STEM Education: Establishing Engineering in Elementary Instruction

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)

- **All STEM**: 14%
- **Math**: 16%
- **Computer Systems Analysis**: 22%
- **System Software Developers**: 32%
- **Medical Scientist**: 36%
- **Biomedical Engineer**: 62%
The U.S. is Not Performing in Spite of an Abundance of Resources

The U.S. Spends More Than Other Nations

Average International Spending Per Student Education

- **OECD Nations**
- **United States**

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

Establish Engineering in Elementary Instruction:
- Facilitating Elementary STEM Implementation
- Providing Faculty with Educational Resources

Our Project
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 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 later tank on its back on a note with laser eye and a claw and an 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
Teachers and Student Editions Provide Structure to Our Hands on Experience

we learnt that positive and negative charges attract each other. -Kleia and Giovanna

I think it worked because it is light enough to be attracted by static electricity.

I made of sticky paper because it didn’t work.

Fill in observations here.

<table>
<thead>
<tr>
<th>Object</th>
<th>Directions</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stick to balloon</td>
<td>Stay still, no movement</td>
<td>11/21/2023</td>
</tr>
<tr>
<td>Sheet of paper</td>
<td>Almost stick</td>
<td>11/21/2023</td>
</tr>
<tr>
<td>Rubber eraser</td>
<td>Move slightly to center and stay still, no movement</td>
<td>11/21/2023</td>
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</table>

What did the object do?

- Stick to balloon
- Almost stick
- Move slightly to center and stay still, no movement

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Fill in observations here.
Project Objectives:

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

Developing Engineering in STEM Education

Increasing Educator’s Exposure to Engineering

Semi-Structured Interview

Literature Review
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

- Engineering in STEM
- STEM Education
- STEM Examples
- Action Plan
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


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?