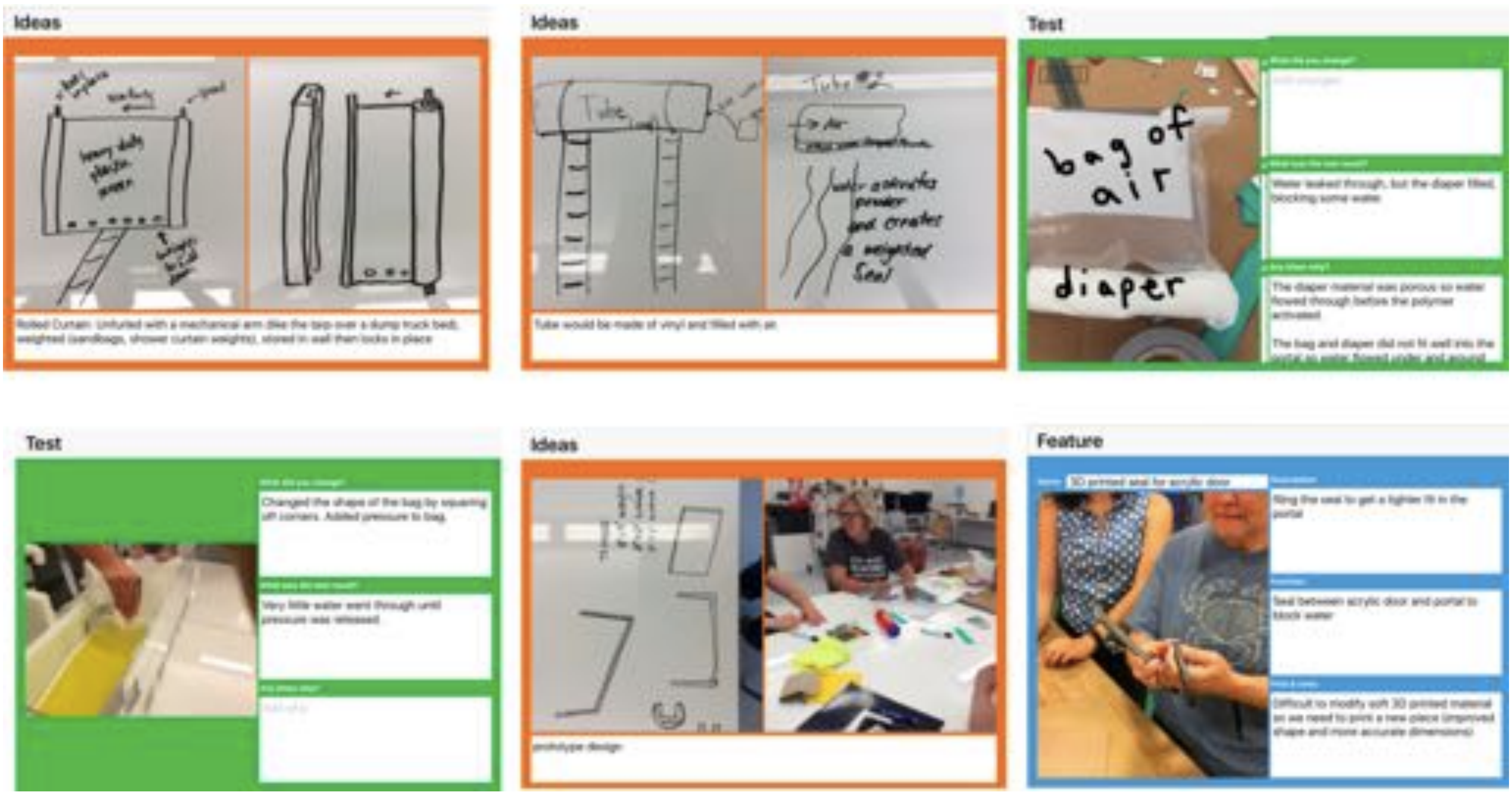
Our process for creating truly connected learning experiences

Teacher Design Squad

(Phase 1)


Sandbags at the Fenway subway tunnel in a 2010 storm


A scale model of the flood-prone tunnel portal

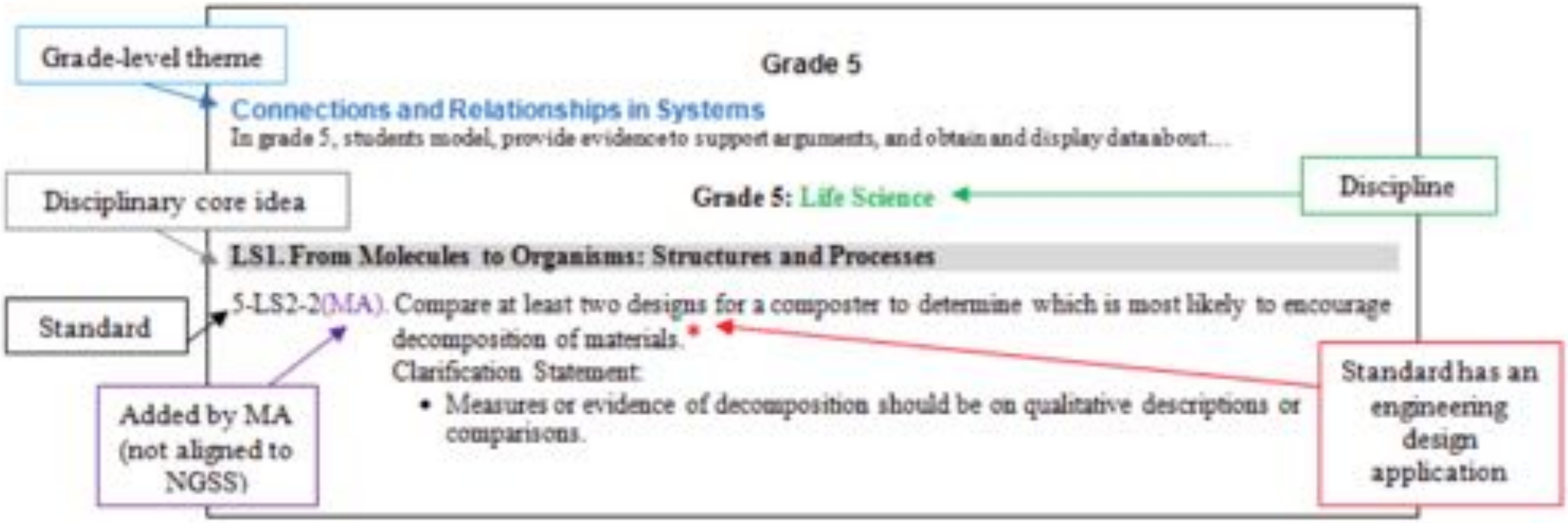


Ideas
Rolled Curtain: Unfurled with a mechanical arm (like the tarp over a dump truck bed), weighted (sandbags, shower curtain weights), stored in wall then locks in place
Ideas
Tube
Tube would be made of vinyl and filled with air
Test
bag of air
diaper
Water leaked through, but the diaper filled, blocking some water
The diaper material was porous so water flowed through before the polymer activated
The bag and diaper did not fit well into the portal so water flowed under and around
Test
Changed the shape of the bag by squaring off corners. Added pressure to bag.
Very little water went through until pressure was released
Ideas
prototype design
Feature
3D printed seal for acrylic door
fitting the seal to get a tighter fit in the portal
Seal between acrylic door and portal to block water
Difficult to modify soft 3D printed material so we need to print a new piece (improved shape and more accurate dimensions)

3D Standards Bundling & Unpacking

(Phase 2)

Structural features of a standard



Overview of the standards. Page 19.
http://www.doe.mass.edu/frameworks/scitech/2016-04.pdf

The MA STE standards are labeled using the NGSS system. The term "learning standard(LS)" is referred to as "performance expectation(PE)" in the NGSS. The LS/PE is comprised of a disciplinary core idea (DCI) and a science and engineering practice (SEP). Many standards include a clarification statement that provides examples or additional clarification to the standards and assessment boundary that specifies limits to assessments for the standards.

Developing an NGSS Aligned Assessment

Step 1: Define what you will assess by analyzing relevant performance expectations and the disciplinary core ideas (DCIs) and science and engineering practices (SEPs) they include, then crafting learning claims.

Step 2: Brainstorm possible scenarios for fulfilling learning claim

Step 3: Select task formats that correspond to the targeted SEPs

Step 4: Use task formats to build questions to engage students with the scenario

Step 5: Imagine the range of possible student responses to the questions

Based on Developing Assessments for the Next Generation Science Standards (NRC, 2014)

Unit Storyline Development

(Phase 3)

Lesson # (may be multi-day)	Lesson focus
Part A - Engineering Focus: Unpack the Problem	
1	Warm-up engineering design challenge; Introduction to Digital Design Notebook
2	Scoping of the community-connected design problem; Initial brainstorming of solutions
Part B - Science Focus: Research Related Phenomena	
3	Investigation of phenomenon #1
4	Investigation of phenomenon #2
5	Investigation of phenomenon #3
6	Scientific sense-making and initial planning of conceptual designs informed by explanations of phenomena

Part C - Engineering Focus: Construct and Test a Prototype	
7	Introduction to Portable Maker Studio
8	Prototyping and testing
Part D - Integrated Focus: Explain, Redesign, and Share	
9	Explanations of testing results and iterations on prototypes
10	Polishing of design documentation and presentations
11	Student Conference and Design Expo
12	Reflection on Design Expo: Considering multiple solutions to the same community-connected problems

Lesson Plan Details

(Phase 4)

Inquiry Lesson Plan

Lesson 3: Oh Deer!

Core ideas/ Standard(s) from the MA Curriculum Framework	Anchor Phenomenon and Focus Question
3-LS4-4 Analyze and interpret given data about changes in a habitat and describe how the changes may affect the ability of organisms that live in that habitat to survive and reproduce.	How does the amount of resources affect the individuals in a population? This lesson is based on the Oh Deer activity fr Project Wild book (pg 36). A scan of the origir plan can be found here.
Materials	**Assessment/Evidence of Learning**
• a large open space, indoor or outdoor • whiteboard or chart paper to make a graph	Individual notebook spread Ideas card to their team design NB

Engage/Elicit [Hook student interest and find out their initial ideas and thinking.]	You have learned that living things need food, shelter, and water to survive. • What do you think would happen if there were not enough resources to go a the individuals of a population? • What if there were more than enough resources for everyone? You can relate this to the last inquiry activity and discussion; food and water are som that are essential in a habitat.
Explore [Give students a task to explore some aspect the phenomenon.]	Explain to the students that we are going to play a game called "Oh Deer!" This game understand how the number of individuals in a population changes based on the amc available resources. **To relate more directly related to the standard, discuss how hal resources) affects a species ability to survive and reproduce (# of individuals in pop** One fourth of the class is the "Deer." They line up on one side of the rug. Three-fourt class are "Resources." They line up on the other side of the rug. The lines of student their backs to each other. Begin a line graph with the students. The x-axis should be labeled "Years" and the y- be labeled "Number of Deer." Graph the starting number of deer. For example, for students, you will have 5 deer on year 0. See an example graph below. Students will t this graph in their notebooks later.

Explain [Help students interact with the core idea. Make the learning more explicit and clearly accessible to all students.]	Along the way ask students to make predictions: How do you think the deer population will change this round? Why do you think so? How is the habitat changing each round? *Students can usually predict when there will be a crash in the deer population because there are not enough resources to go around.* **Again, the main idea is that habitat (ie resources) affects a species ability to survive and reproduce (# of individuals in population).**
Elaborate [Have students rethink and revise understandings; perhaps apply their learning to another task.]	When the game is done, look at the line graph as a class. Host a whole class discussion, asking students to discuss any patterns they notice. *Students should see that the graph is a series of population climbs and crashes.* Ask students to determine what is the maximum number of deer this habitat could hold. Encourage students to think about why that is. **The following is an optional extension piece! Prioritize whole class discussion and time for individual and team notebooking.** Tell students that in some areas, there are designated days where hunters are allowed to hunt deer to reduce the deer population. This is called "culling." Do you think that culling is helpful or harmful to the deer and their environment? Would your answer change depending on the year (from the line graph) that the culling happened?
Evaluate/Extend [Determine whether the learning objective(s) has been met, and extend learning.]	Have the students sit in their design challenge groups and work on their individual notebook spread. They should copy the graph you made during the activity; then they can answer the focus question and jot down any ideas they have on their own. Once students have finished their individual notebook pages, they should work as a team to brainstorm ideas for the design challenge and enter them into the shared notebook on the iPad.

Differentiation Strategies? (from Project Wild)	Supports for Academic Language?
• Introduce a predator. For detailed instructions on how this changes the game, see the original lesson plan. • Have students create their own graphs.	• habitat: the place or type of place where a plant or animal naturally or normally lives or grows • population: a group of one or more species of organisms living in a particular area or habitat • resource: something (as in food, water, shelter, etc) that is found in nature and is valuable to a species

ConnecTions Curriculum Units

From narrowest to broadest definition of “community”

A Playground For Everyone

Miss Barry's 3rd Grade

Challenge: Design a piece of playground equipment that everyone can use, including wheelchair users.

3-PS2-1 (balanced and unbalanced forces)
3-PS2-3, 3-PS2-4 (interaction between magnets)

3.3-5-ETS1-1 (define design problem)
3.3-5-ETS1-2 (generate several solutions)
3(MA)-ETS1-4 (gather information for design solutions)

Criteria:

- Wheelchair should fit on the equipment
- Safe to use
- Easy to get on and off
- Works for students with and without wheelchairs

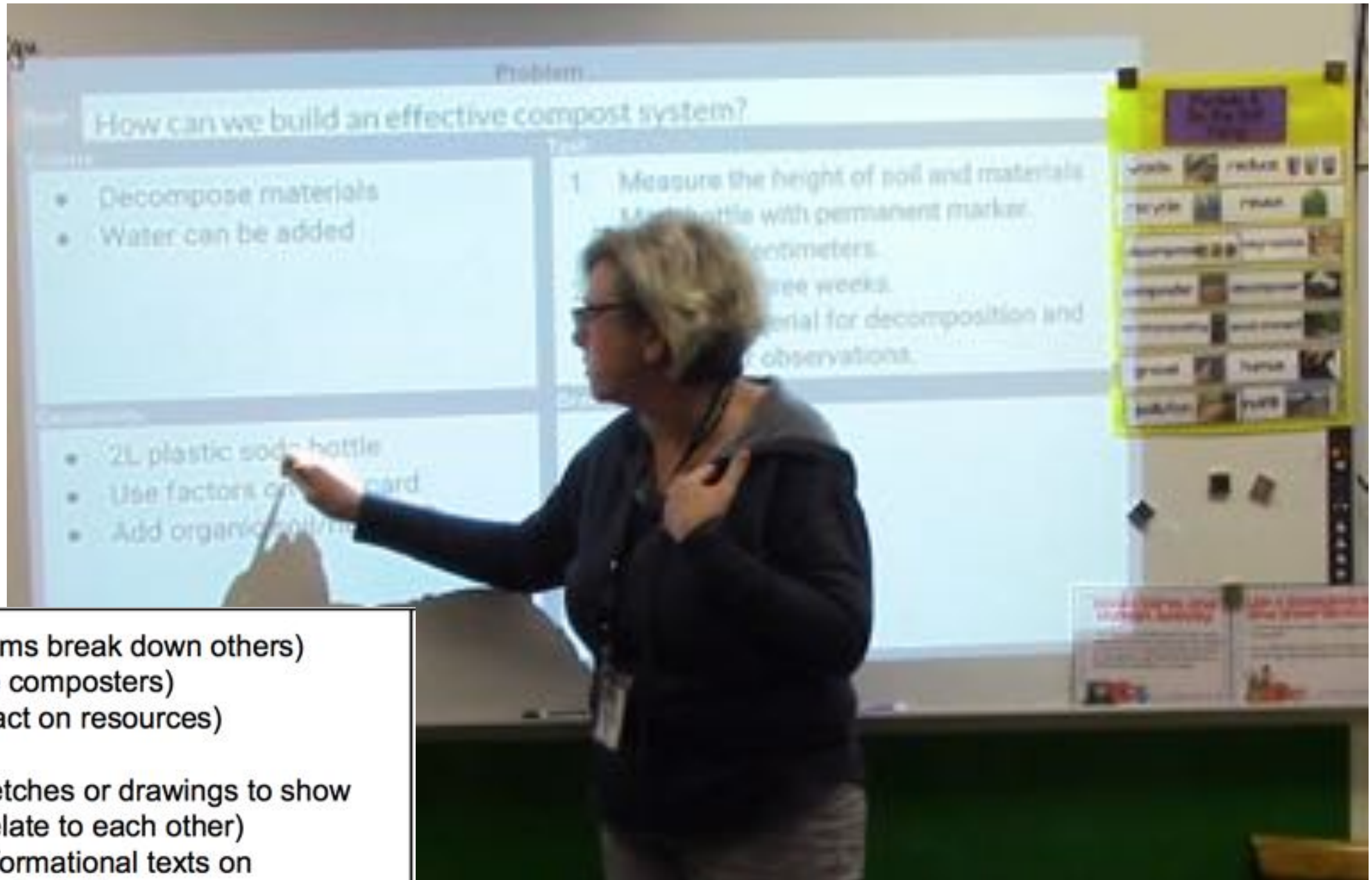
Testing: Use the miniature wheelchairs to try out and improve your design.

Cafeteria Composter Design

Mrs. Hall's 5th Grade

Community concern: To help protect the environment we need to reduce the amount of trash that is produced.

Design Task: Students designed a composting system for use in their school cafeteria.



5-LS2-1 (some organisms break down others)
5-LS2-2(MA) (compare composters)
5-ESS3-1 (human impact on resources)

5.3-5-ETS3-2(MA) (sketches or drawings to show how parts of devices relate to each other)
5.3-5-ETS3-1(MA)- (informational texts on improvements to technologies)

Water Filter Design

Mrs. Hathaway's 5th Grade

Petroleum pollution persists near reservoir in Marlborough

By Christopher Cheney/Special to the Daily News
Posted Mar 5, 2016 at 11:08 PM
Updated Mar 6, 2016 at 6:49 PM

MARLBOROUGH – Despite decades of state-ordered cleanup work, widespread petroleum pollution in the Maple Street neighborhood remains a threat to the Sudbury Reservoir, city officials and residents say.

Although the reservoir is not an active drinking water supply, it is an emergency source of water for more than 2.2 million Greater Boston residents and 5,500 businesses.

Over the past 30 years, cleanups of oil, gasoline and diesel fuel spills have been done at more than a dozen commercial properties in a mile-long stretch of Maple Street. Petroleum-product spills have plagued the neighborhood for more than a century, according to state Department of Environmental Protection records.

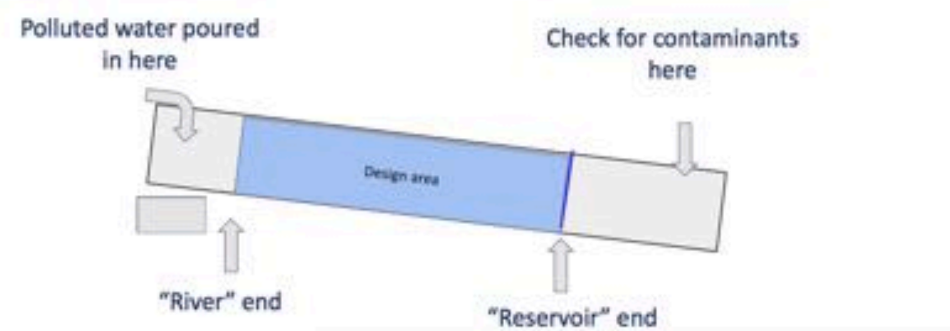
5-ESS2-1. (Use a model to describe the cycling of water through a watershed)
5-ESS2-2 (Availability of fresh water in the biosphere)
5-ESS3-1 (Reducing human impact on Earth's resources and environment)

5.3-5-ETS3-2(MA) (sketches or drawings to show how parts of devices relate to each other)
5.3-5-ETS3-1(MA)- (informational texts on improvements to technologies)

Challenge: Create a device to prevent contaminated water from flowing into the model reservoir.

Criteria:
- Filters out as many pollutants as possible
- Allows most of the water to flow into reservoir

Testing: Pour the polluted water (water mixed with beads and oil) into the 'river' end of container. After a few minutes, examine the 'reservoir' end to see how much water and how many pollutants flowed into the reservoir.



Bird Friendly Building Design

Mrs. DeAngeli's 4th Grade

Problem: When a new building is constructed on land that used to be a forest, some birds may be threatened. Some commercial buildings have large glass windows, a row of bright lights edging the roof, and loud noise from the heating and cooling system. These features may cause serious problems for nearby birds.

Challenge: Add features to the model of the commercial building to make it more bird friendly.

Criteria:

- Withstand wind gusts
- Reduce light pollution
- Reduce reflection from the window

Testing: Use the light meter to find out whether your design reduces light pollution.

4-LS1-1 (internal and external structures for survival, growth, behavior, reproduction)
4-PS4-1 (mechanical waves)
4-PS4-2 (light waves)

4.3-5-ETS1-5 (evaluate design features)

Traffic noise makes it hard for birds to hear an alarm call. This makes it easier for predators to kill them.

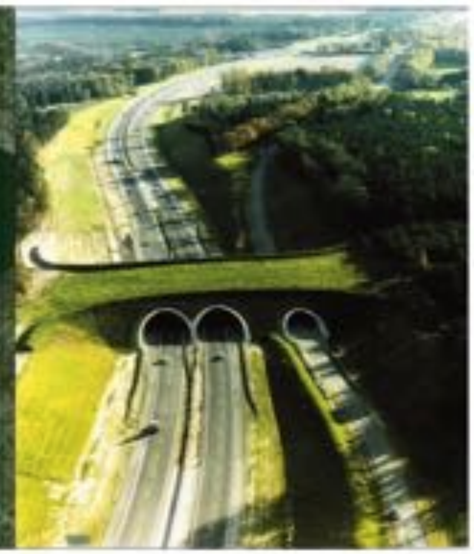
Every year millions of birds die by smashing into buildings and towers with lights on them.

Birds hit windows because they see reflections of plants or are attracted by the lights.

Birds crash into buildings with large glass windows. To stop this you can make the glass more visible.

Animal Friendly Bridge Design

Mrs. Bartlett's 3rd Grade



Problem: Recently in Marlborough, the APEX center of New England was built where there used to be forest. The animals that used to live in the forest are displaced from their native habitat. Some of these animals can't travel back to the new forest to live.

Challenge: Build a bridge on the map to help the displaced animals safely relocate to a nearby conservation land.

3-LS4-4 (changes in habitat affect organism survival)
3-LS4-3 (in particular environment, different organisms have different survival chances)
3-LS4-2 (variation among individuals provides survival and reproduction advantages)

3.3-5-ETS1-1 (define design problem)
3.3-5-ETS1-2 (generate several solutions)
3(MA)-ETS1-4 (gather information for design solutions)

Criteria:

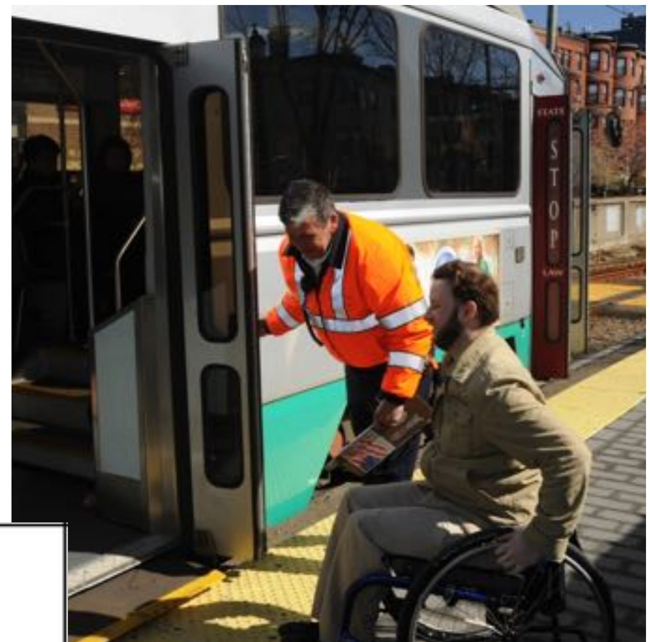
- Starts near APEX center and ends in a more natural habitat.
- Safe and inviting for animals
- Free-standing (hands-free)

Testing:

Weight test: Must support weights spread out across the entire bridge

MBTA Vehicle Improvement Design

Boston Public Schools 3rd Grade



3-PS2-1 (force changing motion)
3-PS2-3 (interaction betw. magnets)
3-PS2-4 (define problem solved w/ magnets)
MBTA

3.3-5-ETS1-1 (define design problem)
3.3-5-ETS1-2 (generate solutions)
3(MA)-ETS1-4 (gather info about possible solns)

Wheelchair Accommodation Challenge

When MBTA subway cars stop, there is a gap between the floor of the car and the station platform surface. This gap makes it difficult for a wheelchair passenger to get onto the subway. Design a subway car that releases a ramp when it stops at the station.

Design Requirements:

- ❑ The ramp must extend hands-free from the car within 1 second of arrival at a station.
- ❑ The ramp must be stored within the vehicle while it is moving.
- ❑ The ramp must cross a gap that is 3 inches wide and fit a wheelchair that is 2 inches wide.
- ❑ The ramp must hold the weight of a wheelchair and passenger (10 gram cubes).
  - ❑ The model wheelchair must be able to roll smoothly on the ramp.

Collision Avoidance Challenge

MBTA buses drive on congested city streets. Keep drivers and passengers safe by designing an MBTA vehicle that can stop quickly to avoid colliding with other cars and trucks. It is important for your MBTA bus to stay on schedule so passengers can get to work on time.

Design Requirements:

- ❑ Your vehicle must move quickly down a 100 cm city street in 4 seconds or less.
- ❑ Your vehicle must use magnets to help it stop within 5 cm of the back of another vehicle.

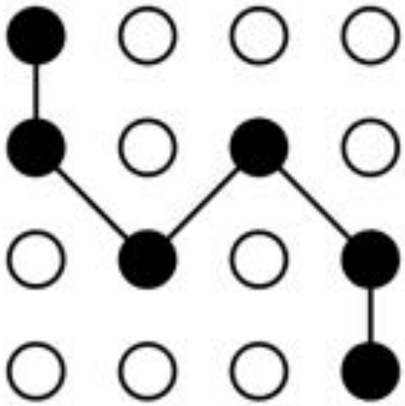
ConnecTions Pedagogy

Key task structures and participation modes for students

1. Community design challenge “launch”
2. Scaffolded design notebooking
3. Whole-class sense-making
4. Mid-design share-outs and gallery walks
5. Community STEM partner check-ins

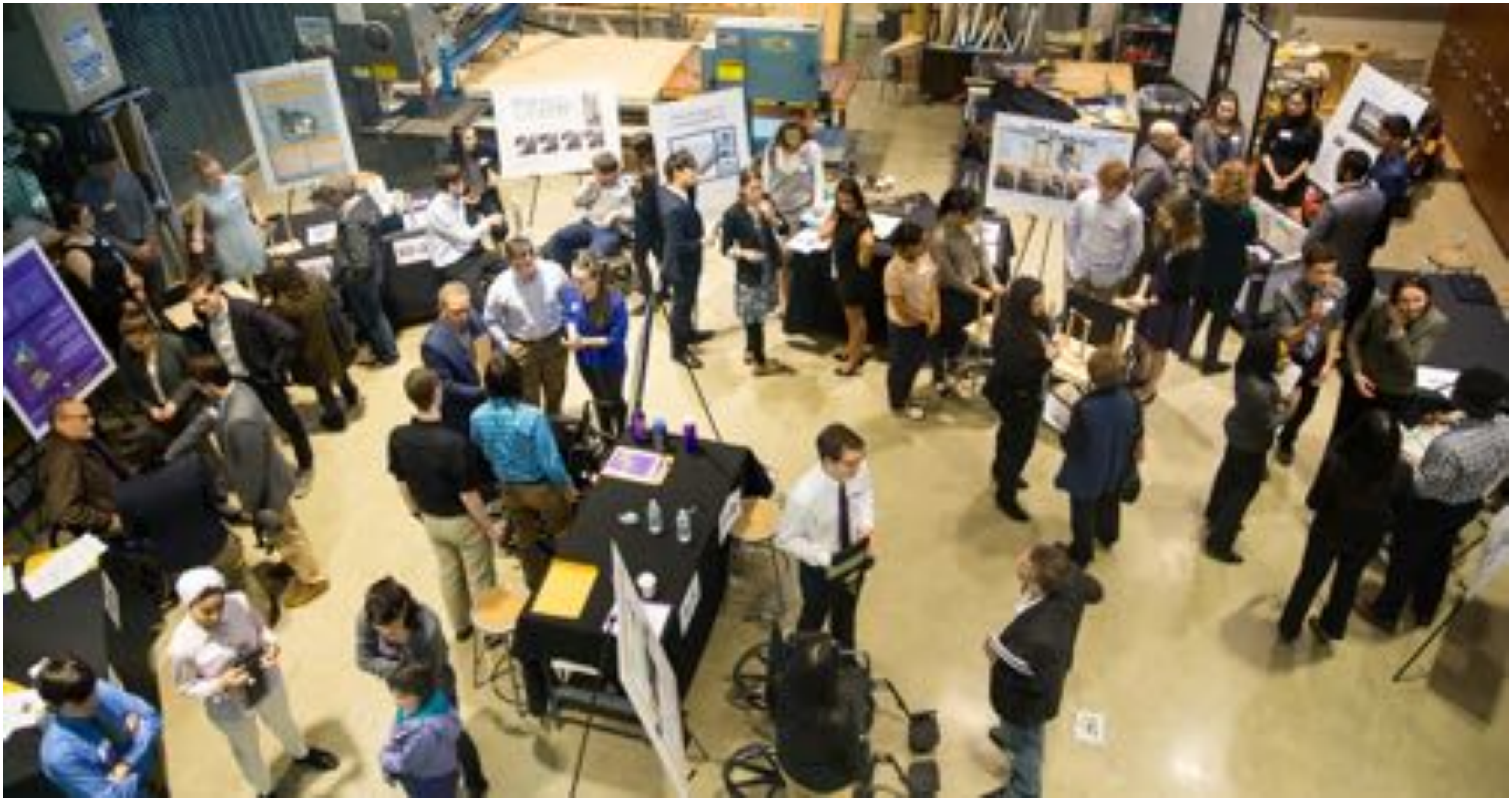
Documentation

Collaboration



Working with Data for Explanation and Argumentation

1. Community design challenge “launch”



ıttp://www.mccormick.northwestern.edu/news/articles/2017/12/segal-design-expo-showcases-innovative-projects.html

As Boston adds glass towers, birds find more lethal obstacles

Investigations into How to Prevent Deadly Bird Window Strikes

Helping Animals Return to a Natural Habitat

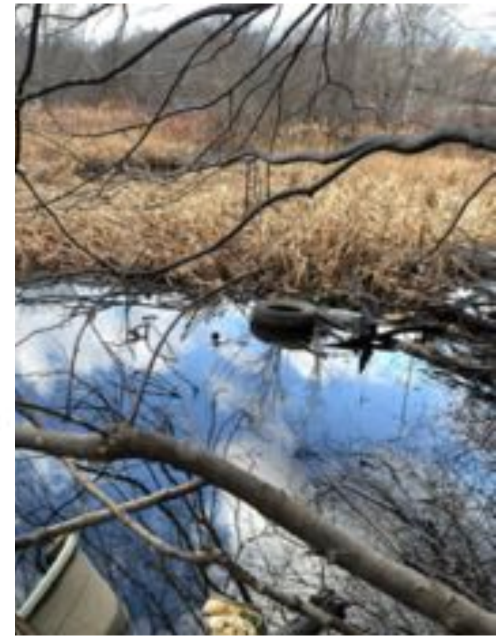
When humans build developments where forest used to be, the animals that used to live in the forest are displaced from their native habitat. These animals must learn to live in the new developments alongside people or find a way to travel to a different natural habitat. Some animals, like birds, can easily travel to a new forest to live. Some animals, who can't survive in the new habitat and can't travel to a new forest, die. When this happens to most of one species of animal, that species might become extinct. Other animals, like deer, black bears, and snakes, can survive in the development alongside people, either in neighborhoods or around businesses. But, these animals are often seen as pests by the people, because they eat people's trash, bushes, trees, and food from gardens. One way engineers can help these animals is to find a way to help them travel to a new natural habitat.

Recently in Marlborough, the APEX center of New England was built where there used to be forest. This development is good for the people of the city of Marlborough, since it has 20 new businesses and gave 1,600 people jobs. However, it is a very big development, 475,000 square feet. All that space is now buildings and parking lots and roads, but it used to be trees and forest area full of animals. Many animals that used to live in this forest have now moved into the nearby neighborhoods to look for food and shelter. People have even seen black bears in their yards! The black bears

This black bear was found eating vegetables in someone's garden.

Petroleum pollution persists near reservoir in Marlborough

By Christopher Cheney/Special to the Daily News



The MetroWest Daily News first reported on the Maple Street petroleum pollution in April 1996. At that time, an official at the Massachusetts Water Resources Authority, which manages the reservoir, called the DCR pond that is closest to the reservoir a "serious source of contamination" for the reserve water supply. The official said silt in the pond, which has public access off Walker Street and is less than a quarter-mile from the reservoir, contained a toxic stew of petroleum-linked contaminants including lead.

For at least the past 15 years, DCR has done little to maintain the Walker Street pond and the half-century-old dam that contains it, neighboring homeowners say. Dionysi McGowan, who has lived on Holm Street for nine years and has the Walker Street pond in his backyard, said he has complained about the condition of the site to the city and the U.S. Environmental Protection agency.

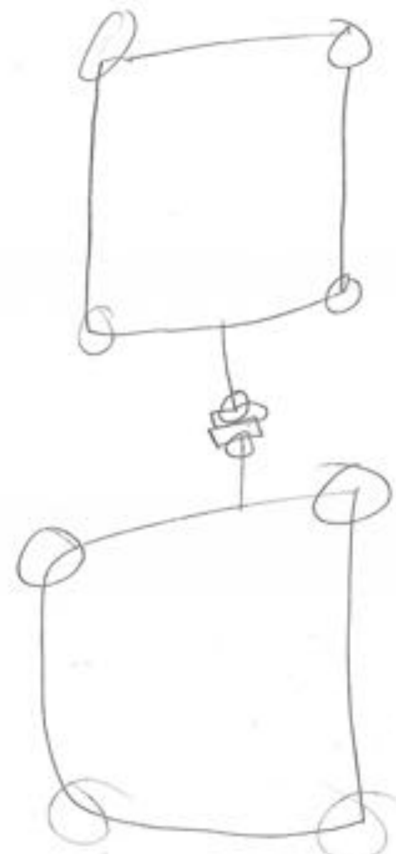
2. Scaffolded design notebooking

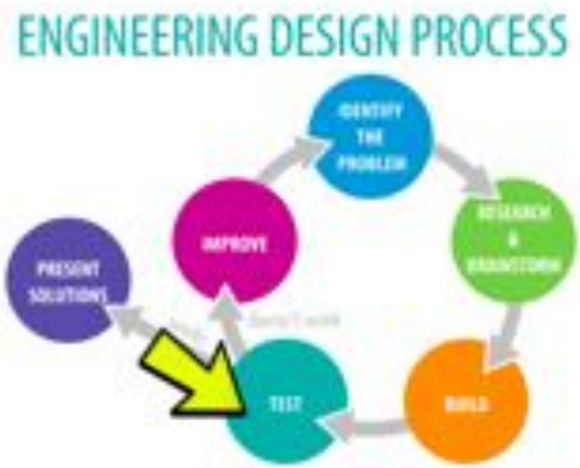
MBTA Design Challenge (Day 1) Date: 11-9-17

FOCUS QUESTION: What science and engineering do transportation professionals do? What are the problems the MBTA needs to solve in the story?

the professionals have to plan befor they build. They make Blueprints. then they build the machin. then they test the machin. then they Drive it around. They need to make some vehicle that can go in snow. And the problem is the snow is to high and thick.

O= super glue



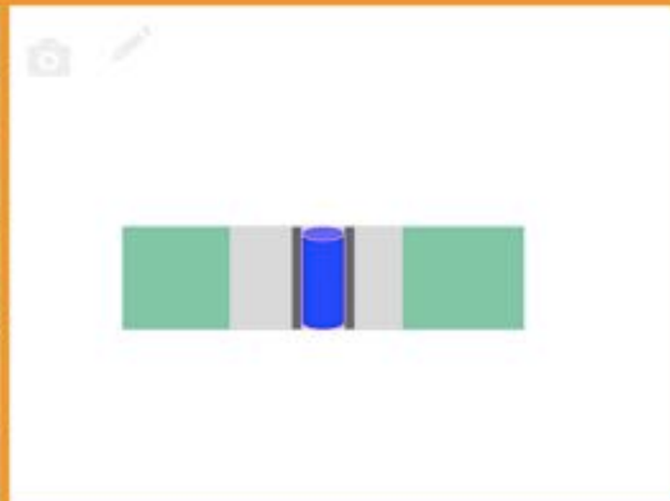


Date	Height	Observations
10/31/ 2017	18 cm	All of our layers are still visible as the browns and greens and they are not yet soil
11/13/ 2017	17.5 cm	There's weird white stringy things in the bottoms near the potato skins and there's more soil in the bottom but the layers are still visible and the height dropped a half centimeter.
11/28/ 2017	13.5 cm	Our compost is looking like it's starting to grow mushrooms and our compost level has dropped 4 and a half centimeters since the 31st of october

Test Results: What happened to your waste? Look at your test results. Was your group successful? Use evidence to support your group's claim.

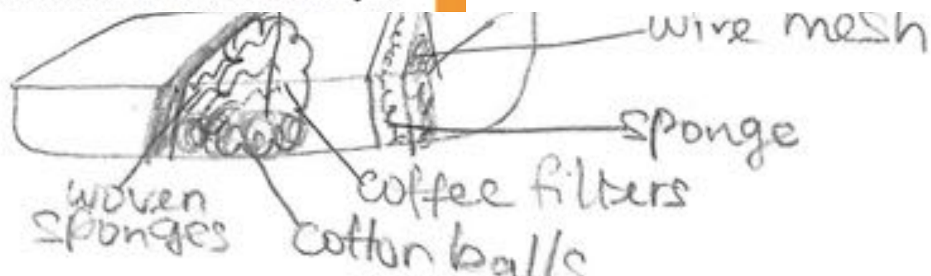
Type here NOt much of our waste decomposed especially the potatoes and egg shells, but the waste level dropped 5 hole centimeters and turned really dark and wet. I,d say our group was overall semi successful because things decomposed but not all of it.

Ideas



Add description, materials, etc.

We could cut the wire fence so it can fit into the model and we roll the wire fence. Put clay to secure wire. Put 1 inch wire to barricade the entrance.
mesh and a v shaped sponge with clay supporting the



We noticed that the sponges helped a lot and cotton balls too. We should make sure the clay is thin so water can flow.

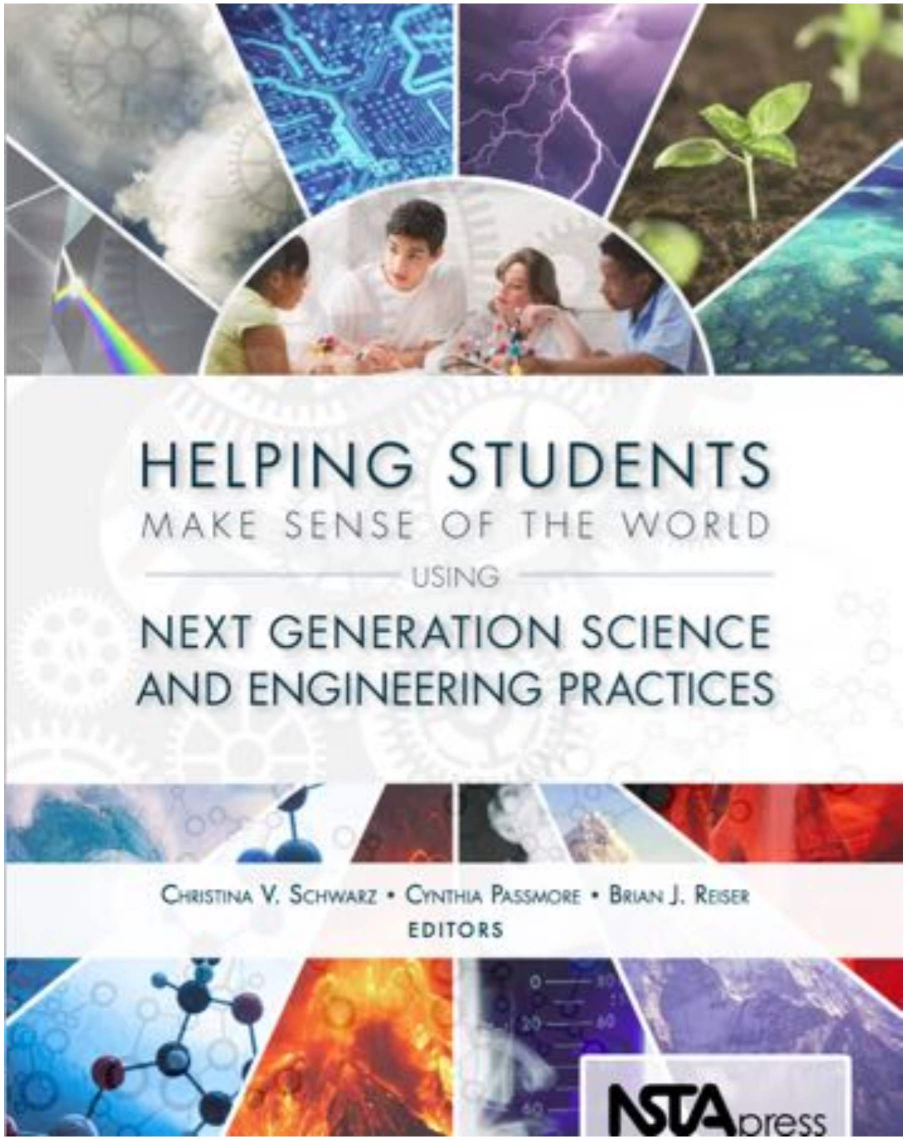
Next Gen SS Practice 6: Constructing Explanations and Designing Solutions

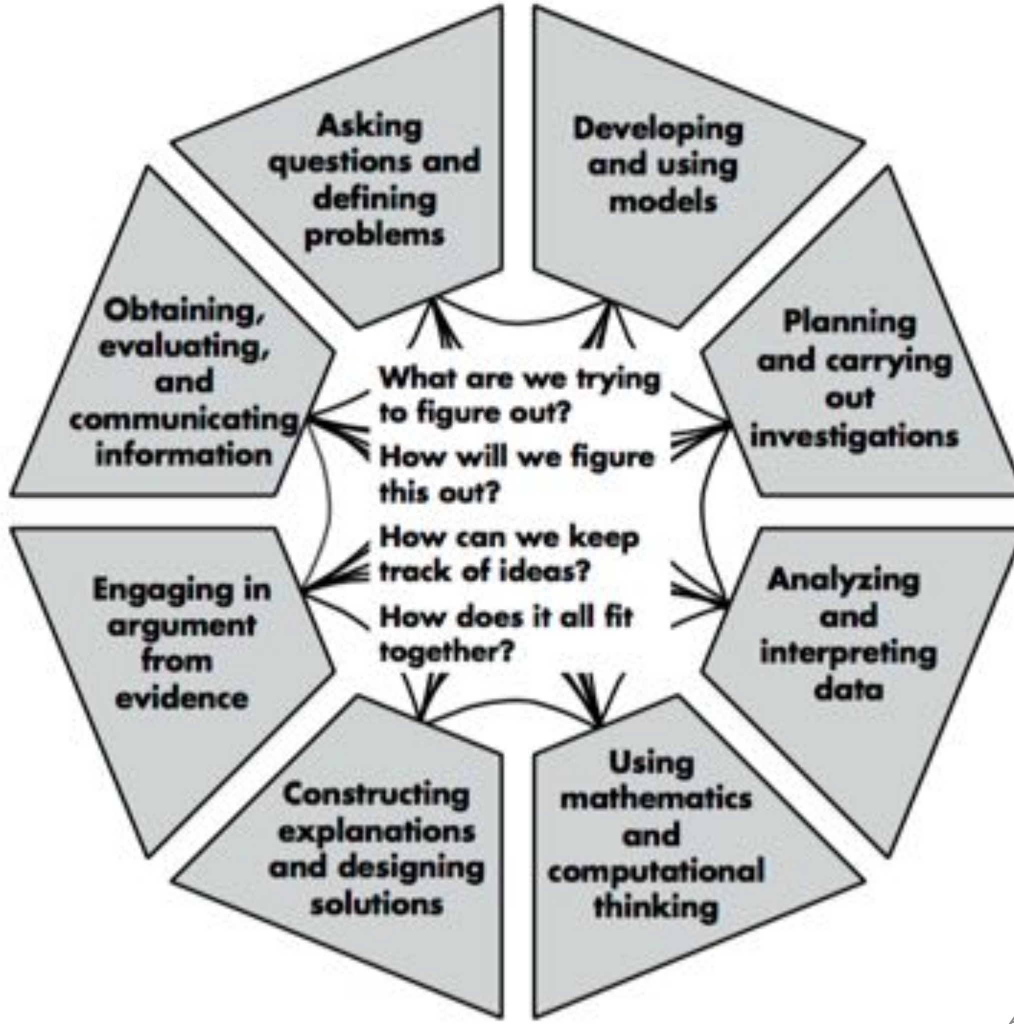
Specific Sub-Practices	Individual Notebooking	Collective Notebooking
(6.2) Use observations to explain or design	All students	No students
(6.3) Identify the evidence that supports particular points	Some students	No students
(6.4) Apply scientific ideas to solve design problems	Some students	All students

Next Gen SS Practice 7: Engaging in Argument from Evidence

Specific Sub-Practices	Individual Notebooking	Collective Notebooking
(7.4) Support an argument with evidence, data, or a model	No students	All students
(7.5) Use data to evaluate claims about cause and effect	No students	No students
(7.6) Make a claim about the merit of a solution by citing relevant evidence about how it meets criteria	All students	All students

3. Whole-class sense-making


HELPING STUDENTS
MAKE SENSE OF THE WORLD
USING
NEXT GENERATION SCIENCE
AND ENGINEERING PRACTICES
CHRISTINA V. SCHWARZ • CYNTHIA PASSMORE • BRIAN J. REISER
EDITORS
NSTApress


Asking questions and defining problems
Developing and using models
Planning and carrying out investigations
Analyzing and interpreting data
Using mathematics and computational thinking
Constructing explanations and designing solutions
Engaging in argument from evidence
Obtaining, evaluating, and communicating information
What are we trying to figure out?
How will we figure this out?
How can we keep track of ideas?
How does it all fit together?


Fractions that equal 1 whole


What does Active Listening mean?


What is a fraction?
One Whole
Fractions that equal 1 whole
years

4. Mid-design share-outs and gallery walks


Playground Design Feedback

To group: Seren Gable and anthony. P Feedback from: Taylor, lily, angel

Physical design

Is it accessible? YES \ NO ___ MAYBE ___

Can ALL kids use it? YES ___ NO \ MAYBE ___

Is it stable? YES ___ NO \ MAYBE ___

Does it look fun? YES \ NO ___ MAYBE ___

Something that impressed us:	A suggestion for improvement:
was how big you mabe the swing	make the base more stable and make a ramp fore the wheel chair to get on to the swing.

5. Community STEM partner check-ins

Main Street Journal

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msjnews.com

186 Main Street
Marlborough, MA 01752
508-460-1166

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Thank you's and questions

- National Science Foundation
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- Participating teachers and students
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- Tej Dalvi
- Chelsea Andrews
- Nicole Batrouny
- Fatima Rahman
- Rucha Londhe
- Cesar Guerrero, Greg Fiorillo, Ben Ginden, Marya Schnedeker

Kristen.wendell@tufts.edu