

STEM Education: Establishing Engineering in Elementary Instruction



WPI

**Presented By: Matthew Bressette, Shannon Hynes,
Joseph Terwilliger, Brent Whitlock**

Mass Audubon's Wachusett Wildlife Sanctuary provides STEM Instruction



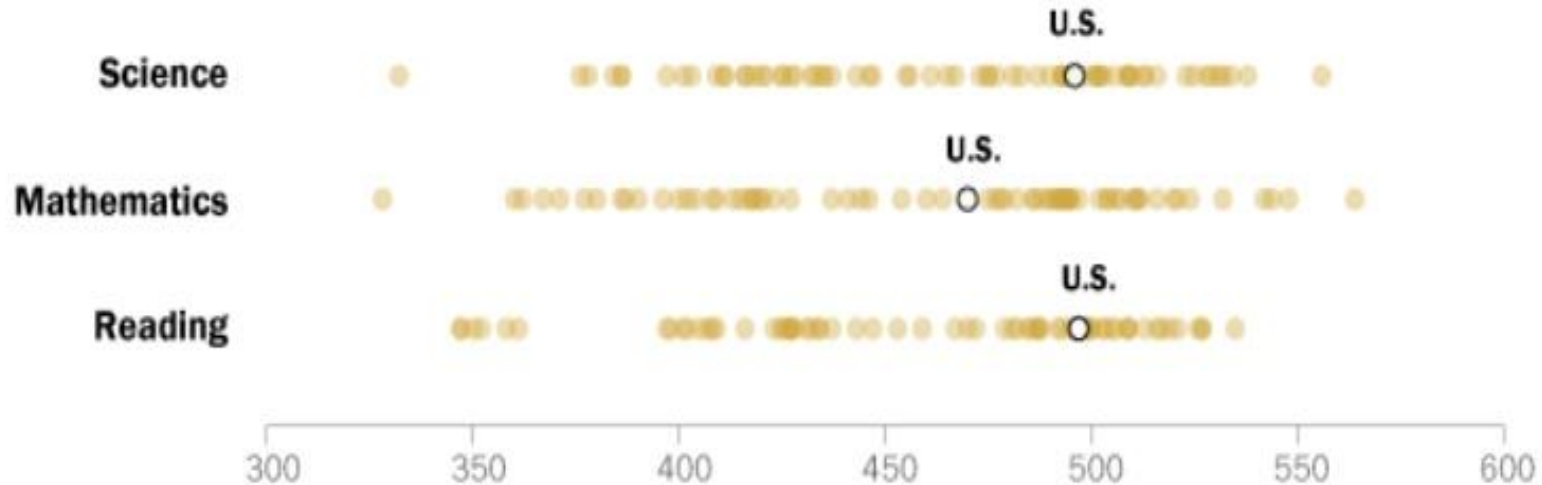
Optimistic Projections For STEM Careers

Projected Percentage in Job Increases (2010 - 2020)



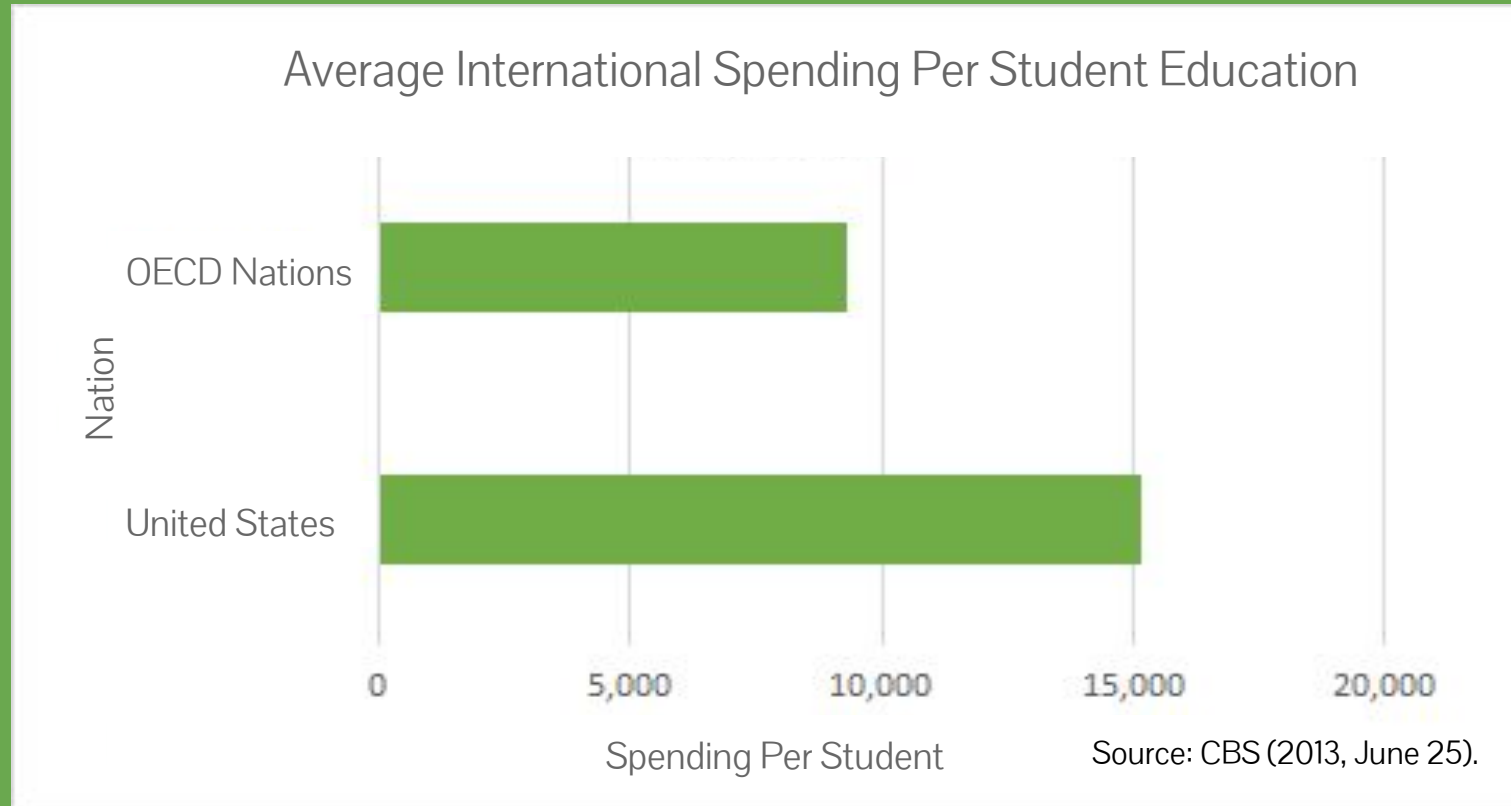
The U.S. is Not Performing in Spite of an Abundance of Resources

Average scores of 15-year-olds taking the 2015 Program for International Student Assessment



Source: DeSilver, D. (2017, February 15).

The U.S. Spends More Than Other Nations



Educators Face Challenges

Teaching in General & Specifically in STEM

Little Time for Science

“22 percent [of schools] had reduced instructional time in science in order to make more time for reading and/ or math.”

- Epstein & Miller

Limited STEM Experience

“Curriculum is already full, and few elementary teachers are comfortable teaching [STEM].”

- Hester & Cunningham

Educational Challenges

- Bloom's Taxonomy
- Different Learners
- Intelligence Ranges
- At Risk Students



STEM Education

Fundamentally Different

More Than The Acronym:

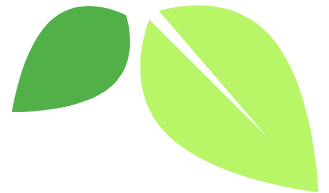
STEM education spans all disciplines

Beyond The Knowledge:

STEM education teaches a new way of thinking

Focus On Industry:

STEM education is a philosophy





Quality STEM Education

Industrial Connection

Interdisciplinary Connection

Application of Engineering Design Process

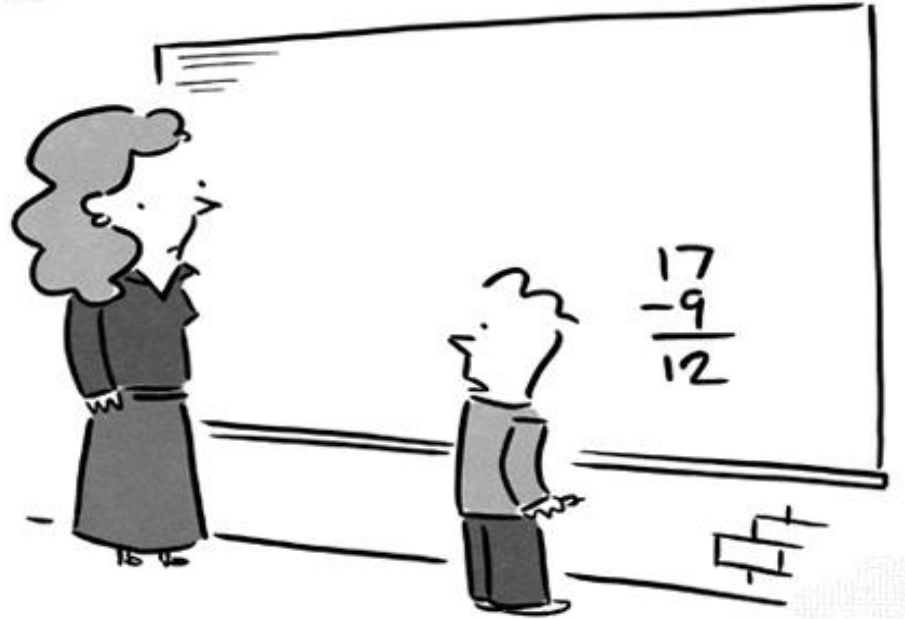
Academic Quality & Inclusivity

Specific Practices are Used to Teach Engineering Effectively

Investigations

Mathematical and
Computational
Thinking

Analyze
Collected Data



"I know it's wrong, I'm just waiting for the autocorrect."

The Goal of Our Project is to Develop Engineering in Early Instruction

What We Know:

- STEM Education Matters
- STEM Education Needs Improvement
- Quality Frameworks Facilitate STEM Education

Our Project

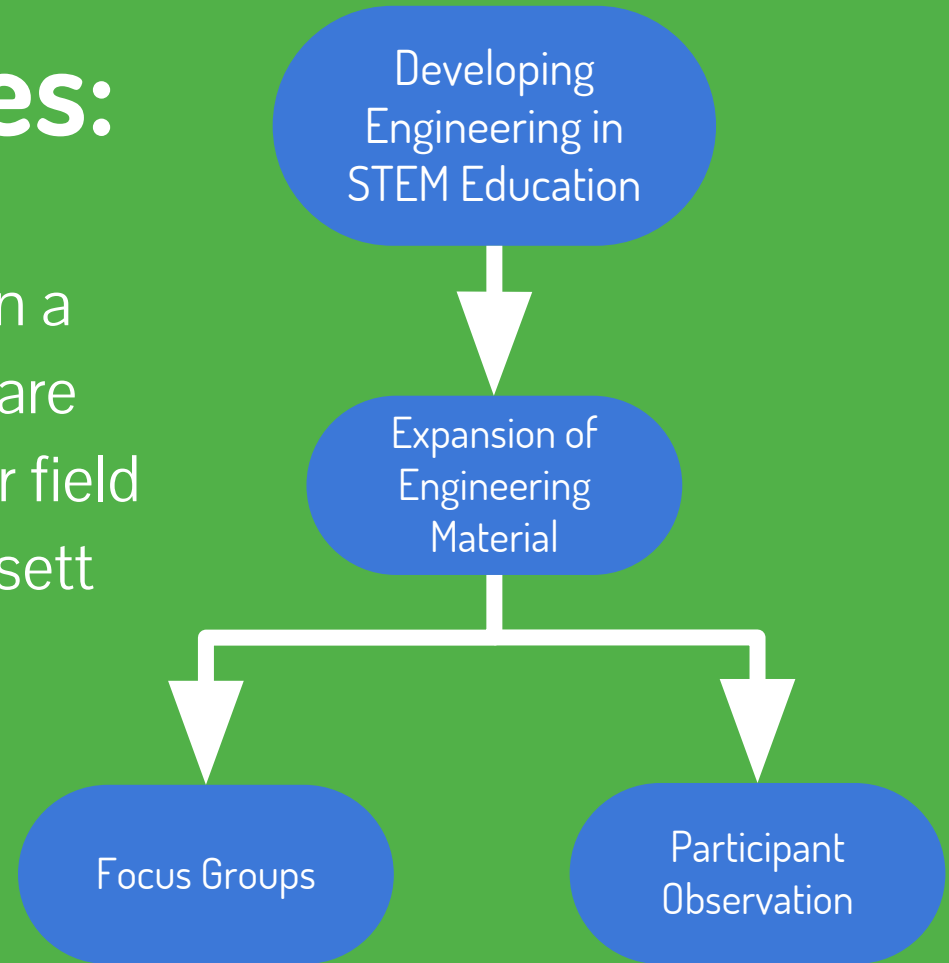


Establish Engineering in Elementary Instruction:

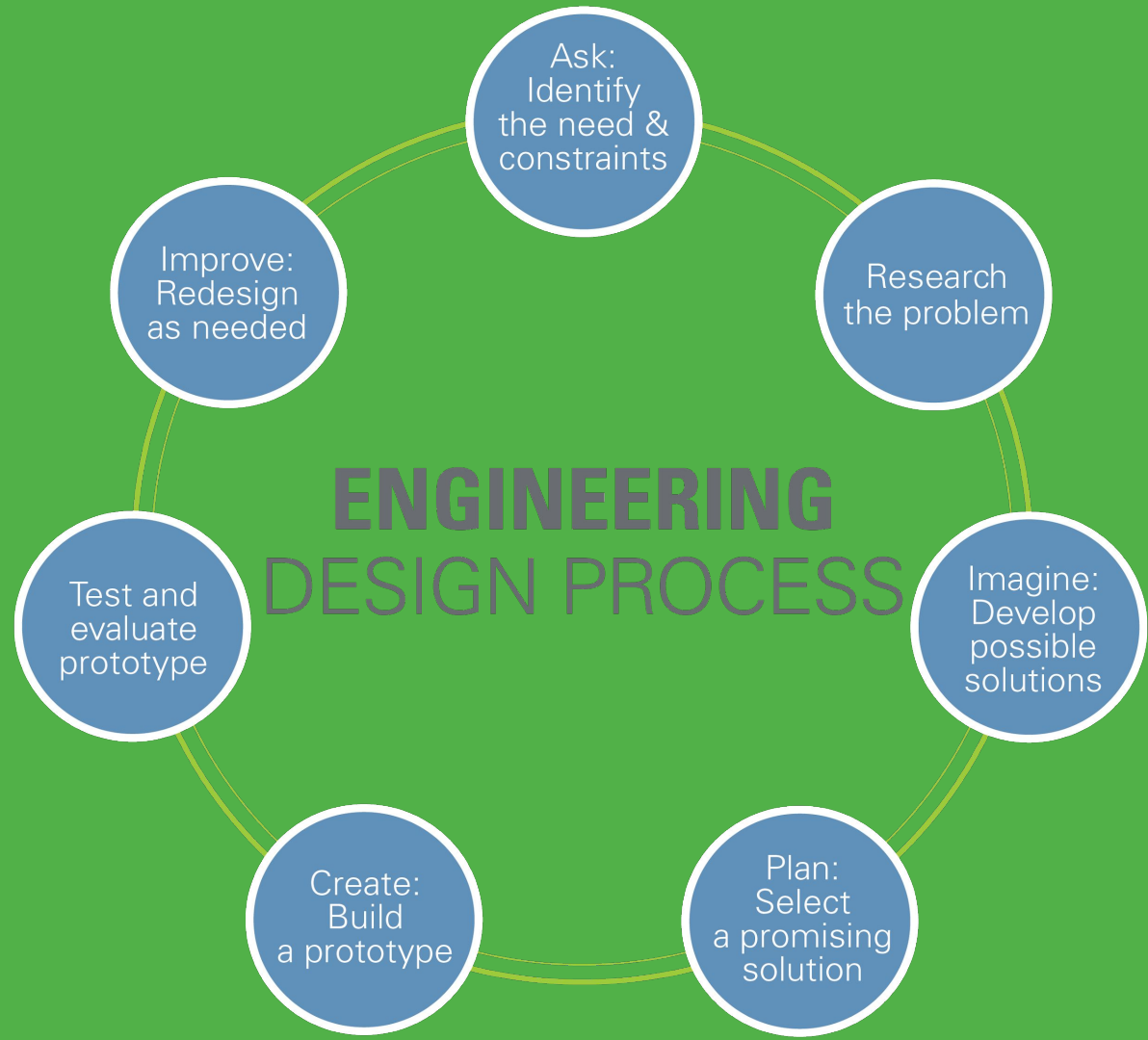
- Facilitating Elementary STEM Implementation
- Providing Faculty with Educational Resources

Project Objectives:

The expansion of engineering in a STEM curriculum that will prepare students for the end of the year field trip at Mass Audubon's Wachusett Meadow Wildlife Sanctuary.



The Engineering Design Process Must be Introduced When Teaching STEM



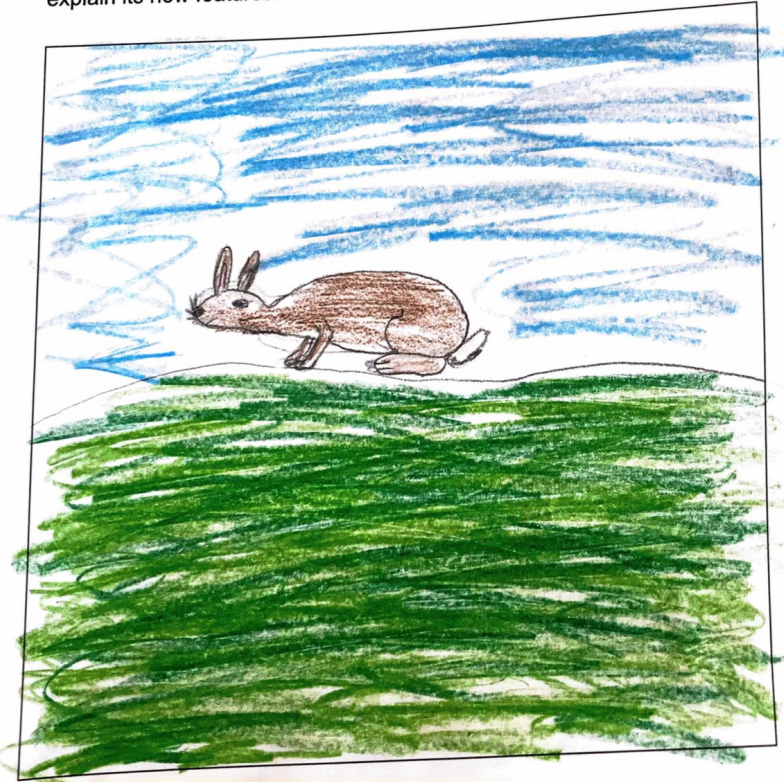
Engineers Often Redesign to Solve a Problem



Why did you choose this animal? Explain how your changes will help the animal be a more successful hunter or hider.

add claws to climb trees
change color to brown to blend in
with the forest

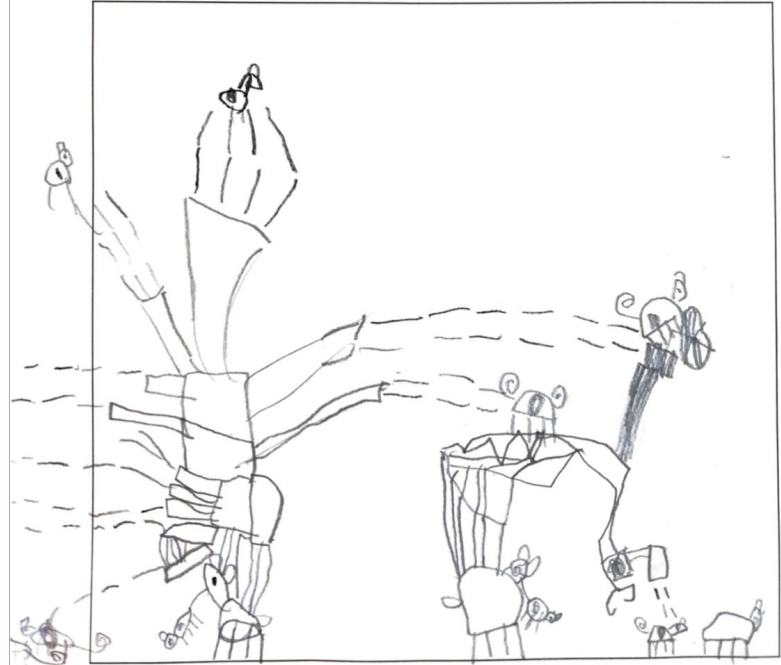
Draw the new and improved animal here! Be sure to label the animal and explain its new features.



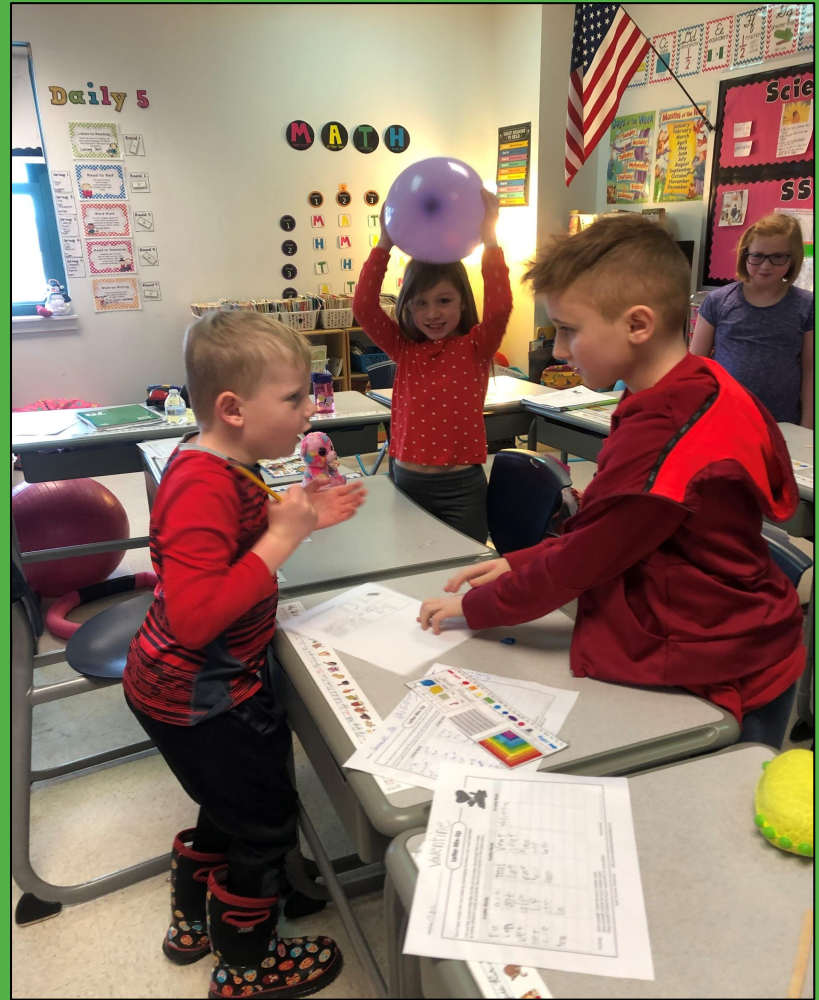
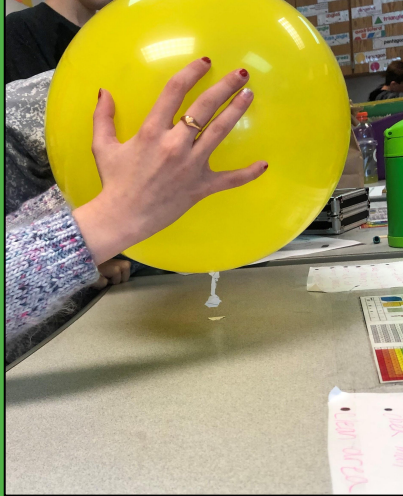
Why did you choose this animal? Explain how your changes will help the animal be a more successful hunter or hider.

made a laser tank on its back on a
notebook, put a laser gun and a clapnet
and extra sensor

Draw the new and improved animal here! Be sure to label the animal and explain its new features.



The Static Electricity Activity Guides Students Through The Engineering Design Process



Name: _____
Date: _____

Direction





1. Will the object move?

Objects
YES
NO

2. Get a fast for 1 object.
3. Hold the object of material.
4. After you observe the object move.

we learnt that positive and negative charge attract each other. - knize, paper, paper, paper

Fill in observations here.





Objects				
What did the pile do... -Stick to balloon -move slightly to center and almost stick -stay still, no movement	NO	yes	NO	no

I think it worked because paper contains the materials and is light enough to be attracted by static electricity.

I think it works because it is light enough.

the same.

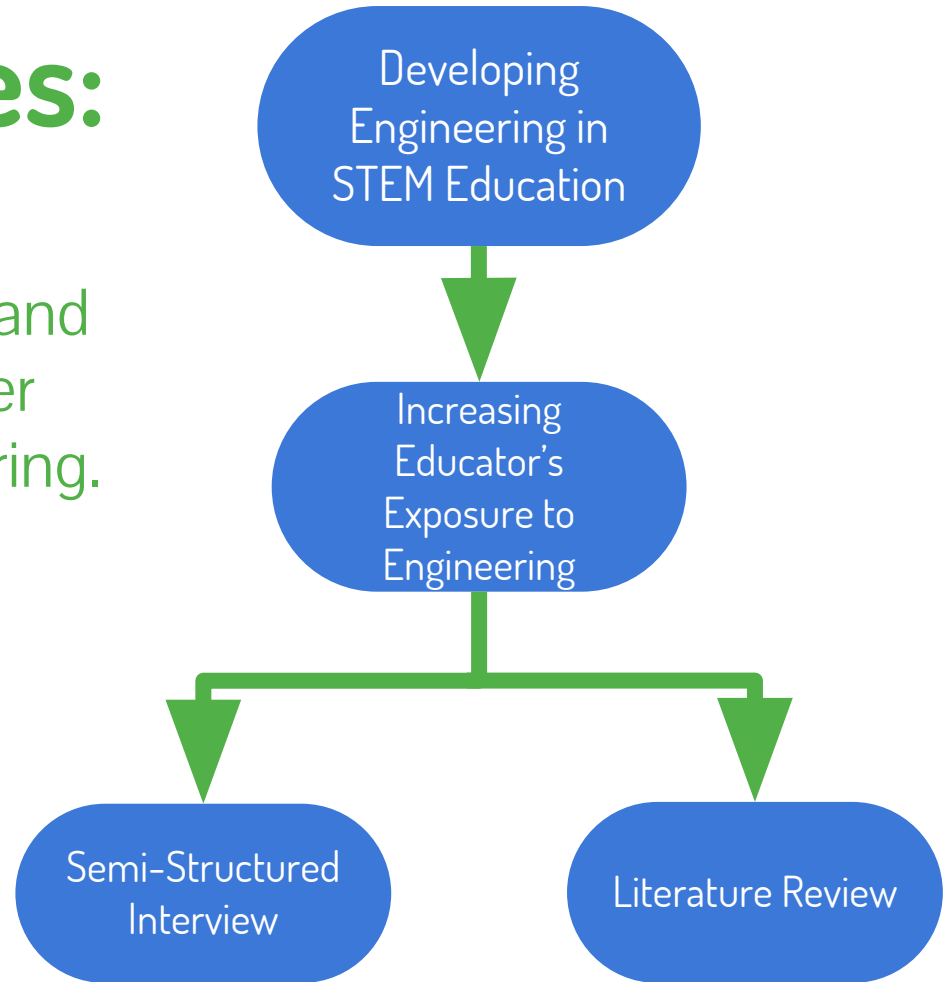
Fill in observations here.

Objects				
What did the pile do... -Stick to balloon -move slightly to center and almost stick -stay still, no movement	It Didn't stick !!)	It Sticked !!)	It Didn't stick !!)	It Didn't stick !!)

It worked because it is made of sticky paper.
no that's wrong.

Project Objectives:

Characterizing common barriers and identifying opportunities to further educate teachers about engineering.

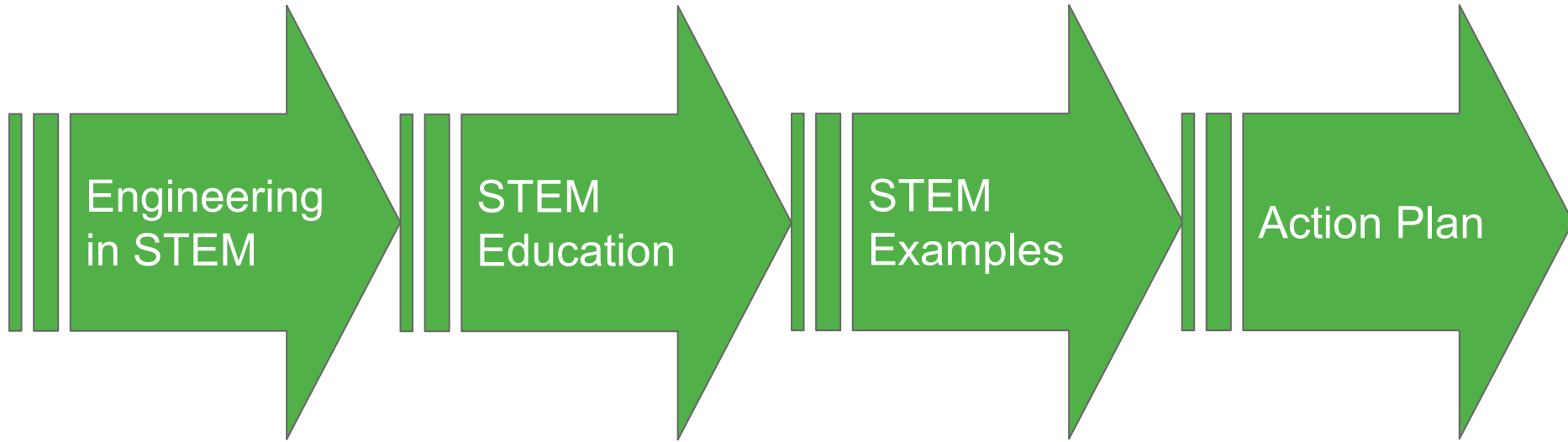


Engineering is Supported by All Elements of STEM

Engineering is “The ultimate human endeavor, creating solutions to the world’s challenges and designing the products that support our quality of life”

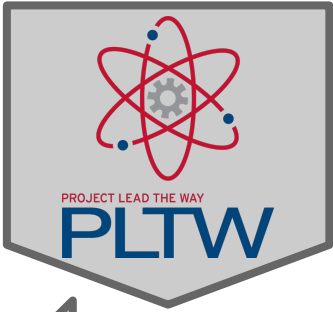
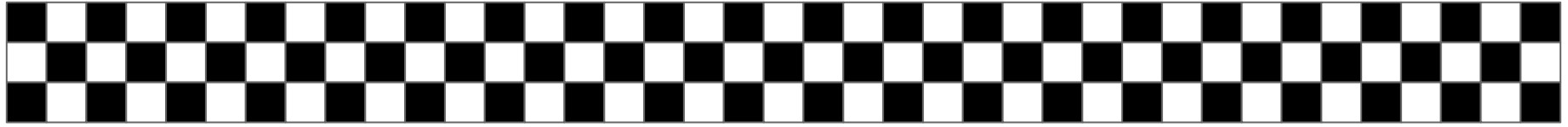


Encourage Educators to Incorporate Engineering



Sold On STEM?

Let's Start Implementing!



Professional
Development

Mass
Audubon
Program

The WPI
Plan

Online
In Person
In Mind

STEM
Educator

Educator

Parent

More

Involvement in
STEM Education

Less



The Created Curriculum Made
a Positive Impact

References

- Gallenstein, N. L. (2005). Engaging young children in science and mathematics. *Journal of Elementary Science Education*, 27-41. Retrieved from https://www.jstor.org/stable/43156150?seq=1#metadata_info_tab_contents
- CBS. (2013). U.S. Education Spending Tops Globalist List, Study Shows. Retrieved from <https://www.cbsnews.com/news/us-education-spending-tops-global-list-study-shows/>
- Science, Technology, Engineering and Math: Education for Global Leadership. (n.d.). Retrieved from <https://www.ed.gov/stem>
- DeSilver, D. (2017). U.S. academic achievement lags that of many other countries. Retrieved from <http://www.pewresearch.org/fact-tank/2017/02/15/u-s-students-internationally-math-science/>
- Engineering Design Process. (n.d.). Retrieved from <https://www.teachengineering.org/k12engineering/designprocess>
- Wachusett Meadow Wildlife Sanctuary. (n.d.). Retrieved from <https://www.massaudubon.org/get-outdoors/wildlife-sanctuaries/wachusett-meadow>

Thank You!

Kristin Steinmetz and Mass Audubon
Donna Taylor at the WPI STEM Center
Clinton Elementary School Teachers
Andrew Wood STEAM Educator in Brownsville Vermont
Professor Foo our Advisor

Any Questions?