PictureSTEM: Using Picture Books to facilitate STEM Learning in Elementary Classrooms

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Agenda

- Second Grade Unit- Designing a Toy Box Organizer
- Overview of K-6 modules
- Discussion

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STEM Integration in Elementary

- Recent National reform documents
  - have identified the importance of scientific and technological literacy to sustain the U.S economy (NRC; 2009, 2012)
  - increase the number of students pursuing STEM fields to remain competitive in the global economy
- Link between Science and Engineering in NGSS
- We also need to get more students interested in STEM fields, children's exposure to engineering should begin in elementary school (NAE 2009, NRC, 2012).

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Designing a Toy Box

- **Second Grade Module (K-2)**

Science Connections	Engineering Connections	Mathematics Connections
• Physical characteristics (color, size, shape, weight, texture, flexibility, strength) • Types of materials in objects	• Importance of materials • Engineering design • Nature vs. human- made	• Standard units of measurement • Understand length as a measurable attribute • Use tools to measure length

Engineering Design Challenge

- Parents have been complaining about messy toys
- A toy company wants to build a new and improved toy box.
- But they need your help!
  - What could they do to help keep the toys organized when they are in the box?

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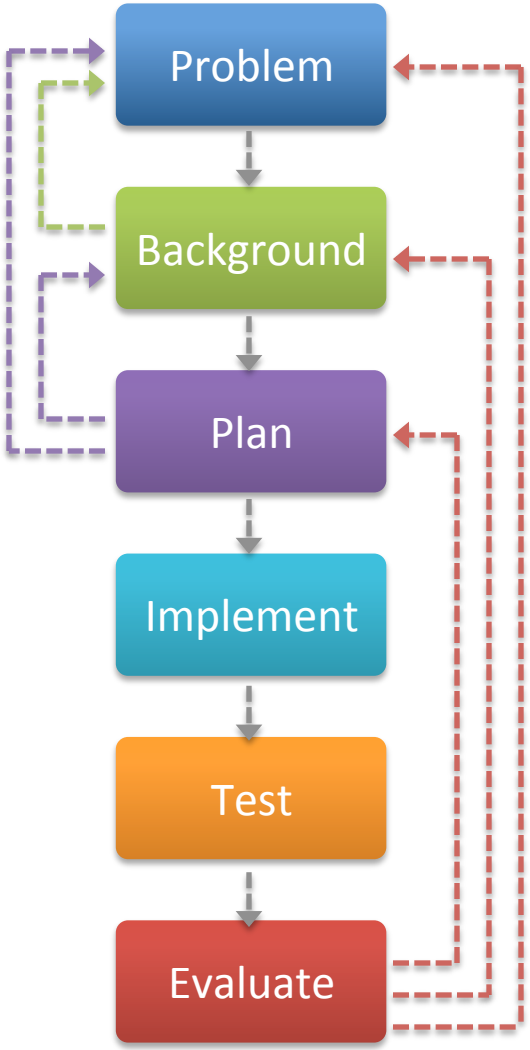
An Engineering Design Process



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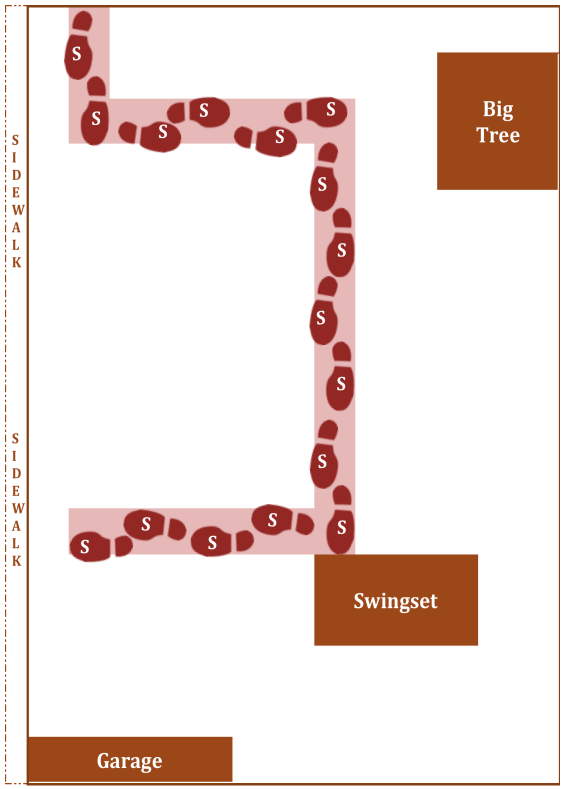
Designing a Toy Box

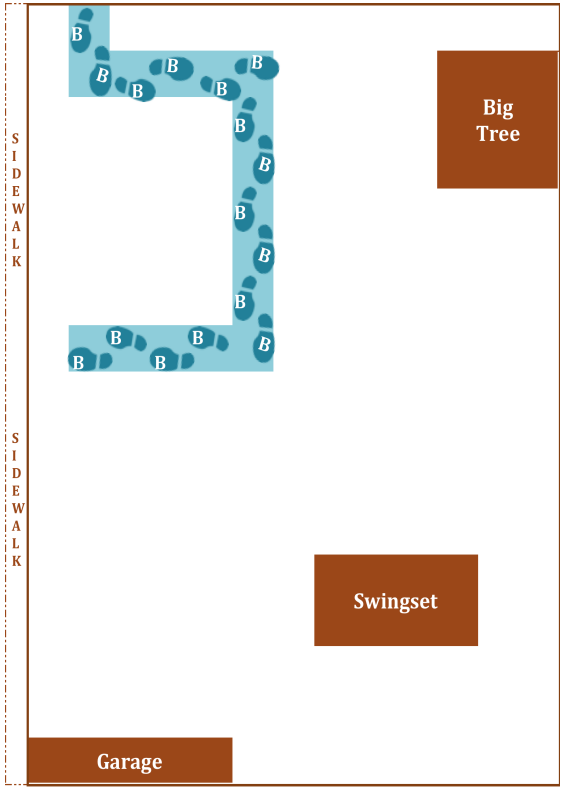
	Day 1 – Non-standard units	Day 2 – Standard vs. Non-standard	Day 3 –Physical properties	Day 4 – Testing Materials	Day 5 – Designing a toy box
Literacy Activities Suggested guided reading:	Book: How Big is a Foot? Strategy: Story Structure	Book: Measuring Penny Strategy: Compare & Contrast	Book: Living Color Strategy: Questioning	Book: Leo Cockroach Strategy: Sequencing to lead to summarizing	Book: Too Many Toys Strategy: Summarizing narrative text
STEM integration activities	Treasure Hunt MEA	Design your own class "standard"	Sort materials by physical properties and describe objects in terms of physical properties (Mystery bag)	Testing materials, Planning and initial design	Create, test, and redesign your toy organizer

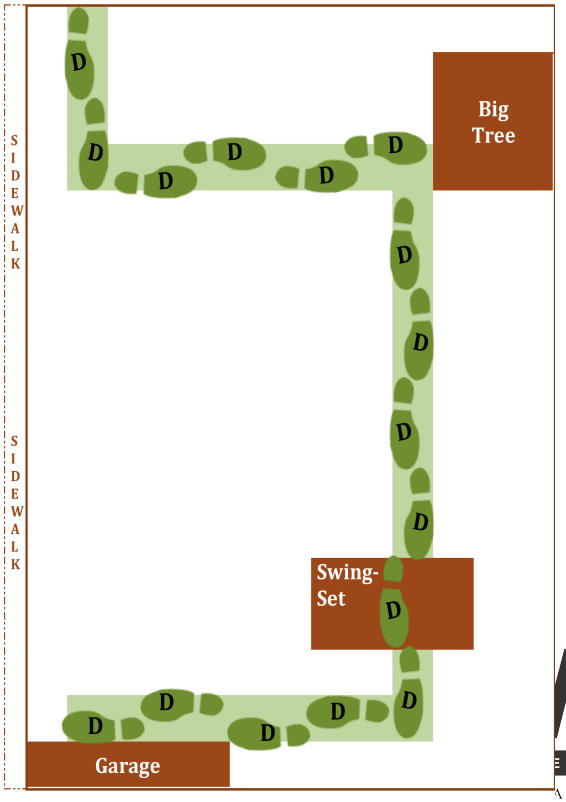
Day 1: Non –Standard Units - STEM

- Treasure Hunt Activity
  - Part 1: Students physically act out the problem scenario

- Susie wants to make a treasure hunt for her upcoming birthday party





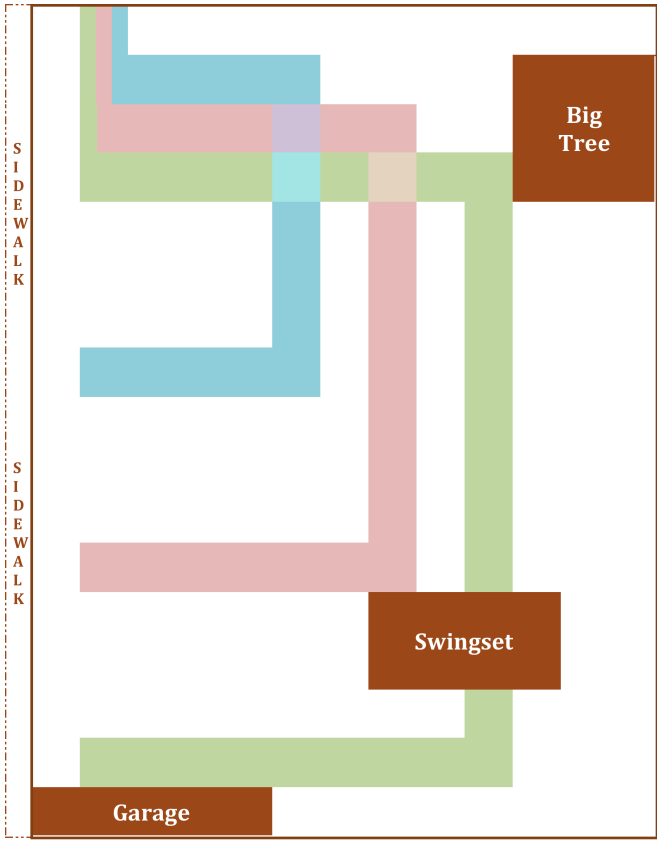


Day 1: Non –Standard Units - STEM

- Treasure Hunt Activity

- Part 2: How can we help Susie?
  - The three paths are shown in the picture on the right.

- Work with your group to come up with an answer.



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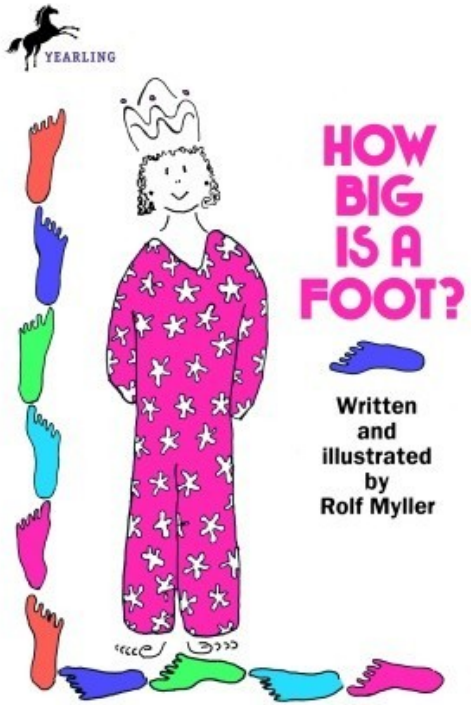
Day 1: Non –Standard Units - Literacy



This Story:

- Builds off the STEM activity
- Reinforces the idea of standard units

Book: How Big is a Foot? by Rolf Myller

Reading Comprehension Strategy: Using story structure to identify key details

- Who, What, When, Where, How

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Day 2: Standard vs. Nonstandard-STEM

- Part 1: How do we measure our toy box?
  - Student use different materials to determine the size of the toy box

- Design our own class “standard”

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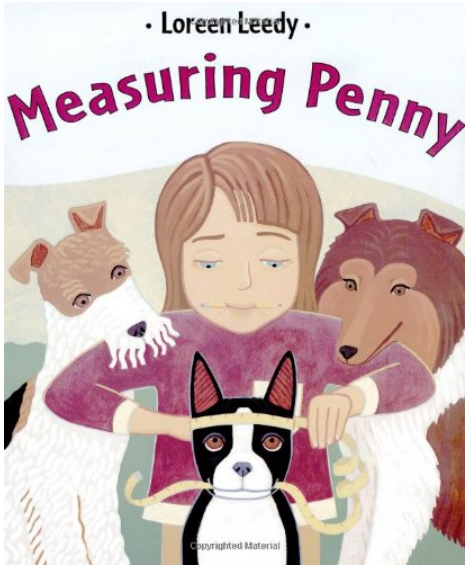
Day 2: Standard vs. Nonstandard-Literacy



This Story:

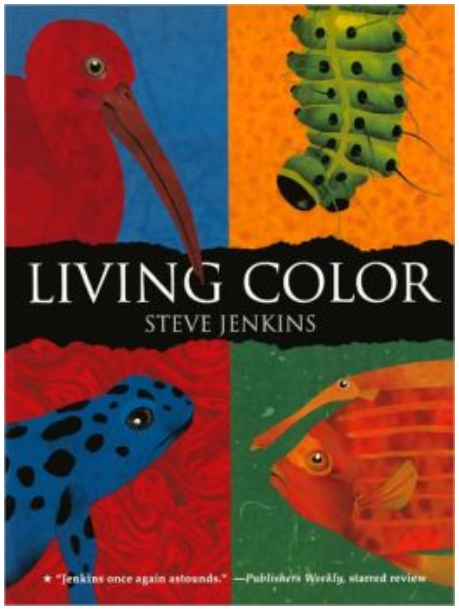
- Builds off the STEM activity
- Reinforces the idea of measuring with different types of measurements and units

Book: Measuring Penny by Loreen Leedy

Reading Comprehension Strategy: Compare and Contrast

- looking at the different units that are used within the story

Day 3: Physical Properties - Literacy



This Story:

- Provides an example of classifying animals by color (physical property)
- Builds background for the STEM activity using a different context

Book: Living Color by Steve Jenkins

Reading Comprehension Strategy: Identifying Important Details

- using a graphic organizer to help identify and record these details

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Day 3: Physical Properties - STEM

- Part 1: Sorting Activity
  - Students first explore and sort the materials how they want
  - Introduce the key vocabulary

    - Color
    - Size
    - Shape
    - Weight
    - Texture
    - Flexibility
    - Strength

  - Sort the objects using the different vocabulary words

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Day 3: Physical Properties - STEM

- Part 2: Mystery Bag
  - Students try to guess the object that is hidden in their mystery bag
    - Looker
    - Guesser
    - Can only ask yes or no questions
    - Try to use the vocabulary words we learned to help you

- Color
- Size
- Shape
- Weight
- Texture
- Flexibility
- Strength

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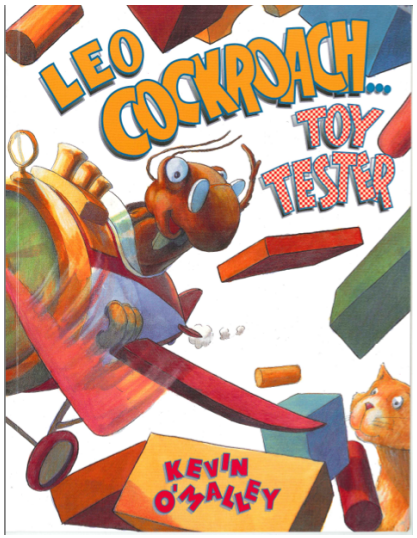
Day 4: Testing Materials - Literacy



This Story:

- Highlights the importance of testing designs
- Helps to set the context for why they are testing materials

Book: Leo Cockroach… Toy Tester

Reading Comprehension Strategy: Sequencing important events

- leads to summarizing narrative text

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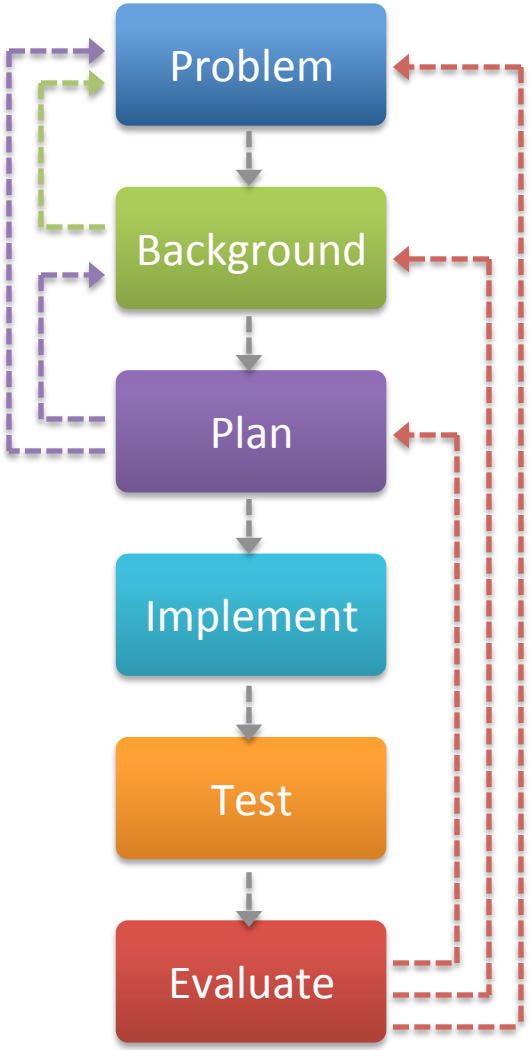
An Engineering Design Process



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Day 4: Testing Materials - STEM

- Your challenge is to design a better toy box
  - Part 1: Build background about the different materials
    - Properties of Sample materials
  - Part 2: Problem and Background
    - Let's start our designs!

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Day 4: Planning our Designs- STEM

- What is our problem?
  - A Toy company wants to make a better toy box that helps to keep the toys organized
- How are we going to solve it?
  - Design the organizer that goes inside
- What are some of the constraints (limits or rules)?
  - Size, Materials
  - Scissors, tape

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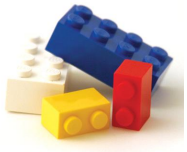
Day 4: Planning our Designs- STEM

- How are we going to test the design?
  - Chooser: Picks a toy card
  - Timer: Counts to 5
  - Teacher: Tries to collect all of the toys of that kind in 5 sec

Car	Legos 	Ball
Crayons	Colored Pencils	Paper
Stickers	Beads	Playdough

Day 4: Planning our Designs- STEM

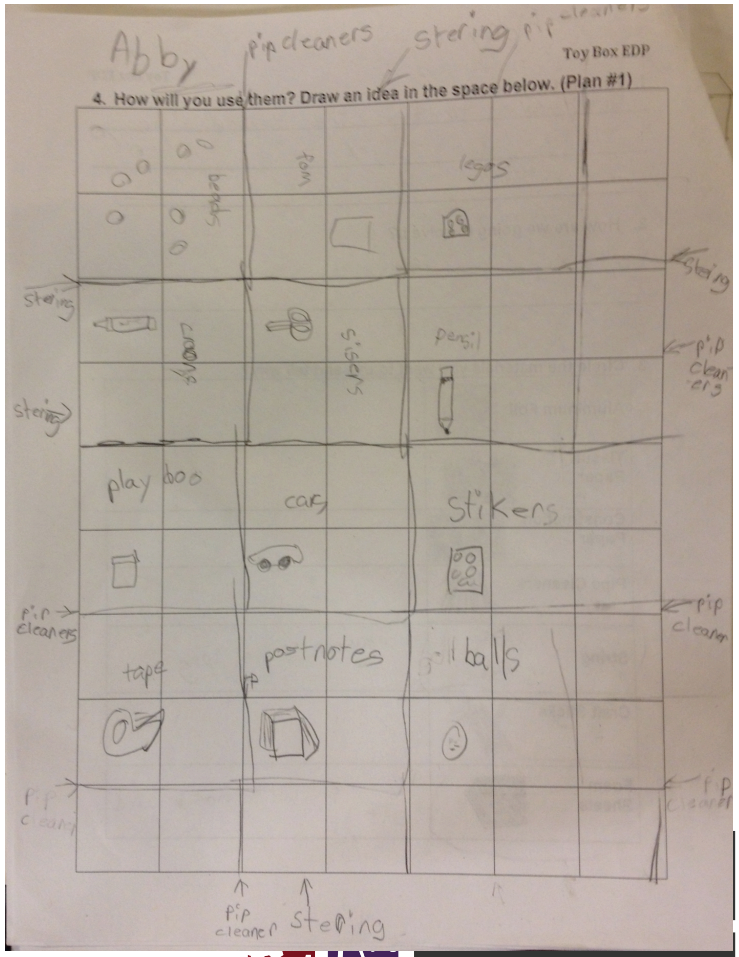
- Individually – Identify materials you want to use

Aluminum Foil	Tissue Paper	Construction Paper	Pipe Cleaners	String	Craft Sticks	Foam Sheets

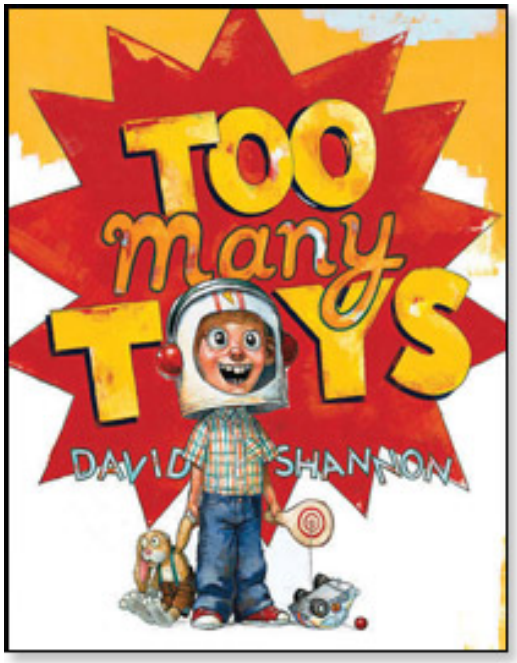
- Individually – Brainstorm 1-2 possible solutions

Day 4: Planning our Designs- STEM

- Talk with your group and come up with one design
  - Draw it on your group plan
    - To scaffold, have students place the toys on their paper
    - Draw the lines around the toys and label the materials
  - Complete your materials list
    - Use your ruler to measure the amount of each material



Day 5: Testing your Toy Box - Literacy



This Story:

- Reinforces the context and problem for the design challenge (messy toys)

Book: Too Many Toys by David Shannon

Comprehension Skill: Identifying important details

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Day 5: Testing your Toy Box - STEM

- Start building your group design!

- When finished building, raise your hand and we will come around to test your design.

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Day 5: Share & Redesign

- Sharing- An important step for students to:
  - Communicate design
  - Gather and Evaluate other ideas
  - Helps with ideas for redesign

- Redesign – Also VERY important
  - Allows students to evaluate their own
  - Focus on Improvement, not failure

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PictureSTEM - Objectives

- Create STEM integration modules that can be implemented into elementary classrooms.
  - Include an engineering component
  - Meaningful and intentional connections between STEM fields to highlight interdisciplinary and not a “silo” approach
- STEM activities that can be tied into literacy instruction.
- Create modules that allow for maximum flexibility for teachers, but are still useful and authentic.
- Develop resources to help integrate engineering into K-6 classrooms.

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Overview of our Modules

- Each module includes:
  - Literacy Component
  - STEM activity (with connections to all four STEM fields)
  - Flexible implementation

Possible Implementation:

- 5 day Unit
  - Primary: 20-30 Literacy, 30-45 Science
  - Intermediate: 30-45 literacy, 45 – 60 science
- 10 Day Unit
  - All done during Science Block with alternating literacy/ science

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STEM Activity

- Inquiry-based activity that incorporates different components of the STEM fields.
- Builds on previous learning and knowledge from the literacy lesson
- Sets the learning in a real world context
- Activities and challenges authentic to engineering/ engineers

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Literacy Component

- High-quality trade books connected to STEM activities
- Targets a comprehension strategy
- Teach vocabulary at the point of contact
- Encourage higher level thinking through questioning

- Five Whole Group/Read Aloud Lessons

- Help build background knowledge for a related STEM integration activity

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Module Overview (K-5)

Grade	Unit Title	Engineering Design Challenge	Science Connections	Mathematics Connections	Stage of Development
K	Designing Baskets	• Students design a basket made from woven paper to carry the wet and dry rocks they find	• Sorting by properties • Nature vs. human-made	• Patterns • Counting	• Completed, small pilot next fall
1	Designing hamster habitats	• Students design a habitat trail for their hamsters that meet their hamsters' basic needs	• Animals, basic needs, animal habitats • Designed and natural systems	• Characteristics of basic shapes and use those to compose and decompose objects, • Making numbers 0 - 20	• Completed, multiple classroom pilot
2	Toy Box Organizer	• Students design an organization system for their messy toy box	• Physical properties and characteristics (color, size, shape, weight, texture, flexibility, strength and the types of materials in the object)	• Standard units of measurement • Understand length as a measurable attribute; • use tools to measure length	• Finishing initial development, small pilot next year
3	**UNDER DEVELOPMENT**				
4	Countdown Clock	• Students design the layout of the circuit for one of the numbers in their countdown clock	• Energy • Electricity • Circuits • Compare insulators and conductors of electricity	• Modeling • Cost component • Polygons • Collect/organize data	• Initial Development
5	Nature Inspired Design	• Students design and test a prototype for finding or gathering water that is inspired by the adaptations of desert animals	• Animal/plant structures that provide advantages, • Natural systems	• Algebraic Thinking and Recognizing Patterns • Interpret multiplication as scaling • Geometry & Measurement	• Completed small pilots with teachers,, small classroom pilot next year

Discussion

- How do you see these modules being implemented in the K-6 classroom?

- Thoughts or comments about the specific modules?

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Thank you!

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