STARnet
Science-Technology Activities & Resources For Libraries

NCIL
National Center for Interactive Learning

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January 18, 2017

Audio problems? Click the "communicate" button at the top of your screen. Then click "test audio."

STARnet Hands-on

Tested & Approved STEM Activities

- For multiple age groups
- Inexpensive!
- Flexible for use in different types of programs
- Correlate to national education standards

Playful Building

Activity 1: *Design a Park*

Activity 2: *Team Machine*
Activity 3: *Water Wedges*
Activity 4: *Levers at Play*

For families or groups of children
Ages 5-13

Social!

Additional activities listed as extensions

Activity 5: *Low-tech Water Filter for High-impact Clean*
Activity 6: *Wind Turbine Tech Challenge*

Playful Building Implementation Guide

Plan

Activity 1: *Design a Park*

Play

Activity 2: *Team Machine*
Activity 3: *Water Wedges*
Activity 4: *Levers at Play*

Power and Protect

Activity 5: *Low-tech Water Filter for High-impact Clean*
Activity 6: *Wind Turbine Tech Challenge*

Plan

Activity 1: *Design a Park*

Play

Activity 2: *Team Machine*
Activity 3: *Water Wedges*
Activity 4: *Levers at Play*

Engineers work to solve the basic challenges of life — including having fun!

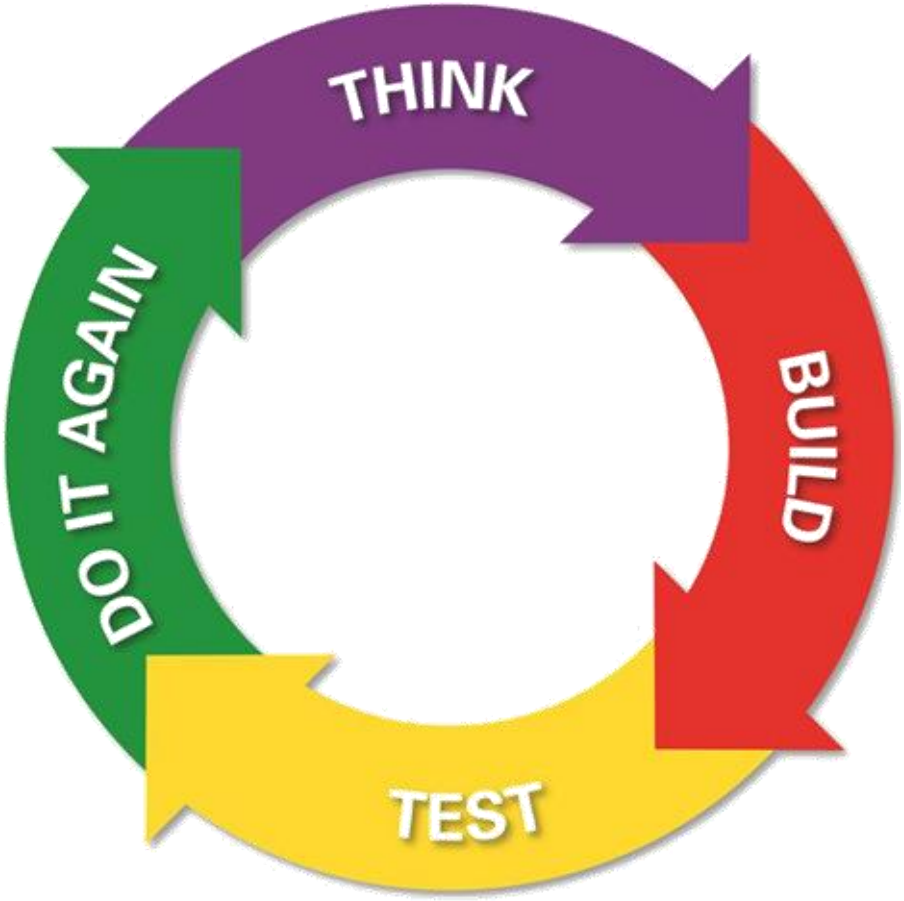
Engineers use technology — including everyday materials — to help us enjoy our world.

Children, like engineers, can build things using a creative process of thinking, building, testing…and doing it again!

Power and Protect

Activity 5: *Low-tech Water Filter for High-impact Clean*
Activity 6: *Wind Turbine Tech Challenge*

Be Creative...Be an Engineer!



Implementation Options

Stations

- One or more longer events
- Patrons sample multiple activities
- Example: Offer activities 2-4 as a "Playground of Machines"
- Train teens or undergraduate engineering students to facilitate stations

Implementation Options

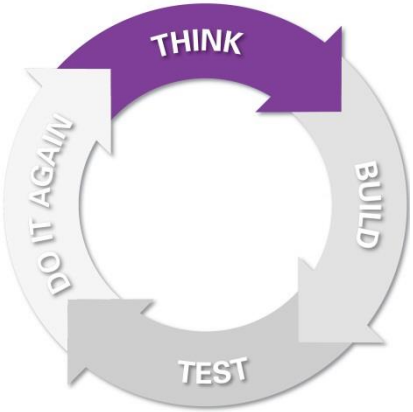
Individual Events

- Facilitator-led
- Offer each activity as a separate event
- Patrons may fully explore the engineering design process

Activity 1:

DESIGN A PARK

Plan the Park of Your Dreams!



THINK

Place different park features on the grid to create a map of your park!

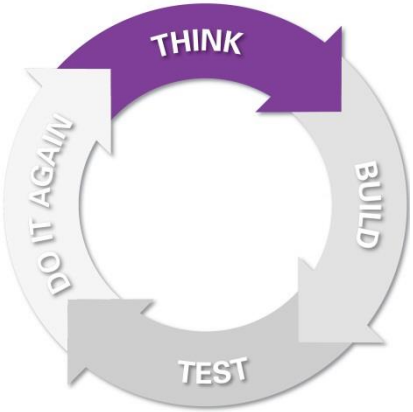
Draw

Talk **Explore**

Write

- 10 or fewer park features OR keep your total under 250 points
- Everything must fit on the grid!
- Your park must include restrooms.
- Use yarn to represent trails or bike paths. Give visitors a way to get to each of your park's features.
- Add yellow beads along the paths — these represent lights.

Plan the Park of Your Dreams!



What would you choose for the park of your dreams?

Costs

10	Pond
15	Ball Courts (such as for basketball or tennis)
15	Dog Park
20	Water Playground
30	Swimming Pool
30	Stream and Footbridge
30	Trail/bike paths
50	Community Garden
75	Picnic Area
90	Restrooms and drinking fountains
150	Playground
215	Skate Park
250	Baseball Diamond
200	Parking Lot

Savings

-1	Wind Turbine Generating Electricity
-30	Boat Rental Shop, Boat Slip, and Pond
-30	Wetland
-85	Open space
-300	Ice Cream Shop

Activity 2:

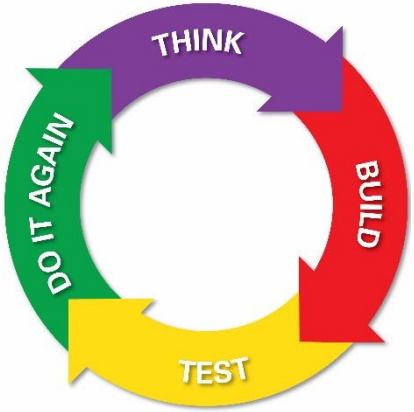
TEAM MACHINE

Establish a pattern

1. Form a circle.
2. Say your name.
3. Toss the beanbag to someone *across* from you (not next to you). Remember that person's name.
4. Keep going until each person has caught the beanbag.

Keep the same order as you try to go even faster!

The faster, the better!



THINK

How can you decrease your time?

Draw

Talk

Explore

Write

BUILD, TEST, and DO IT AGAIN!

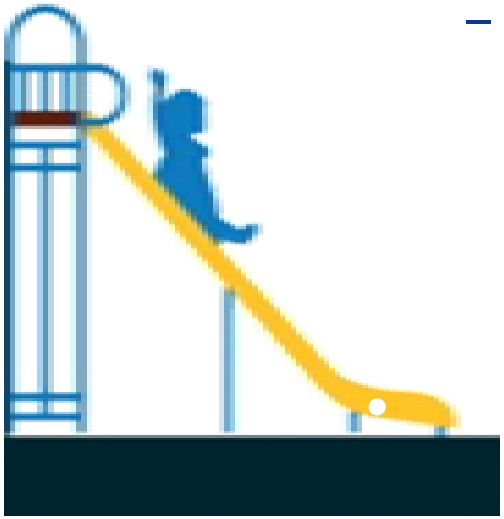
1. Pass the beanbag around the circle again — as quickly as possible!
2. Say the name of the person who will catch the beanbag each time you pass it.
3. Try to “beat” your shortest recorded time

Hints:

You may move around. You may stand or sit.

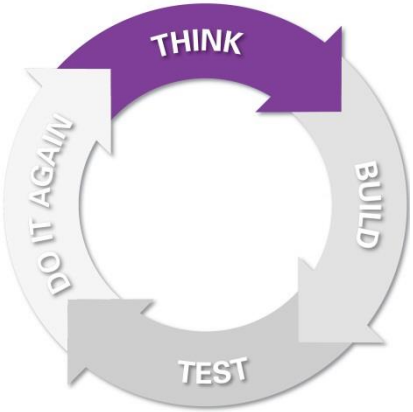
Playful Building: Team Machine

- **Inclined planes make it easier to move something up or down.**
- **An object can be**
  - lifted straight up (shorter distance)
  - or it can be pushed diagonally up an inclined plane (uses less energy)



Playful Building: Team Machine

- **Inclined planes make it easier to move something up or down.**
- **An object can be**
  - lifted straight up (shorter distance)
  - or it can be pushed diagonally up an inclined plane (uses less energy)
- **A screw is a type of inclined plane that has been wrapped into a spiral shape**



Poll 2

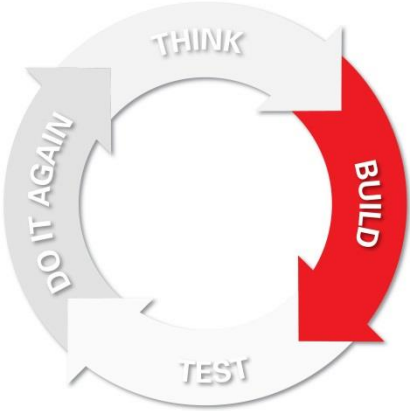
Activity 3:

WATER WEDGES

This kayak is an example of a boat that has a wedge-shaped bow.

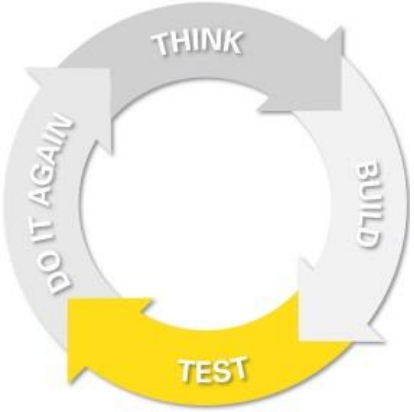
This paddleboat has a squared front edge.

BUILD



- **Activity**:
  - Fold an origami boat!

TEST



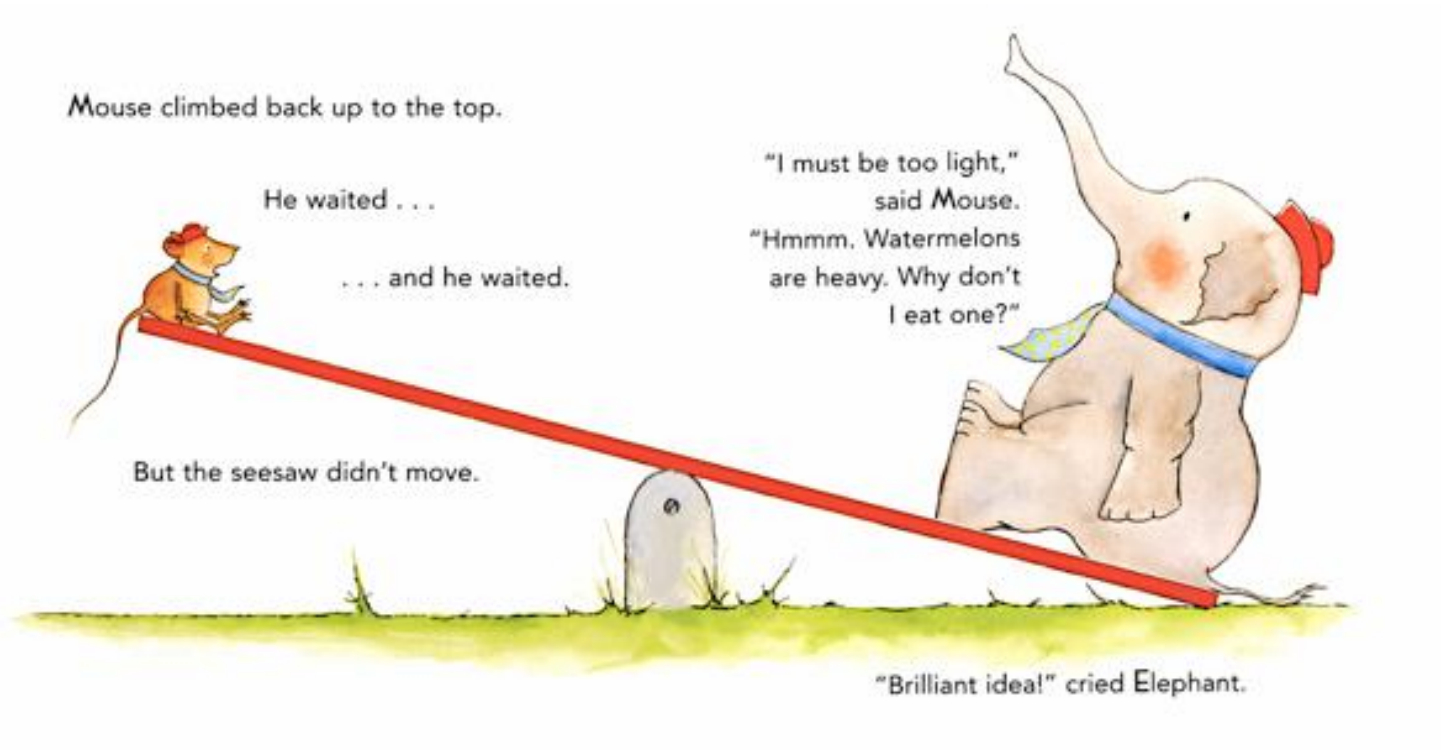
A raft pushes water along in front of itself.

A boat with a bow slices through the water, allowing the boat to move forward more easily.

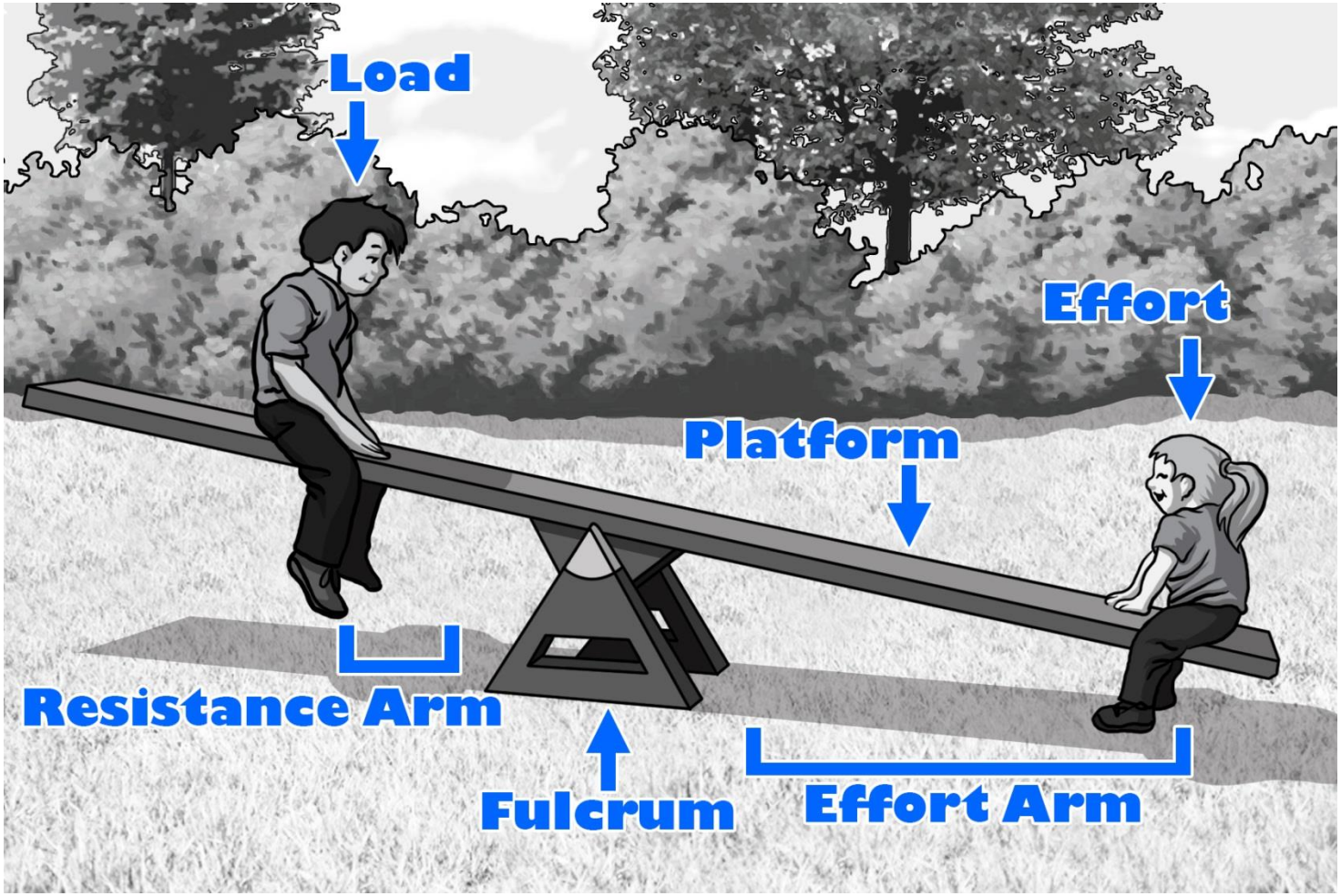
Activity 4:

LEVERS AT PLAY

Using Stories to Provide Context

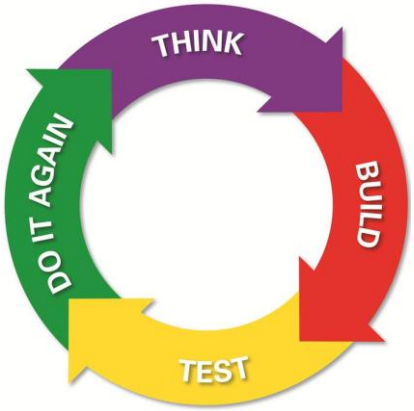


HOP! PLOP!
By Corey Rosen Schwartz & Tali Klein
Illustrator Oliver Dunrea
Publisher Walker Children's
ISBN-10: 0802780563
ISBN-13: 978-0802780560



Credit: Lunar and Planetary Institute

Your Seesaw Design



THINK and BUILD

1. Pick the materials you think would be best for building a seesaw.
2. Together, plan how you will use the materials to build the seesaw.

Draw

Talk **Explore**

Write

BUILD and TEST

3. Follow your plan to create your model seesaw.

DO IT AGAIN!

Modify your design — but change only one thing at a time!

Activity 5:

LOW-TECH WATER FILTER FOR HIGH-IMPACT CLEAN

Playful Building: Water Filter

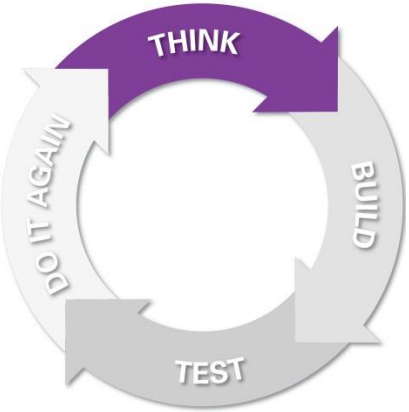
- **Water features are popular choices/wishes for parks**

- **Many parks face the challenge of getting clean water or keeping water clean**

- **Contaminates:**
  - Leaves and twigs and sediment get into the water
  - Algae and bacteria live in the water
  - Pesticides and other substances run off from the land and into the water

Playful Building: Water Filter

What types of materials do you think could be used to construct a water filter?

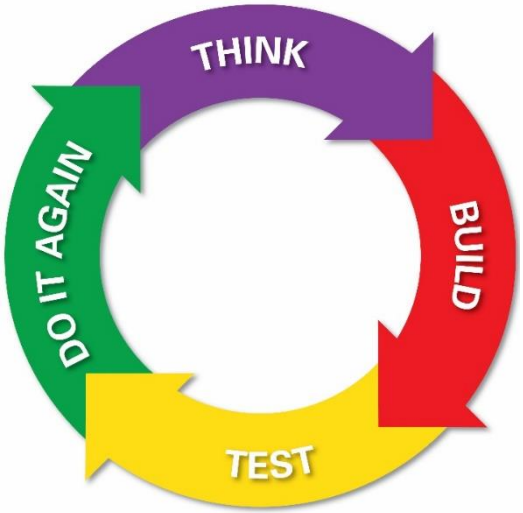


Playful Building: Water Filter

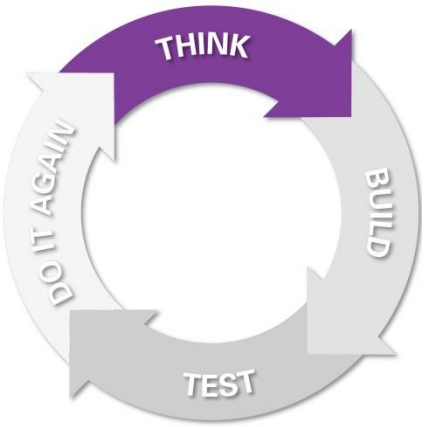
- Offers an engineering challenge to the children in your programs:

  How do I create a way to clean my park's water?

- Uses the Engineering Design Process



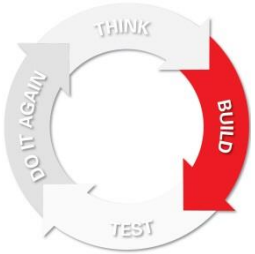
Playful Building: Water Filter

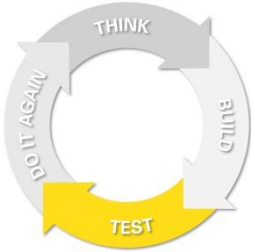


- Think:
  - What materials will work best to clean the water?
  - Which will work best for twigs and leaves?
  - Finer sediment?
  - Pesticides?

Playful Building: Water Filter

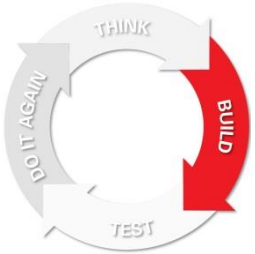
Playful Building: Water Filter



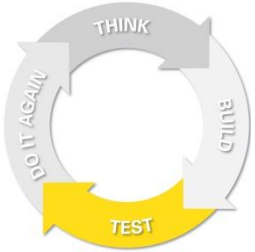


- **Activity**:
  - Use common materials to design a water filtration device to supply the park / water feature with clean water
  - 15 to 30 minutes; longer for children who like to experiment
  - Plastic water/soda bottles, variety of filtration materials, access to water
  - Can get a little messy!
  - Don’t drink the water!

Playful Building: Water Filter

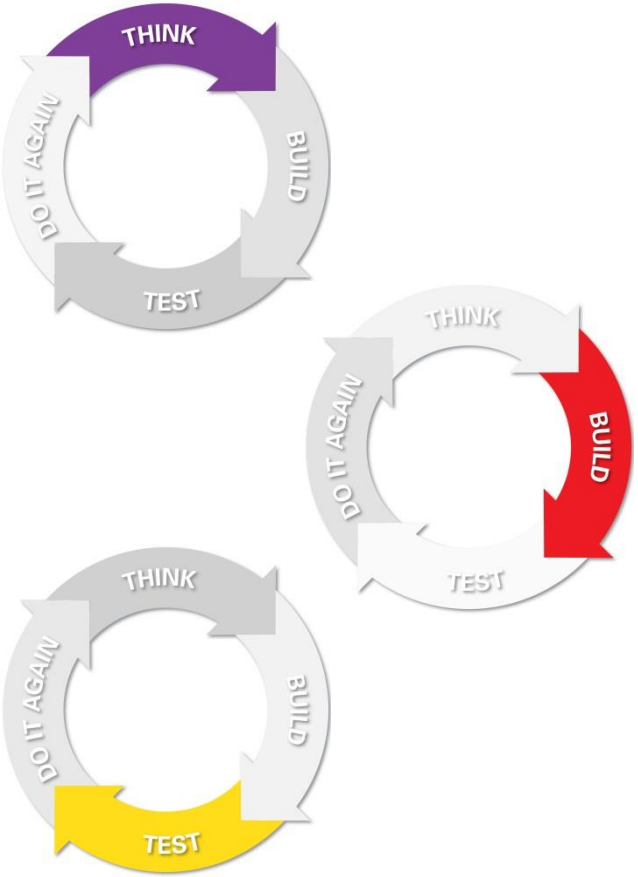


- **Procedure**:
  - Build a water filter
  - Test:
    - 1 material at a time
    - What happened?



  - Do It Again: Think about what you observed, test another material and repeat the process

Playful Building: Water Filter



- Next, think about what *combination of materials* – in *what order* – will provide the best filter
- Build
- Test

Playful Building: Water Filter

- Compare!
- Which combination and in what order worked best?
- Can you get the water cleaner?
- Can you filter the water faster?
- Do It Again!

Some people in Bangladesh use cloth to clean their water…

Credit: National Science Foundation

...to take out small creatures in the water that help spread disease

Credit: National Science Foundation

Students help clean water in Nepal

Credit: Engineers without Borders

Playful Building: Water Filter

Activity 6:

WIND TURBINE TECH CHALLENGE

There are two different types of wind turbines…

Horizontal Axis Wind Turbine

Blades

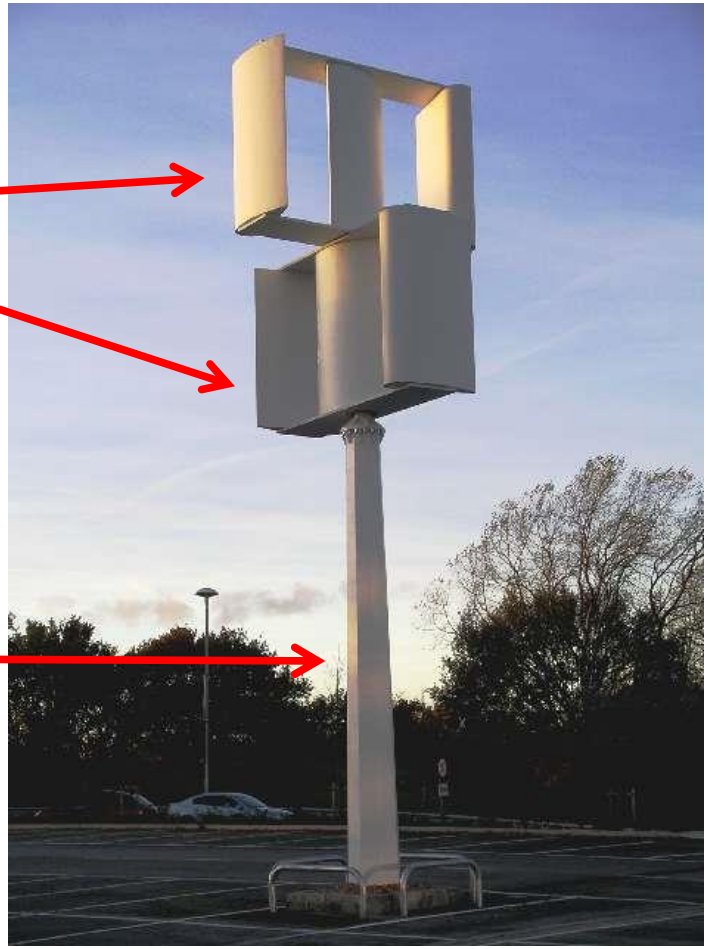
Tower

Credit: Gary Halvorson, Oregon State Archives, via Wikimedia Commons

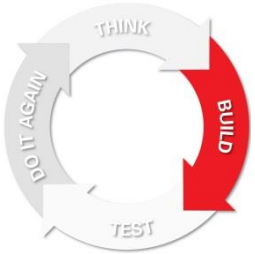
Vertical Axis Wind Turbine

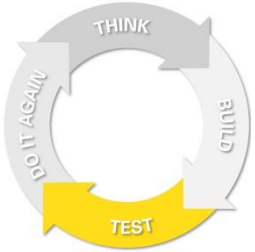
Blades

Tower



Playful Building: Wind Turbine





- **Activity**:
  - Use common materials to design a wind turbine to supply the park with electricity
  - 15 to 30 minutes; longer for children who like to experiment
  - Soda straws, Post-It note pads, play-doh, toothpicks

Build your own wind turbine!

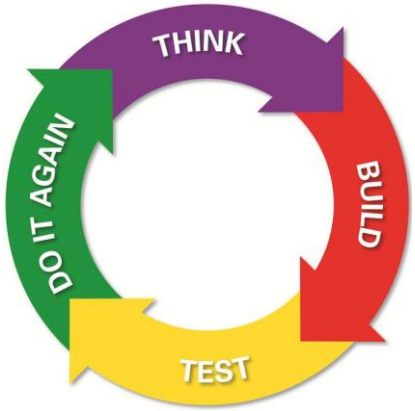
BUILD and TEST

1. Push the four toothpicks into the putty so that they stand upright. Keep them close together.
2. Put a small scrap of paper at the bottom of the toothpicks. This will keep the straw from sticking!

3. Stick the Post-it notes to one end of the straw. Make sure they don't cover each other!

4. Slide the straw over the toothpicks.
5. Use a second straw to gently blow across the blades.

Make it even better!



DO IT AGAIN!

Modify your design — but change only one thing at a time!

Draw

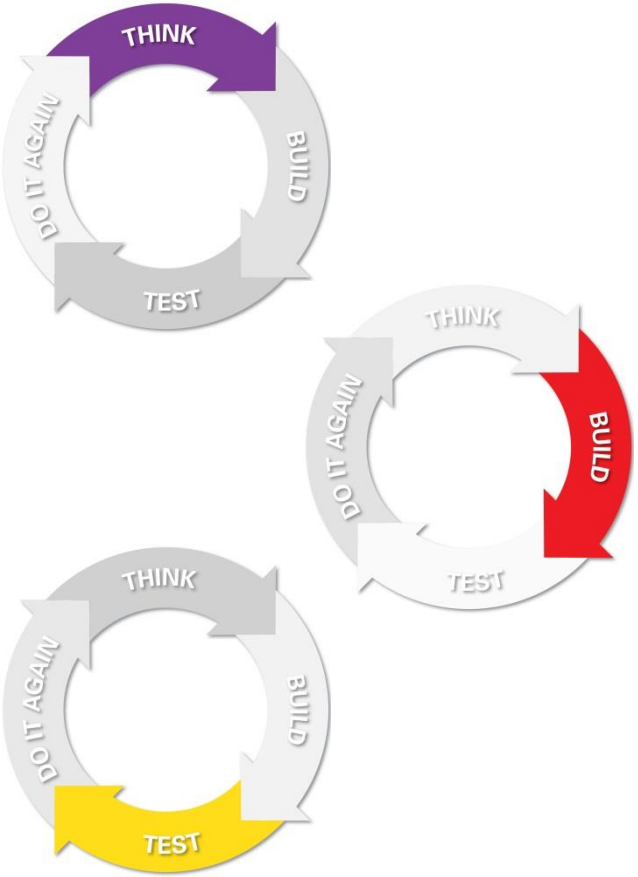
Talk Explore

Write

THINK, BUILD, and TEST

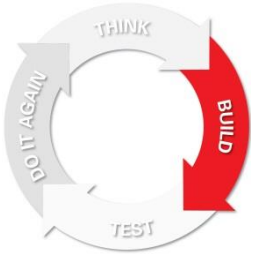
- Which different material could you try using?
- What else can you try changing?
    - The angle of the blades?
    - The size of the blades?
    - The shape of the blades?
    - Could the blades be more curved (cupped)? Less curved?

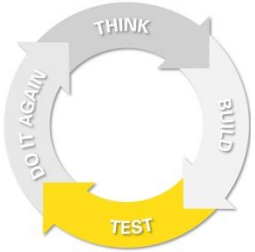
Playful Building: Wind Turbine



- Next, think about what *type of materials* will create the best wind turbine
- Build
- Test

Playful Building: Wind Turbine





- **Activity**:
  - Use common materials to design a wind turbine to supply the park with electricity
  - 15 to 30 minutes; longer for children who like to experiment
  - Soda straws, Post-It note pads, play-doh, toothpicks
  - Paper towel tube, corrugated cardboard, tape

Playful Building: Wind Turbine

- Compare!
- Which size/shape and/or material worked best?
- Can you get the blades to spin faster?
- Do It Again!

IDEAS FOR MAKING THIS YOUR OWN!

Plan

Activity 1: *Design a Park*

Play

Activity 2: *Team Machine*
Activity 3: *Water Wedges*
Activity 4: *Levers at Play*

Community Park

Power and Protect

Activity 5: *Low-tech Water Filter for High-impact Clean*
Activity 6: *Wind Turbine Tech Challenge*

Other Ideas...

Statewide Afterschool Networks

www.statewideafterschoolnetworks.net

The statewide afterschool networks foster partnerships and policies to develop, support and sustain quality afterschool and expanded learning opportunities for children and youth.

The Connectory

www.theconnectory.org/provider-portal

The Connectory is the largest database of STEM program providers where you can search for and discover new partners and share resources.

Other Ideas...

National Girls Collaborative Project

www.ngcproject.org

The National Girls Collaborative Project™ (NGCP) is designed to reach girl-serving STEM organizations across the United States.

Aspire

aspire.swe.org

This Society of Women Engineers (SWE) K–12 outreach program offers resources and events designed to share the excitement of engineering with girls in grades K–12.

DISCUSSION

Resources

- "Dream Big to Build a Better World"
  - Blog
  - Webinar archive (12/14/2016)
- Upcoming Special Event: Engineers Week: February 19-25, 2017
- STEM Activity Clearinghouse

THANK YOU!!

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