C5ISR Center Outreach STEM@Home

Welcome to STEM@Home!

As we maneuver the challenges of COVID-19, we strive to continue to make STEM accessible to all.

The STEM@Home Newsletter is intended to be a resource for our C5ISR Center Family to provide engaging and educational activities that can be done with minimal materials and a whole lot of imagination.

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The Raft Challenge (Grades K-2)

Mission: The small town of Sunnyville needs help! The Mayor of your town has asked you to design a raft that can carry food and medical supplies across the river to them.

Requirements:

1. Build a raft using the materials listed below.
2. Place your raft in a tub of water to make sure it floats.
3. Place as many testing items as you can on the raft.
4. See how many items your raft can carry without sinking or tipping over.

Materials for planning:

- Paper
- Pencils

Materials for building:

- Tape
- Rubber bands
- String
- Glue
- Tub for water

Choose one of these items for the base of the raft:

- 10 straws
- 13 popsicle sticks
- piece of cardboard
- index card
- aluminum foil

Instructions:

ASK: What is the problem you need to solve? (Design a raft that can carry heavy supplies across a river to a town that needs them.)

IMAGINE: Brainstorm and decide on one idea. (What type of raft do you want to design?)

PLAN: Design your raft by drawing a picture. (What will your raft look like?)

CREATE: Use the materials to create a model of your raft.

TEST: Use items from around your house to test the raft:

- Pennies
- Paper clips
- Plastic bottle caps
- Erasers
- Game tokens

IMPROVE: As you test the raft, ask yourself:

1. How many items can my raft hold?
2. How could I improve my design to hold more items?
3. How many different types of items can my raft hold?

Try changing your design and retest.

SHARE: Show the raft to your family and tell them how many pennies it can hold.

Building Bridges (Grades 3-5)

Mission: Your town has been working with the town of Sunnyville to share materials and supplies.

Sunnyville is on the other side of a large lake, so both Mayors have decided that a bridge would help the towns work together more easily.

They have asked you to design and build the bridge, but you have a budget of only $1,000.

Use the provided list to select materials and track how much you are spending.

Think left and think right and think low and think high. Oh, the thinks you can think up if only you try!

~Dr. Seuss

Instructions:

Design and build a bridge to connect Sunnyville to your town.

ASK: What is the problem I need to solve? (Design a bridge that can hold the most weight and stay with a $1000 budget.)

IMAGINE: Brainstorm and decide on one idea. (What will my bridge look like?)

PLAN: Draw a picture of the bridge. Label the different parts with the materials you plan to use.

CREATE: Use the materials to create a prototype within the $1000 dollar budget (Use the cost list to determine how much the bridge will cost.)

IMPROVE: Test the bridge. Make sure it meets the following requirements:

1. Your bridge must be 1 foot long.
2. It must be at least 3 inches wide.
3. Your bridge must be able to hold at least 3 matchbox cars (if you don't have matchbox cars, pick another item of the same size and weight.
4. You must stay within your budget.

Look for ways to redesign and improve the bridge.

SHARE: Explain the design.

Materials:

Item	Cost
Books	$210 / book
Newspaper	$60 /sheet
Paper	$35/ page
Tape	$45 /12 in.
Glue	$50
Popsicle sticks	$65 /15 sticks
Straws	$40 /12 straws
Cardboard or cardstock	$185/ piece
String	$75 /24 in.
Inside of paper towel roll	$100 each
Toothpicks	$180 / 40
Folder	$190 each
2 cups the same size	$220
Rubber bands	$25 for 1
If you don't have one of the materials, replace it with something similar for the same price.	

Materials for planning:

- Paper
- Pencils
- Ruler

Air Pollution Detector Challenge (Grades 6-8)

Goal:
Create a "pollution collector!" The collector should be able to stay outside for several hours and hold one of the liquids that will be used to attract and trap particles from the air.

Instructions:
Use materials from around the house to design and build a pollution collector. Your collector should meet the following requirements:

- It should have a flat surface that can hold the collection liquid.
- It should be at least 4 in x 4 in.
- It should be secured.

Test your air pollution device by leaving it outside of your house for approximately 4-6 hours. Be sure to place it somewhere that it will be protected from wind and rain.

Document the amount and types of particles you see (ex. dust, pollen, dirt etc..) along with their size color, shape, and texture.

ASK: What is the problem you need to solve? (Design an air pollution detector that can detect the presence of pollutant in the air.)

IMAGINE: Brainstorm and decide on one idea. (What will your air pollution device look like?)

PLAN: Draw a picture of your air pollution device. Label the picture with the materials you intend to use.

CREATE: Use the materials to create a prototype.

IMPROVE: Test your invention (Secure your air pollution device somewhere outside your home.) Did it work? What could work better? Make any adjustments that you think will improve its function.

Questions to think about:

- Did you succeed in creating an air pollution detector that can detect the presence of particles in the air?
- If you had access to additional materials what would you have used? Why?
- If you had to do it all over again, would your plan design change? Why?
- What type of particulate pollution did your device most attract?
- What do you think can be done to reduce particulate air pollution around your school?

SHARE: Share your project and findings with your family and friends.

Mission: There has been an increase in the amount of air pollution (chemicals, natural materials, or particles in the air) in your state because of pollutants from factories, cars, fireplaces, and other things.

Your Governor has enlisted you to help engineers design an air pollution detector.

Materials to build your collector:

- Construction paper
- Cardboard
- Plastic wrap
- Wax paper
- Fabric or Felt
- Coffee filters
- Index cards
- Tape
- Paper plates
- Paper cups
- Hangers
- String

Materials to attract particles:

- Petroleum jelly
- Lotion
- Oil (vegetable, olive oil)
- Glue

Natural Disaster Resource Challenge (Grades 9-12)

Requirements:

- Use only those items that you can find at home to build your prototype.
- Explain how your invention is going to help during a natural disaster.
- Explain what each piece of material represents in your prototype.
- Ensure your invention can withstand the elements that occur during natural disasters.

Questions to think about:

Did you succeed in creating a resource that will make a significant impact when a natural disaster occurs?

If you had access to additional materials, what would you have used? Why?

If you had to do it all over again, would your plan design change? If so, why?

Mission: Droughts, floods, hurricanes, and other natural disasters affect millions of people each year. Engineers design emergency shelters, figure out how to rescue survivors, transport supplies, and rebuild destroyed homes and businesses. You have been selected by the United States Agency for International Development (USAID) to design a resource (i.e. shelters, a way to transport supplies, equipment for rescuing people) that can make a significant impact should a natural disaster occur.

Instructions:

ASK: What is the problem I need to solve? (Design a resource that can make a significant impact should a natural disaster occur.)

IMAGINE: Brainstorm and decide on one idea. (What is the purpose of my invention?)

PLAN: Draw a picture of the resource. (What will my invention look like?)

CREATE: Use materials from home to design a prototype.

IMPROVE: Will my invention work? What could make it better?

SHARE: Explain to family and friends how the invention will help them during a natural disaster

Standards: C5ISR Center STEM Outreach Activities Align with the National Core Curriculum Standards

ACTIVITY ONE: K-2-ETS1-1 Engineering Design—K-2-ETS-1. Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new improved object or tool. K-2-ETS1-2. Develop a simple sketch, drawing ,or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.

ACTIVITY TWO: 3-5-ETS1-1 Engineering Design—Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost. 3-5-ETS1-3 Engineering Design — Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

ACTIVITY THREE: MS-ESS3-3 Earth and Human Activity (6-8 grade) - Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment. MS-ETS1-1 Engineering Design (6-8 grade) Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.

ACTIVITY FOUR: HS-ETS 1-2 Engineering Design (9-12): Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering. HS ETS 1-3 Engineering Design (9-12): Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts.