Hands-On STEM Integration:

An Egg-Cellent Engineering/Math Challenge

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Who I Am

- Professor of Practice in Teaching, Learning, & Technology @ Lehigh
- Instructional designer & educational technologist
- Designer of integrated STEM & agriculture curricula

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Agenda

- ➔ The Problem - Kids need STEM and agricultural literacy
- ➔ The Solution - Integrate the curriculum
- ➔ An Egg-Cellent Activity - Engineering + Math + Science
- ➔ The Results - Inquiry, Learning, and Fun!

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The Problem

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Kids need STEM literacy.

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They need agriculture, too.

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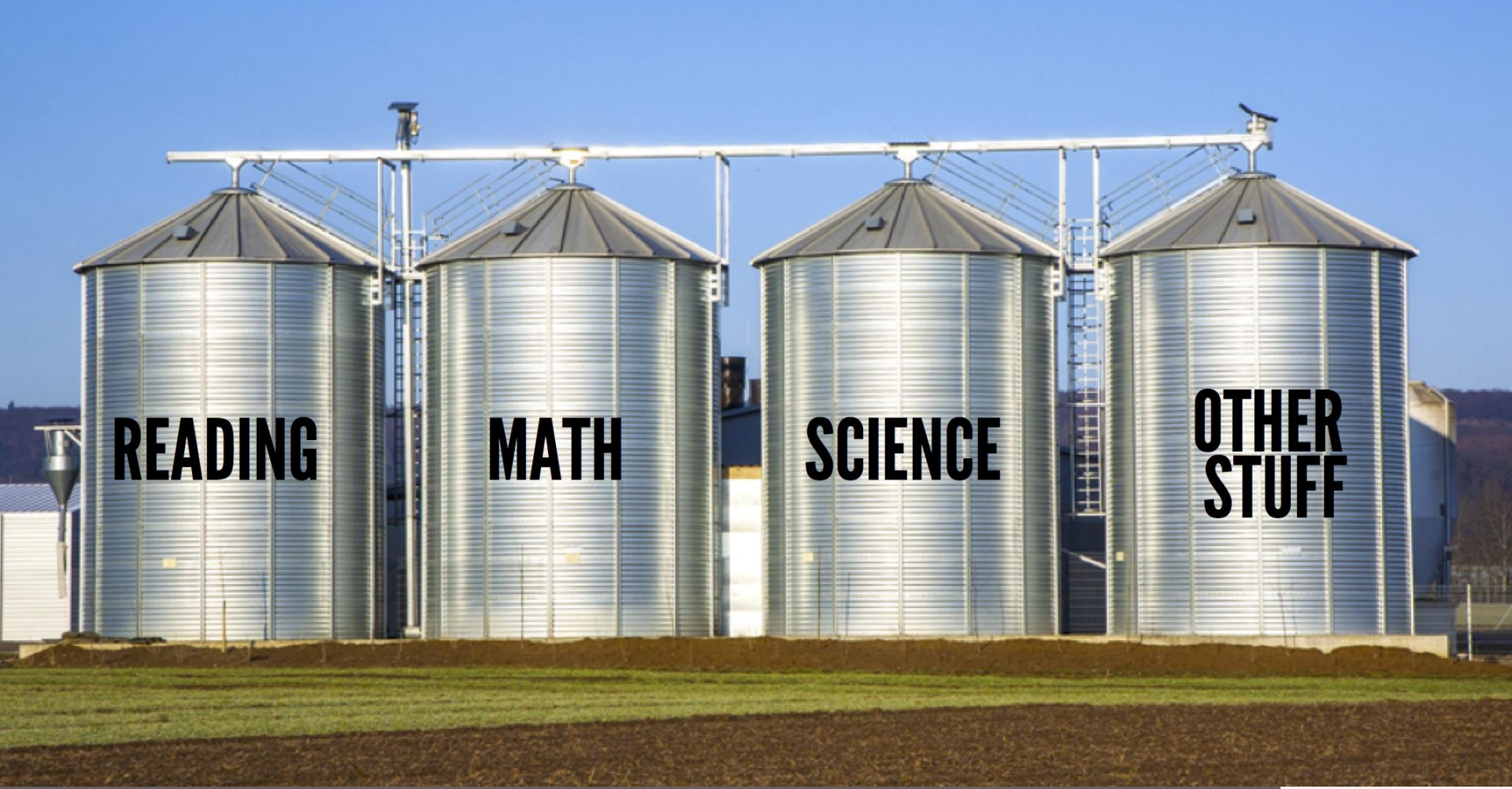

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7 /ˈsīəns/
from Latin *scientia* meaning "knowledge"

S

Science

both a body of knowledge and a process for acquiring that knowledge, known as the scientific method

10 /tekˈnäləjē/
from Greek *tekhnologia* meaning "systematic treatment"

T

Technology

the application of scientific knowledge for practical purposes

11 /enjəˈni(ə)riNG/
from Latin *ingeniare* meaning "contrive, devise"

E

Engineering

the action of working artfully to bring something about

11 /maTH(ə)ˈmatiks/
from Greek *manthanein* meaning "learn"

M

Mathematics

the abstract science of number, quantity, and space

AgLIT

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The Solution

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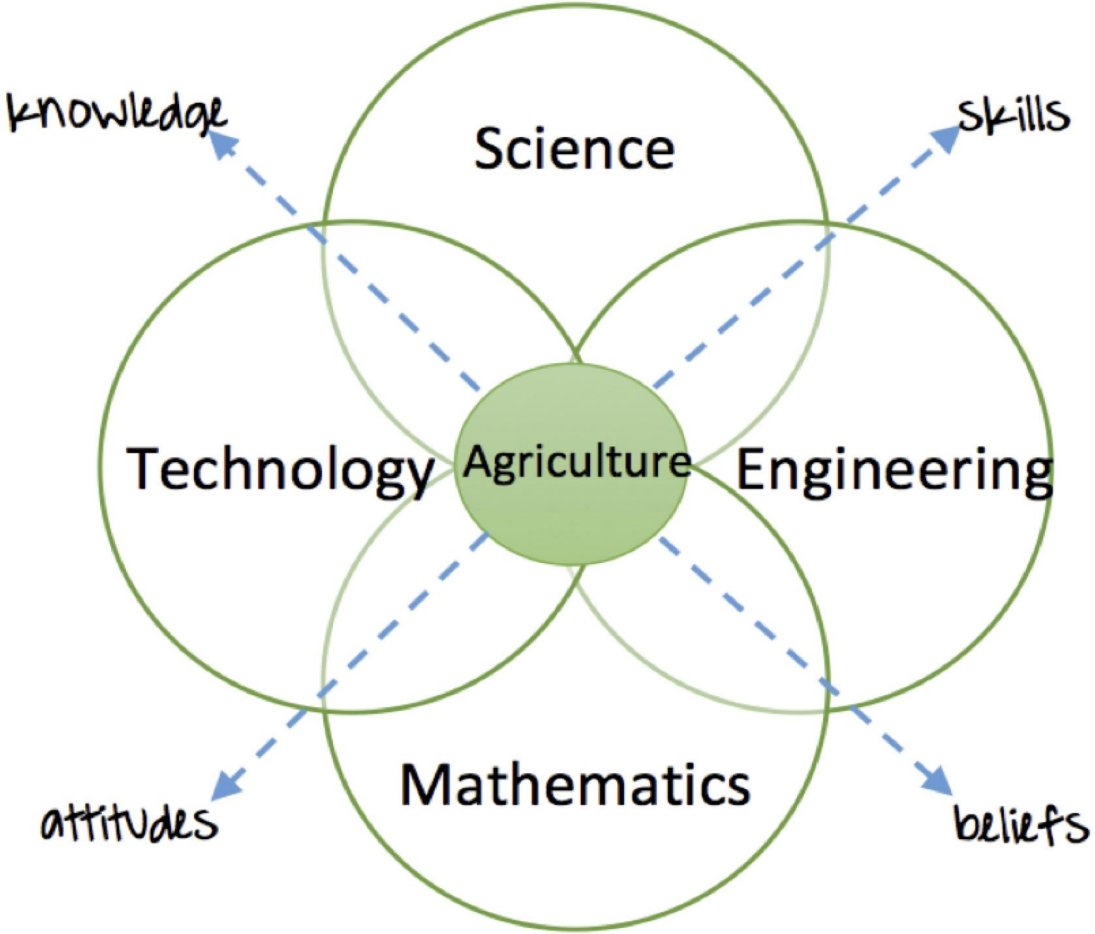

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https://tinyurl.com/y6p9vhwh

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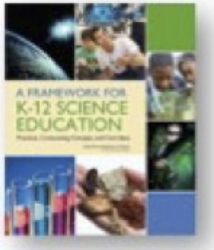
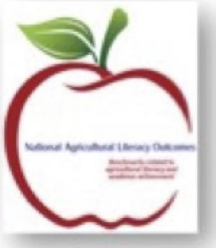
AgLIT

Agricultural Literacy through Innovative Technology

AgLIT



A Guide To
Food & Fiber
Systems Literacy



NEXT GENERATION
SCIENCE
STANDARDS

COMMON CORE
STATE STANDARDS INITIATIVE
PREPARING AMERICA'S STUDENTS FOR COLLEGE & CAREER

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NALO	FFSL	CCSS	NGSS	STATE
Gain Awareness of Global Interconnectedness:				
Culture, Society, Economy & Geography.1. Provide examples of agricultural products available, but not produced in their local area and state.	4.5.IV.D.1. Students will explain why nations trade products and services.	---	5-ESS3-1. Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.	3.4.4.D3. Investigate and assess the influence of a specific technology or system on the individual, family, community, and environment.
Acquire Conscientiousness of the Future:				
Agriculture and the Environment.4. Identify land and water conservation methods used in farming systems.	4-5.III.D.1. Students will explain how technological advancements enhance Food and Fiber Systems' efficiency.	---	4-ESS3-2. Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans.	3.4.4.B3. Explain why new technologies are developed and old ones are improved in terms of needs and wants.
Identify Applications of the Subject(s) in Practice:				
Science, Technology, Engineering & Mathematics.4. Provide examples of science being applied in farming for food, clothing, and shelter products.	4-5.I.E.1. Students will examine the changes in Food and Fiber Systems due to technological advances, and subsequent changes in occupational opportunities. They will identify agricultural careers and how they have changed.	4.MD.A.3. Apply the area and perimeter formulas for rectangles in real world and mathematical problems.	4-ESS3-1. Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment.	3.4.4.C2. Describe the engineering design process: Define a problem. Generate ideas. Select a solution and test it. Make the item. Evaluate the item. Communicate the solution with others. Present the results.
Design Models, Diagrams, and Drawings:				
Food, Health, and Lifestyle.2. Diagram the path of production for a processed product, from farm to table.	4-5.V.B.1. Students will identify the six basic food nutrients: carbohydrates, protein, water, vitamins, minerals, and fats. They will categorize foods based on nutritional content.	4.NF.B.3.D. Solve word problems involving addition and subtraction of fractions referring to the same whole and having like denominators, e.g., by using visual fraction models and equations to represent the problem.	5-LS2-1. Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.	3.1.4 B5. PATTERNS. Identify observable patterns in the physical characteristics of plants or groups of animals.

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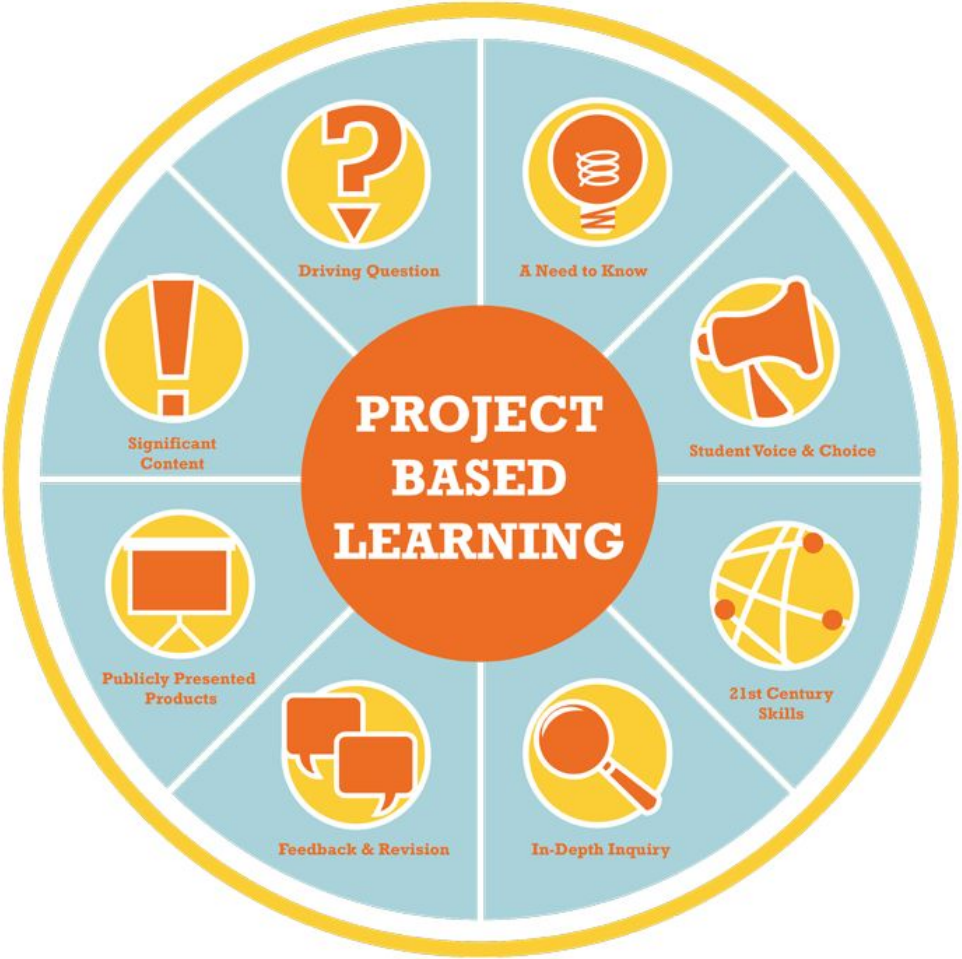

- Relevant
- Engaging
- Authentic
- Scaffolded
- Practice-Oriented for competency development

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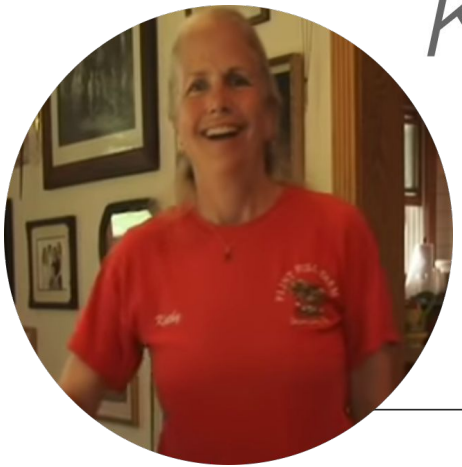
How will you help Farmer Kathy prepare for the farmers' market?



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KnowASTE
knowledge

TEST OF AGRICULTURE, SCIENCE, TECHNOLOGY, & ENGINEERING
KnowASTE

AgLIT
Agricultural Literacy through Innovative Technology

Name_____**ID**_____

Please circle the best answer to each question.

1. One reason that United States farmers can produce a great variety of agricultural by-products is that:
   a. The growing seasons are all short.
   b. United States farmers are smarter than other farmers.
   c. The United States has diverse climates, soils, and weather.
   d. Rainfall in the United States is the same all over the country.

ThinkASTE
attitudes

ATTITUDES OF AGRICULTURE, SCIENCE, TECHNOLOGY, & ENGINEERING
ThinkASTE

AgLIT
Agricultural Literacy through Innovative Technology

Name_____**ID**_____

Please rate how much you personally agree or disagree with each of the following statements.				
		I Agree	**Not Sure**	**I Disagree**
1	Scientists help make people's lives better.	O	O	O
2	Engineers help make people's lives better.	O	O	O
3	Even farm animals should be treated well.	O	O	O

PBL Tasks
skills

PRODUCING A SUSTAINABLE MARKETING PLAN
Scoring Rubric

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Agricultural Literacy through Innovative Technology

Question/Criteria	Exemplary (4)	Proficient (3)	Adequate (2)	Needs Improvement (1)	Insufficient Response (0)
	All listed activities are identified with clear illustration, specific examples.	At least half of the listed activities are depicted with general examples but lack sufficient detail.	Activities are vague but accurate.	Activities are ambiguous and include misunderstandings.	Students did not address components of the question.
Analyze current market trends (math)	Students identified and described the most important trends effectively	Students identified and described the important trends effectively but did	Students identified and described some important trends adequately and did	Students identified and described some important trends adequately but did	Students did not identify the important trends or explain the charts
Information/Media Literacy					

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An Egg-Cellent Activity

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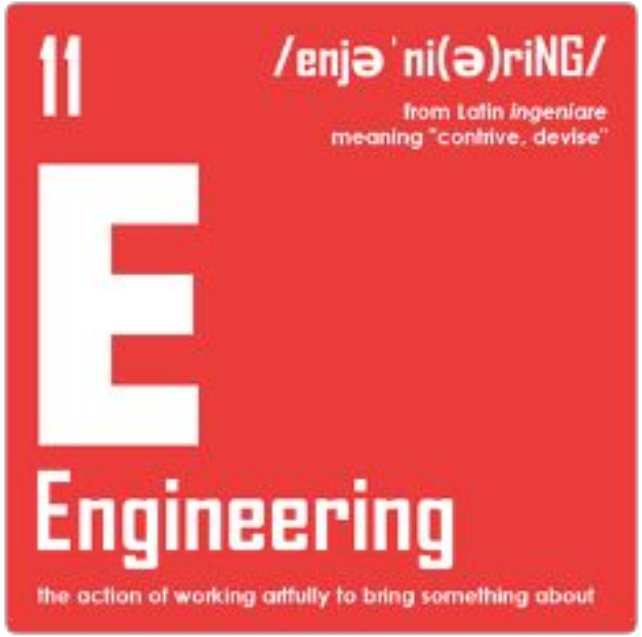

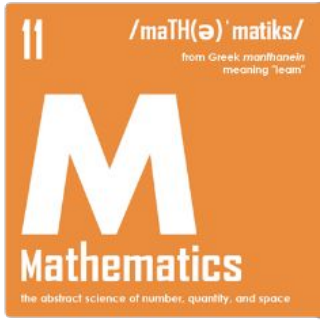

Driving Question
How will you safely transport four eggs from the farm to the farmers' market on a bumpy truck ride?

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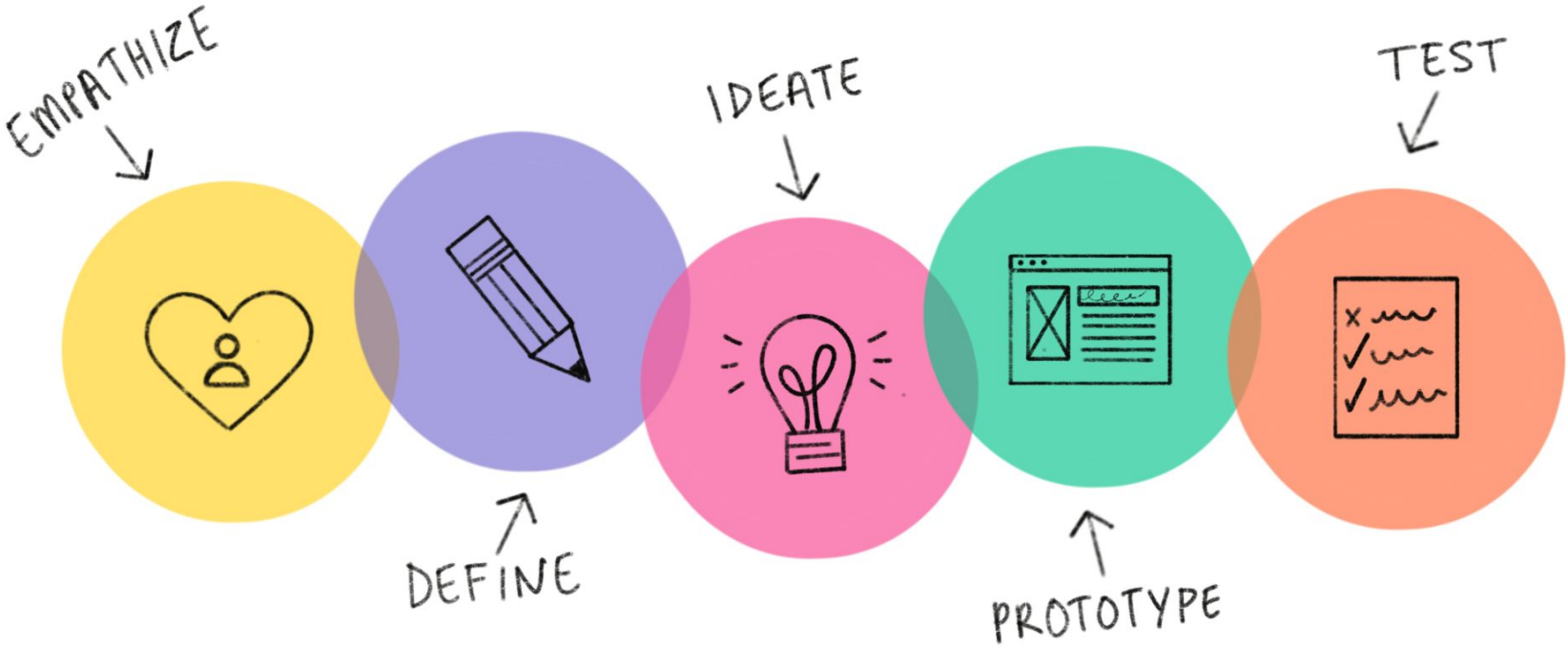

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Getting eggs to the farmers' market in one piece is going to be a real challenge – especially since there are no egg cartons on the farm. You and your team will have to design a new way of transporting the eggs to the market without breaking them. What will you use? How much will it cost? And how will you do it?

Using materials you find around the farm, you will design an egg transport system to get four eggs safely to the farmers' market. There are three things you must keep in mind when designing your transport system:

Cost Effective

Clean & Sanitary

Environmentally Friendly

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empathize

review personas

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Monica, 25

DEMOGRAPHICS

Marital Status: *Single*
Education: *Masters Degree*
Job Title: *Marketing Executive*

BEHAVIORAL IDENTIFIERS

Incredibly successful young professional who cares deeply about others and the environment. Does most grocery shopping online.

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Susan, 37

DEMOGRAPHICS

Marital Status: *Married with 4 kids*
Education: *Associates Degree*
Job Title: *Stay-at-Home Mom*

BEHAVIORAL IDENTIFIERS

Wants to feed her family well, but with 4 kids, things must be easily prepared, quick, and pre-cleaned. Does some gardening on her own.

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Frank, 68

DEMOGRAPHICS

Marital Status: *Widowed*
Education: *High School*
Job Title: *Retired*

BEHAVIORAL IDENTIFIERS

Living on a small pension and Social Security income. Very concerned about the rising costs of living and expenses. Relied on his wife to cook.

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define

review other designs

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ideate

consider materials and solutions

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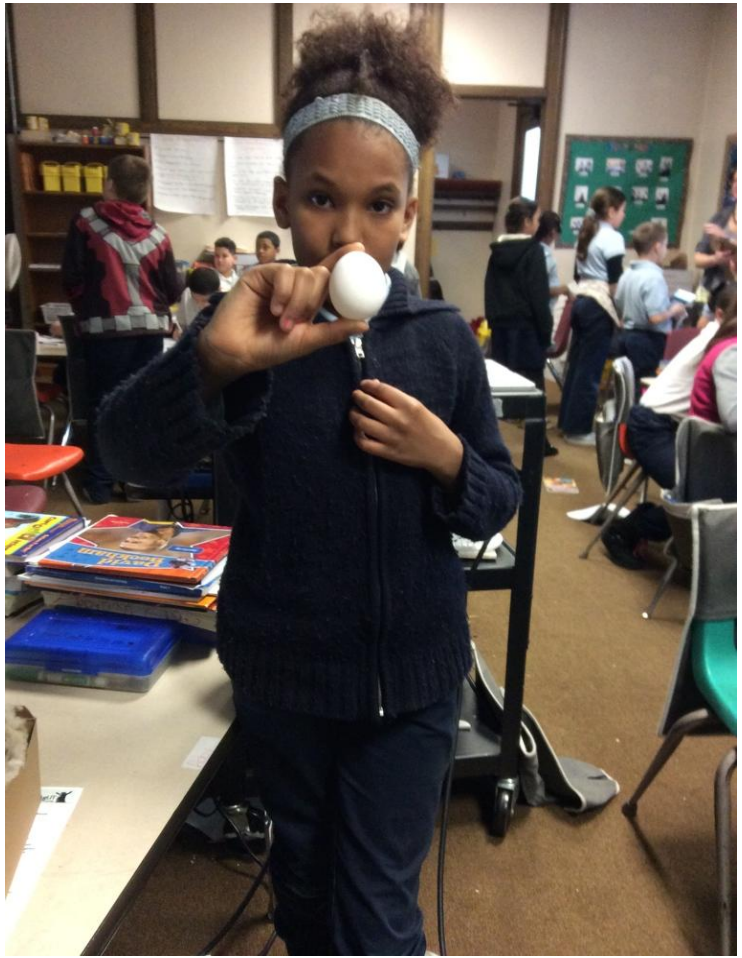

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prototype

with low and high fidelity

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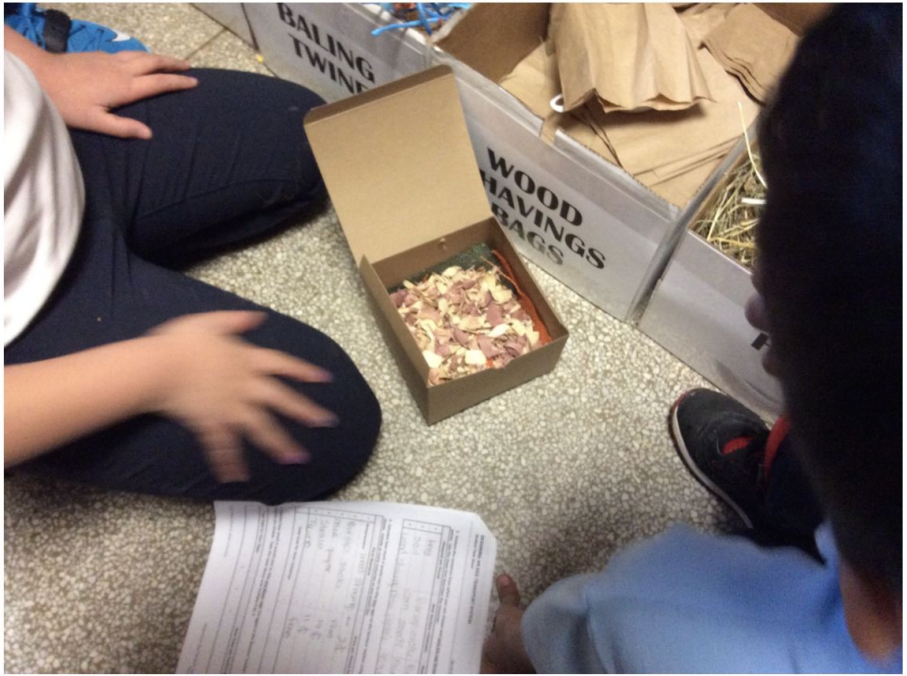

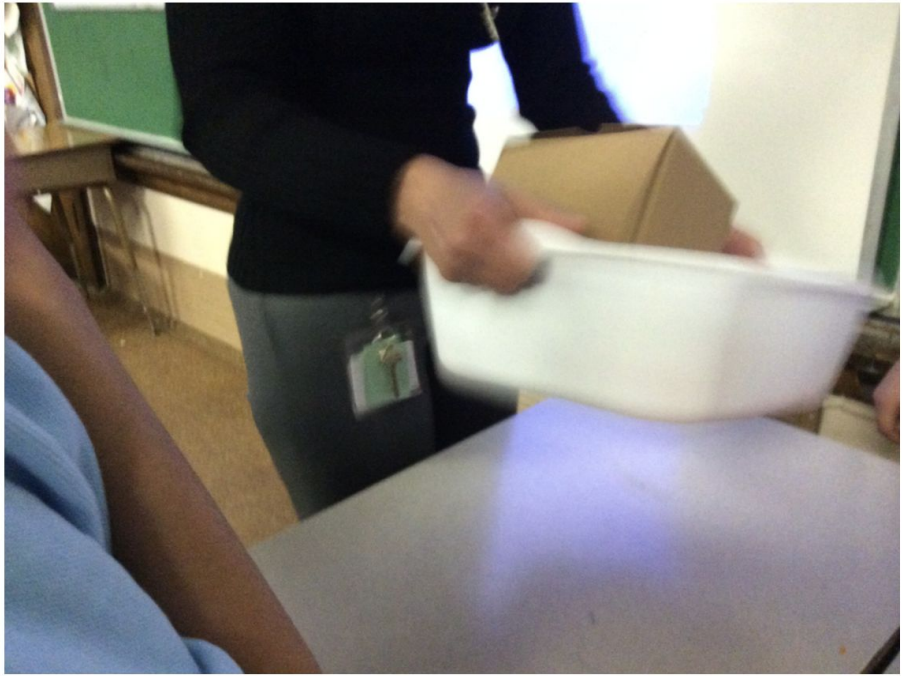

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test

on a bumpy truck ride

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reflect

on math and design

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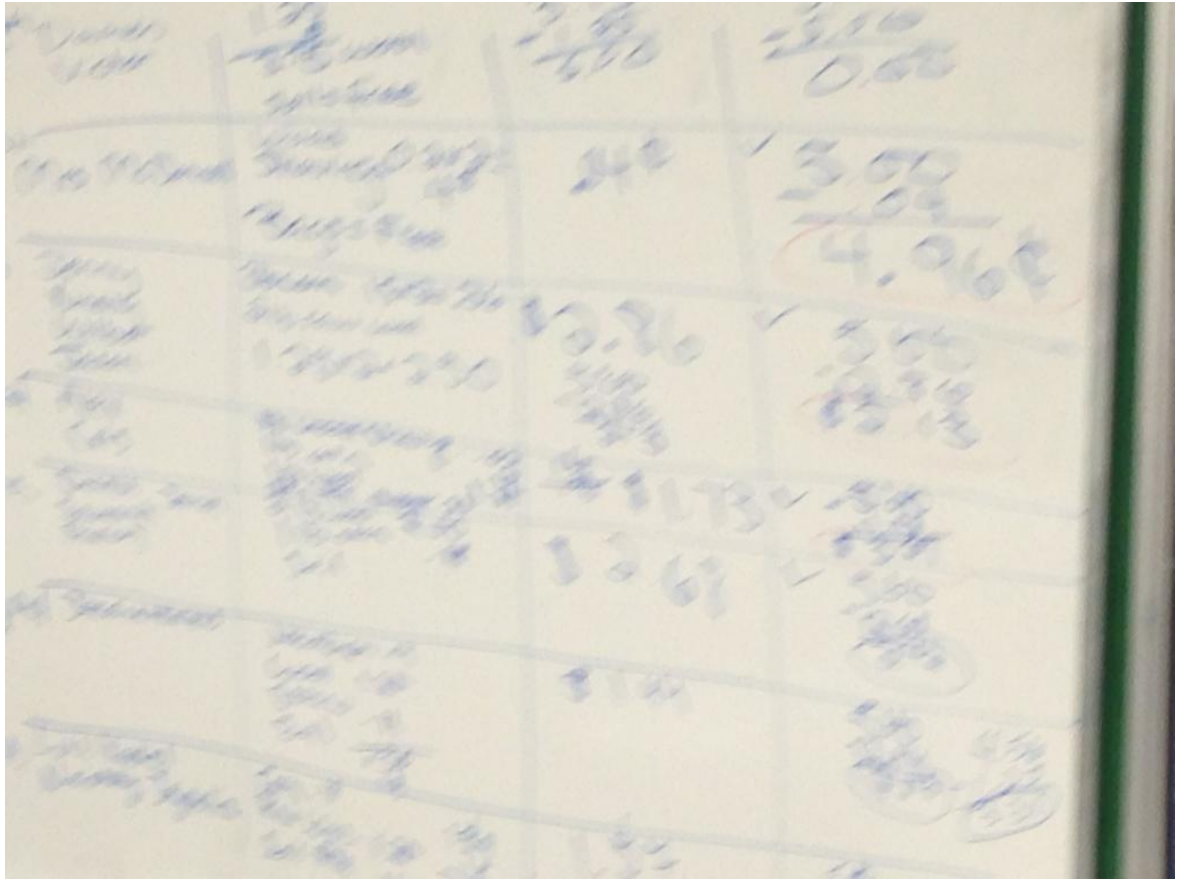

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The Results

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AgLIT

- Soil
- Sticks
- Feed Bags

Cost Effective

- Corn Feed
- Wood Shavings
- Straw

Sanitary

- Newspaper
- Feed Bags
- Baling Twine

Environmentally Friendly

* Responses are subjective.

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Student 1: Look, here's soil! It's free.

Student 2: Yeah, but it's dirty.

Student 1: So. Shouldn't we get the cheap and free stuff?

Student 2: Yeah, but it has to be clean and environmentally friendly.

Student 3: Do *you* want to buy dirty eggs?

Student 1: No....Here's burlap! It says it's free, too and it looks clean....

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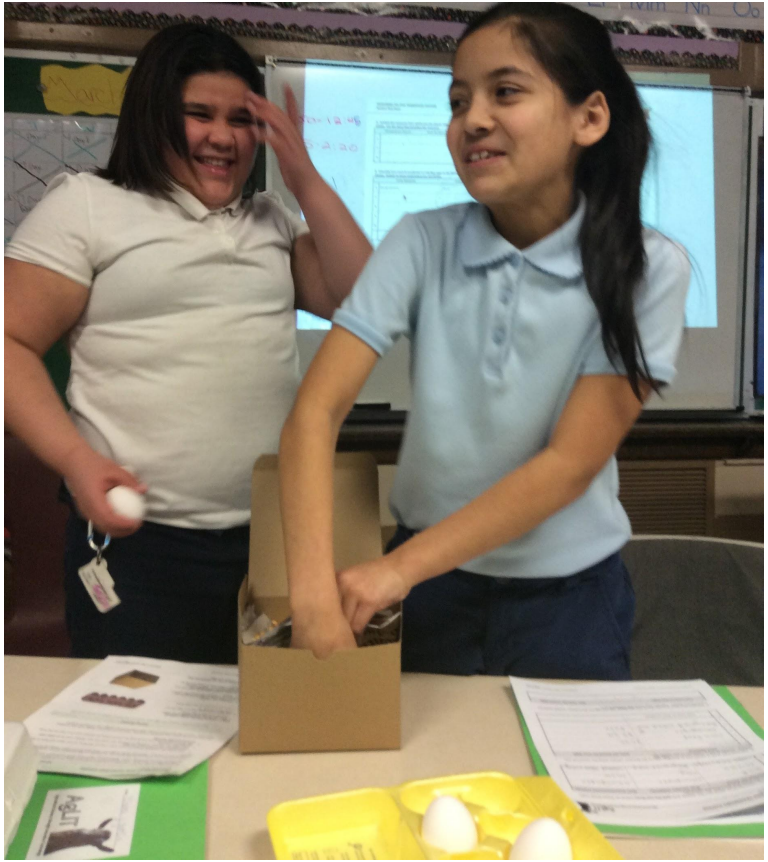

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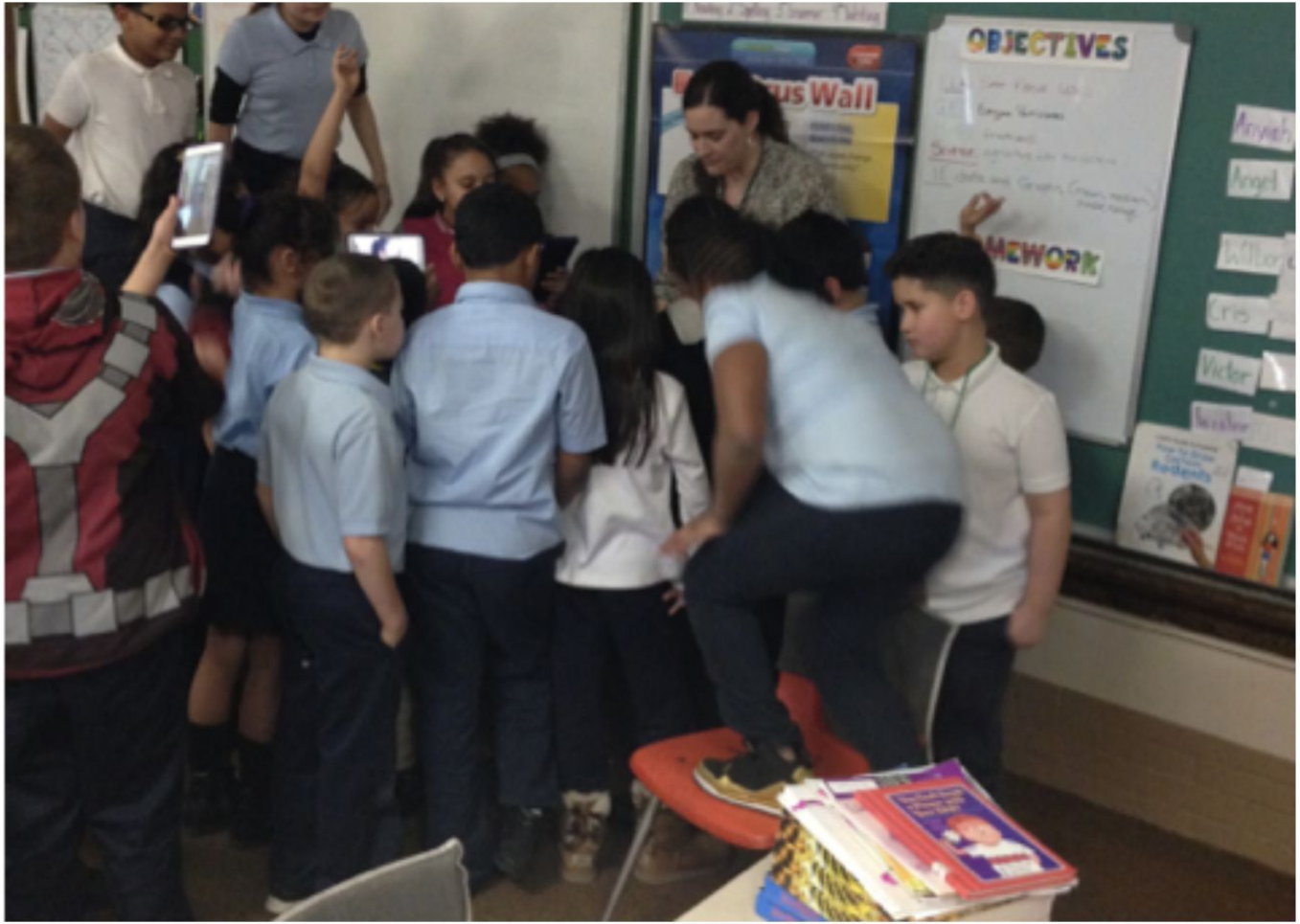

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Questions

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