Hop To It!

August Workshop
MSP STEM Grant

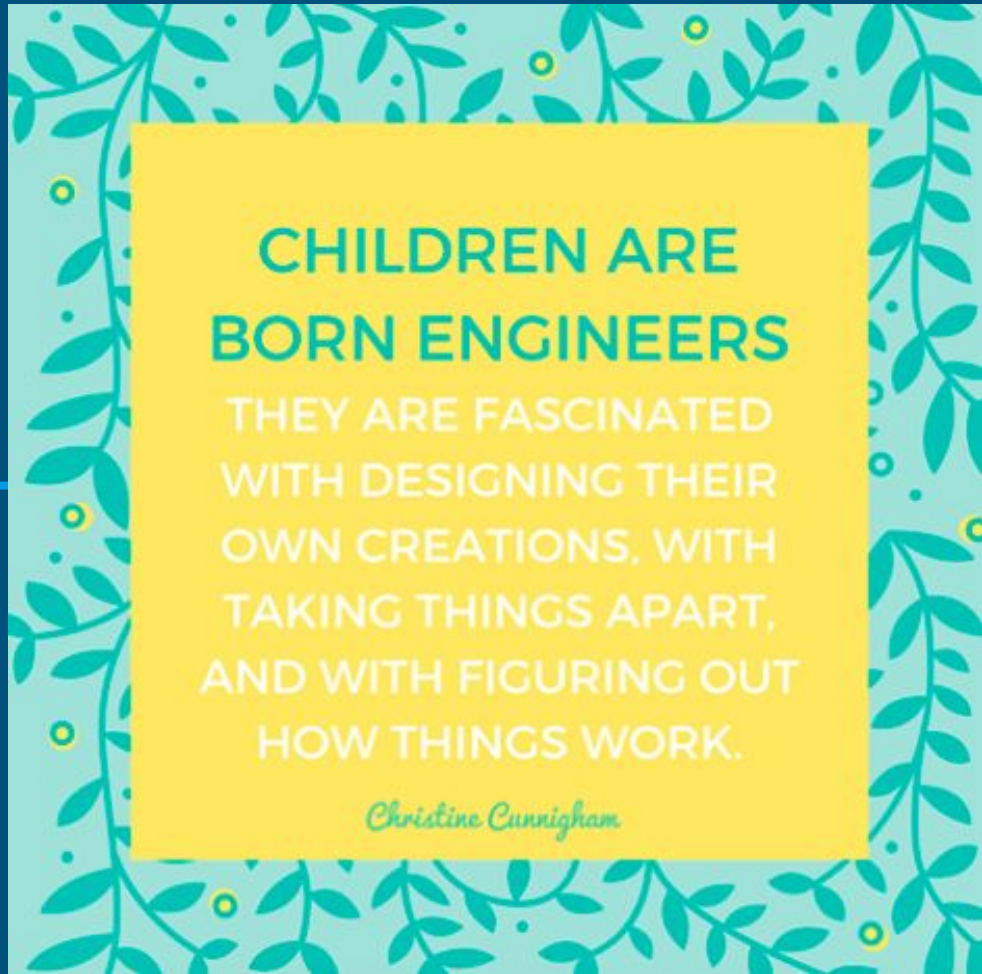
- Take your science notebook and make observations at the springs.

- Take notice of how things have changed
  - Over time (6 weeks)
  - Different time of day

- Please sit in your grade level teams.
- Take a piece of construction paper and write your name on one side.
- Draw a picture of an engineer on the other side.


KEY & PEELE

Tell the people at your table about the engineer you drew.



I have 3 goals for you for the next 2 days:

- I want you to experience an engineering unit as a student.
- I want you to know more about Problem-Based Learning.
- I want you to learn more about embedding Literacy into STEM.

Please write ***your*** goals in your notebook.

Quick Write #1

Write to the prompt

Pencil must be writing the entire time

"I have nothing else to write."

Timer goes off=pencils down

What is engineering and how can I embed that into my classroom?

Write to the prompt

Pencil must be writing the entire time

"I have nothing else to write."

Timer goes off=pencils down

What is engineering and how can I embed that into my classroom?

Count how many words you wrote.

Cannot count "I have nothing else to write."

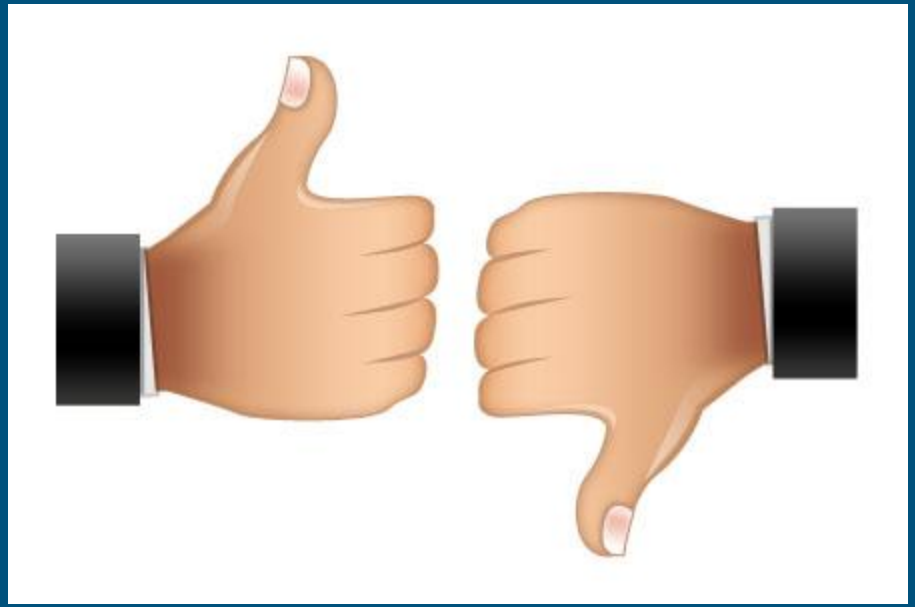
Put number in top right corner.

Graph your number (QW#1).

Engineering Vocabulary

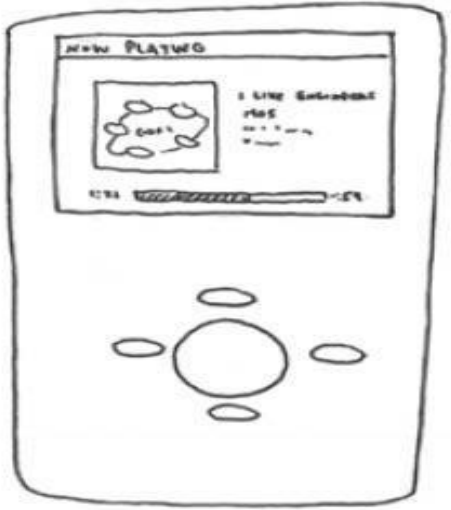
- **You have index cards at your table.**
  - **Vocabulary Word**
  - **Definition**
- **Match your cards**
  - **match words and definitions**
- **Does everyone agree?**

What is Technology?

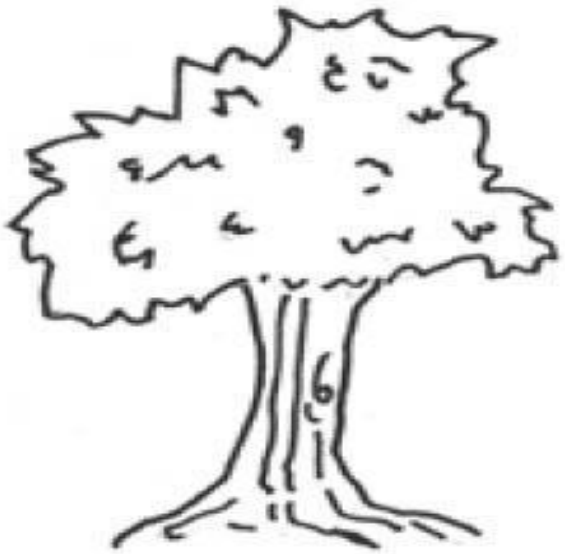


Computer

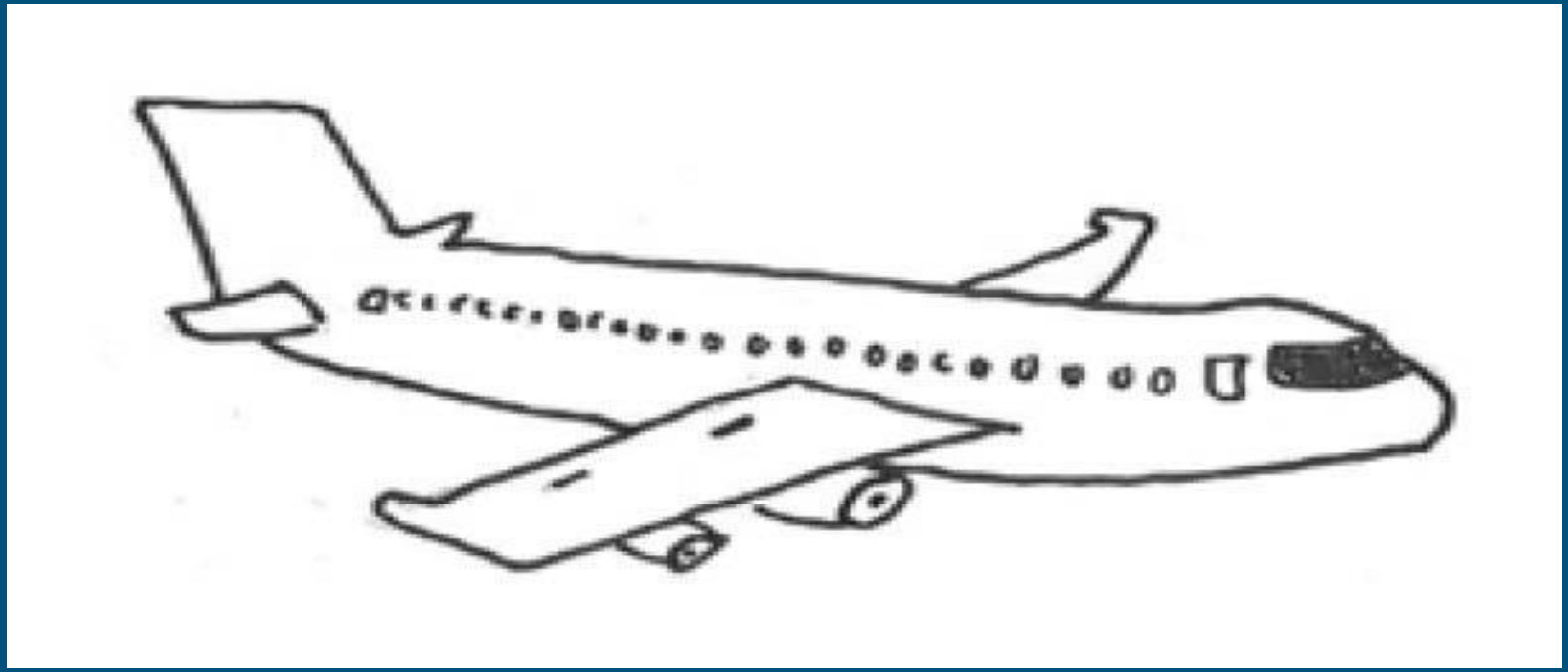
iPod



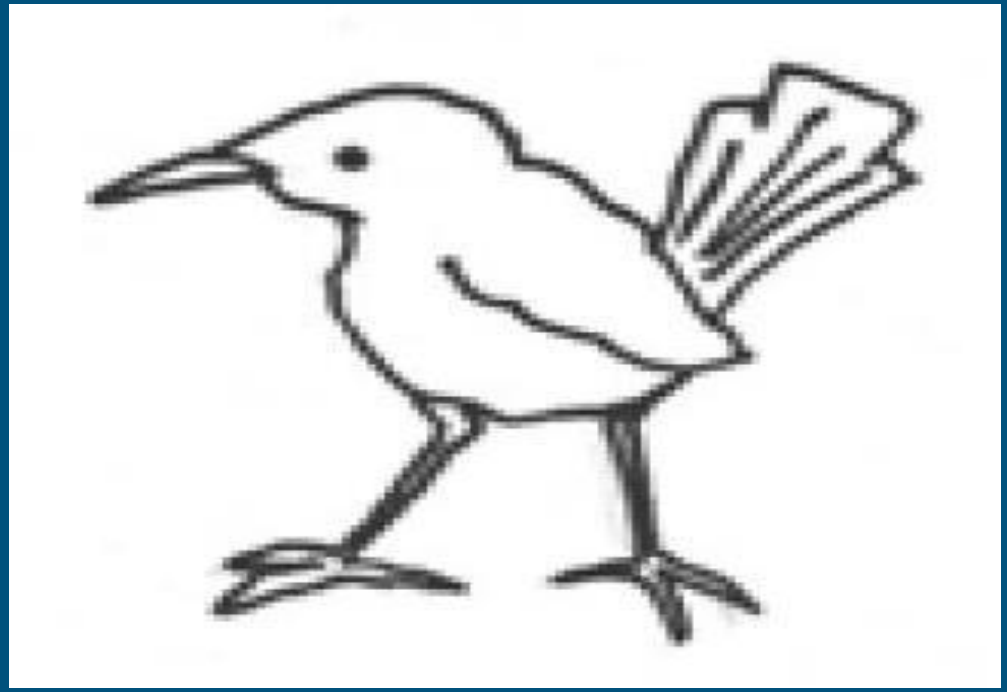
Tree



Airplane

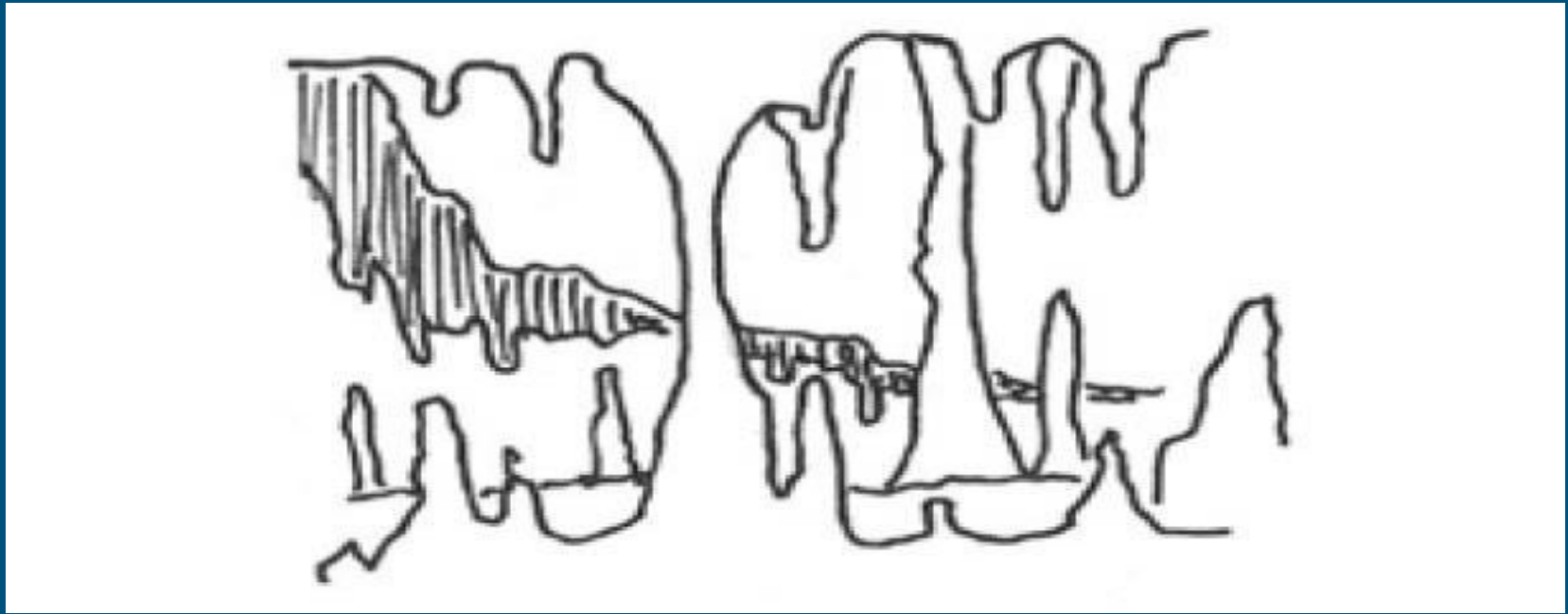


Bird



Backpack

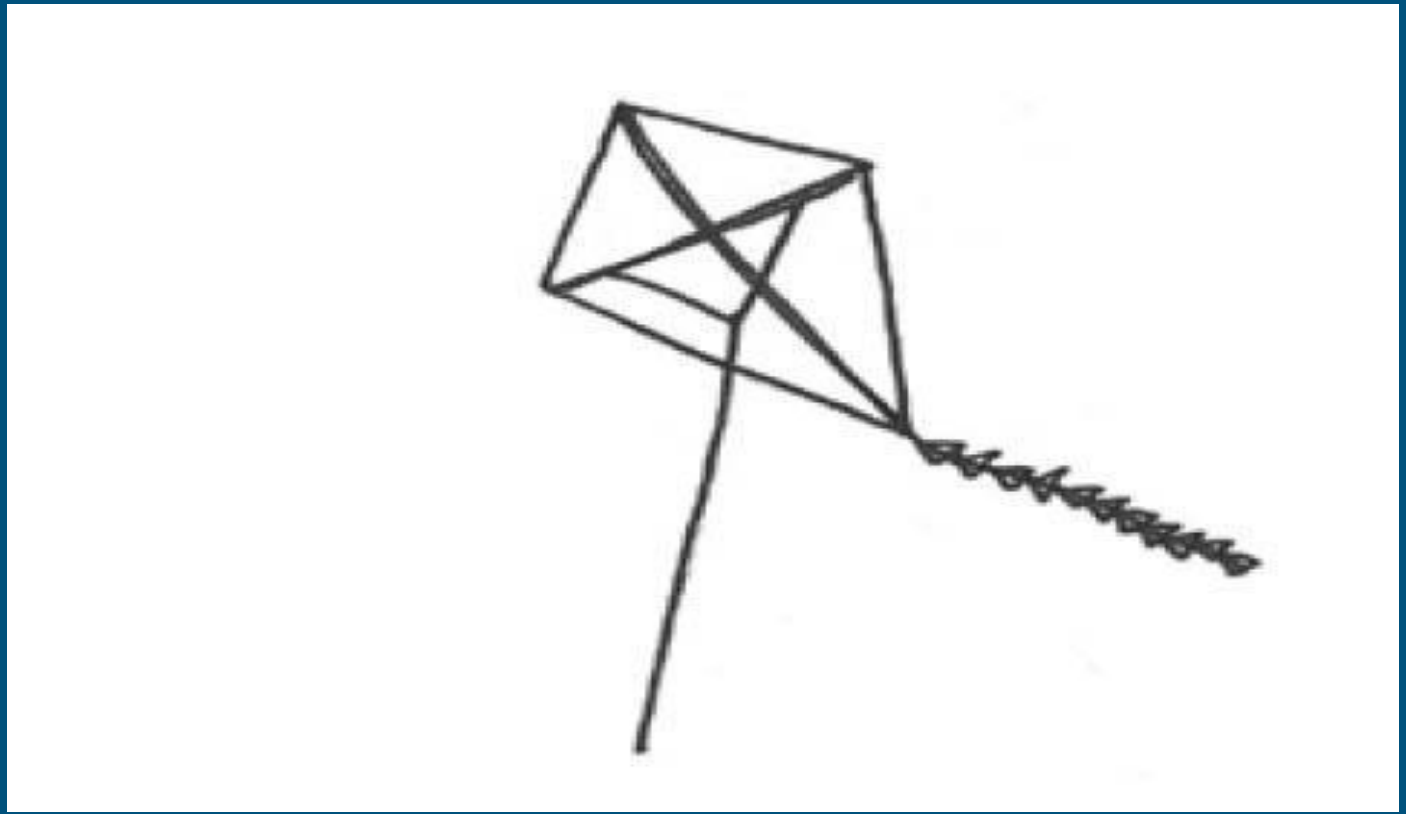
Cave



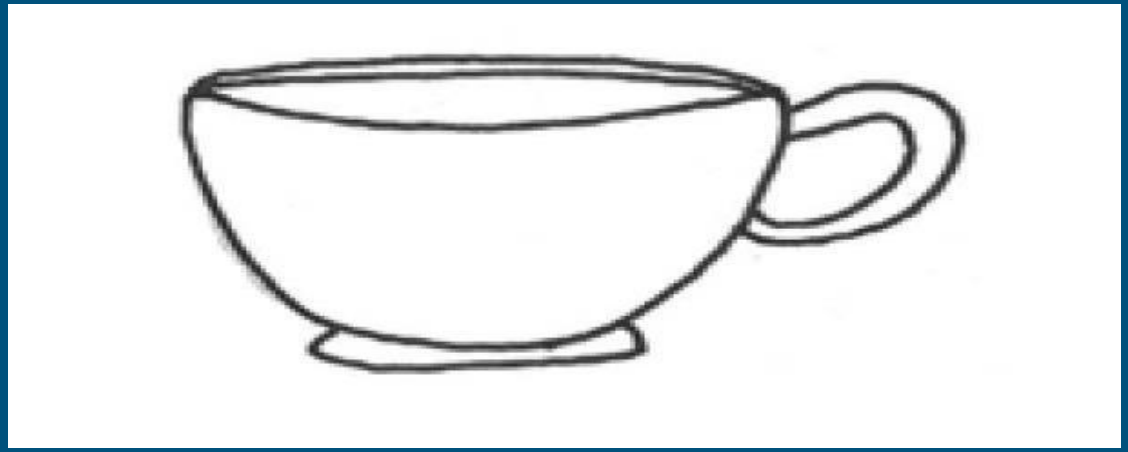
Dog Food

Hiccup

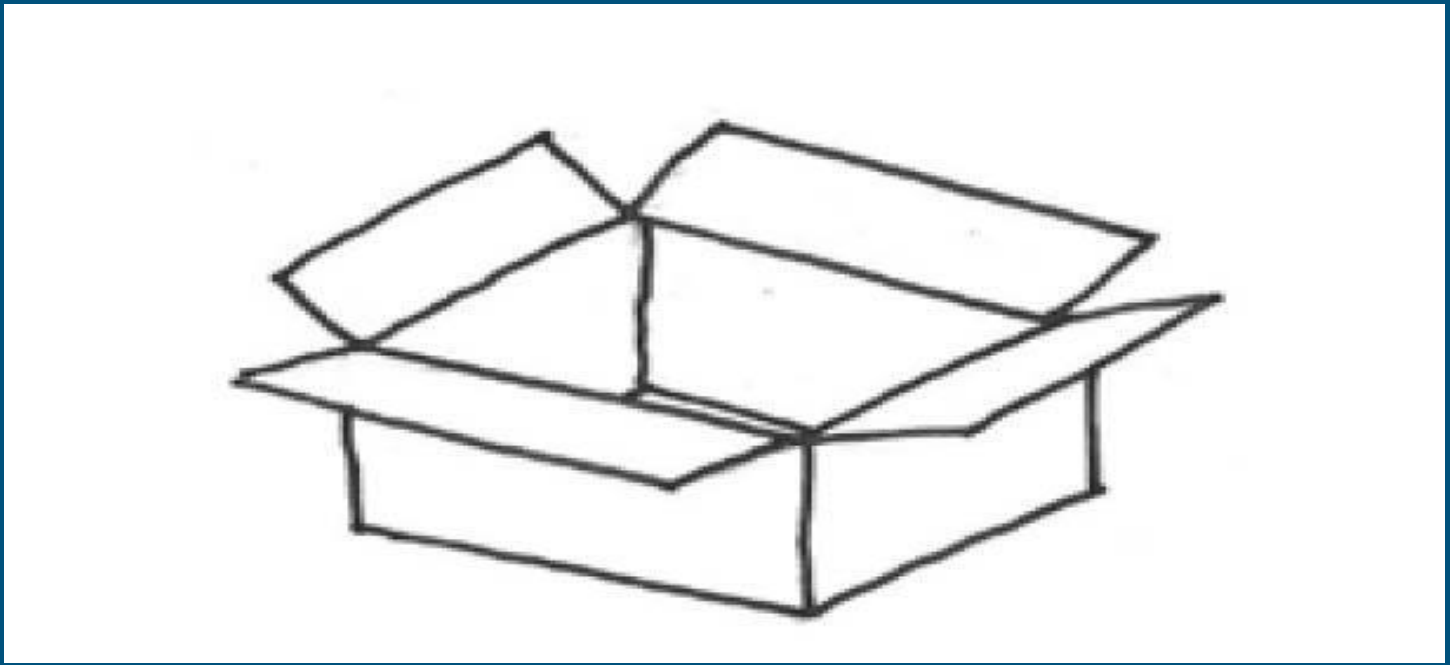
Kite



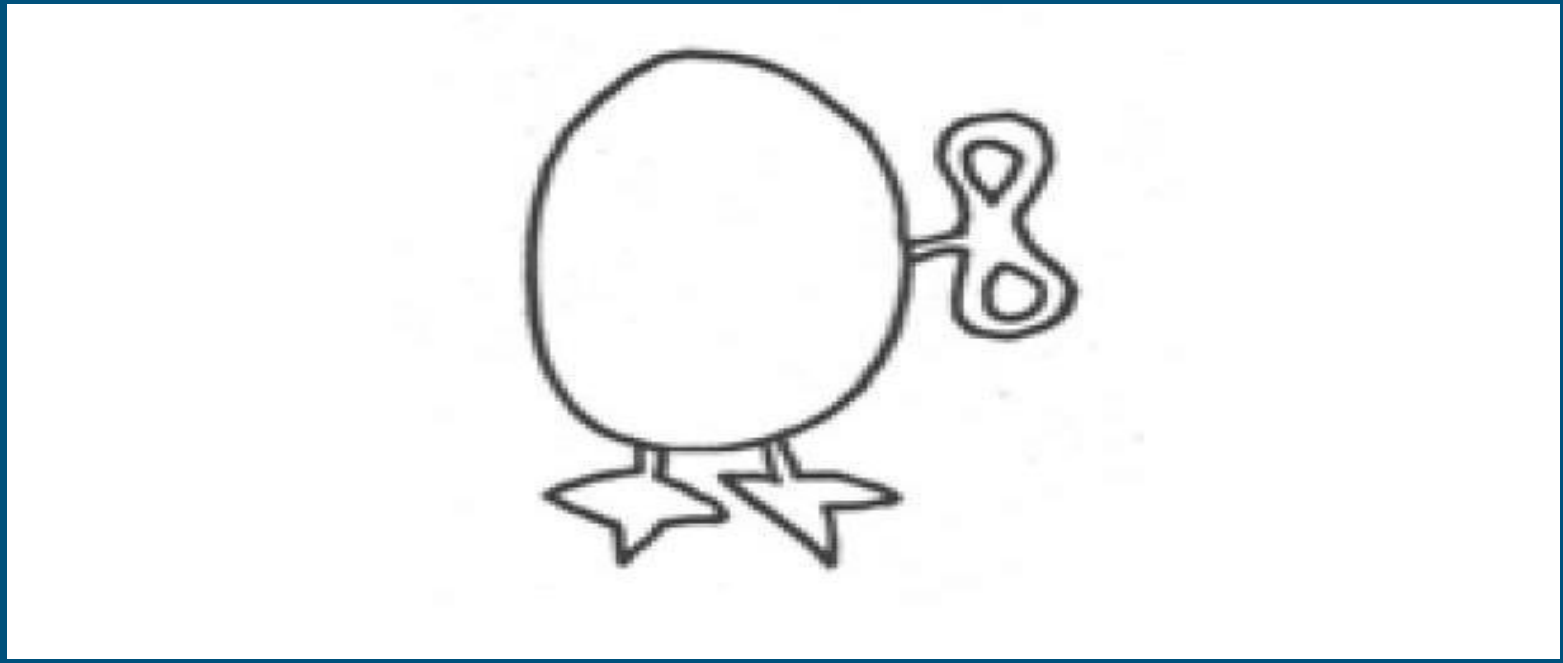
Cup



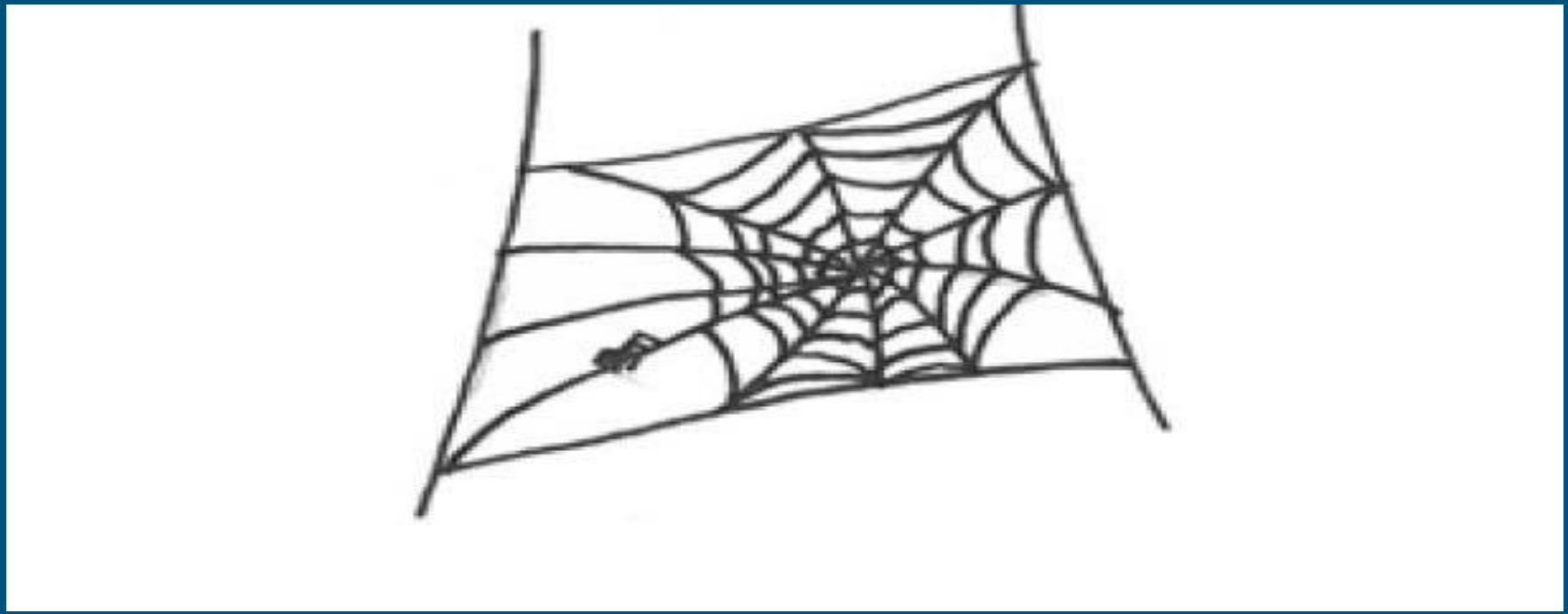
Cardboard Box



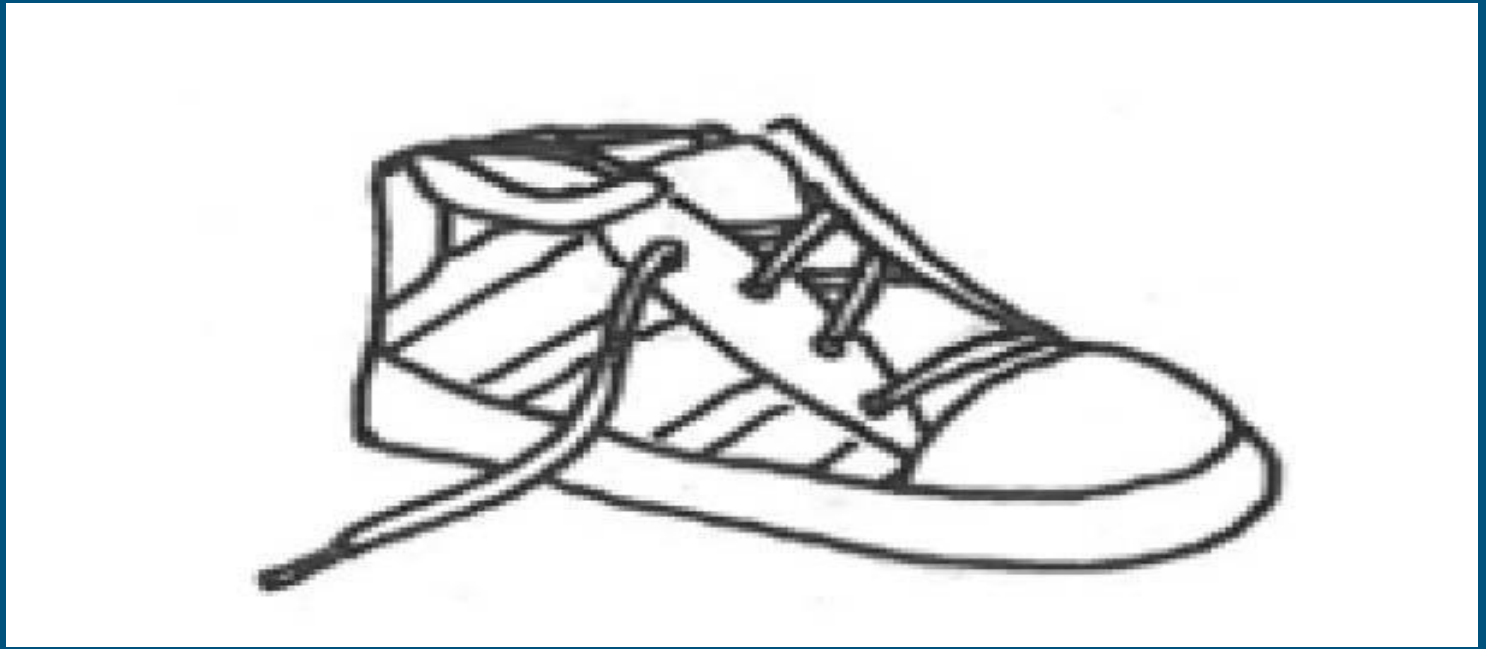
Wind Up Toy



Spider Web



Shoe

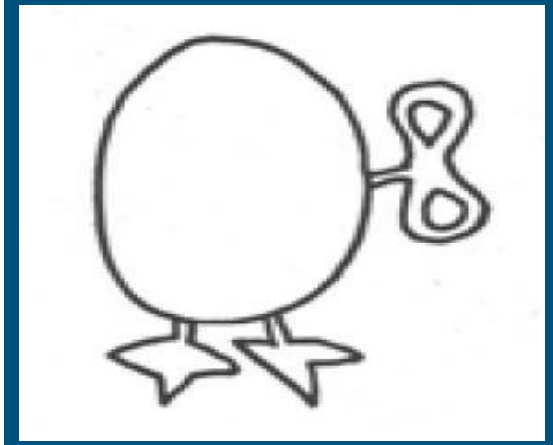


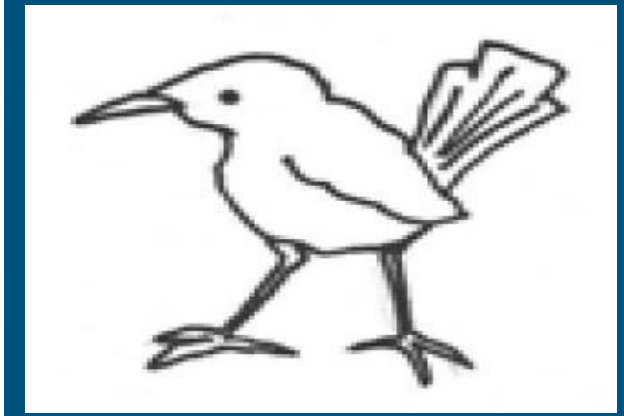
Rock

Stick

Axe

So…What is Technology?





Technology Defined

In Engineering, technology is defined as:

Anything designed by humans
to help solve a problem.

Engineering Defined

Engineering is defined as:

designing technologies to help people and to solve problems

Hop to It!

Activate your prior knowledge

Educational researchers have shown that the activation of prior knowledge is critical to learning of all types.

(*Classroom Instruction That Works*, Marzano)

Activate your prior knowledge

Complete the BEFORE section of your video activity sheet now.

Catch that toad!

Activate your prior knowledge

Complete the AFTER section of your video activity sheet now.

Ask: Table Talk

What are some of the problems cane toads are causing in Australia?

Why do you think it is important for us to help India and Jacob catch the cane toad they let loose in New Zealand?

Plan and Create

Look at pages 8-9 in your packet. I will come around and tell you which trap your group will make.

Send your Materials Manager to the “STEM Store” to get the supplies.

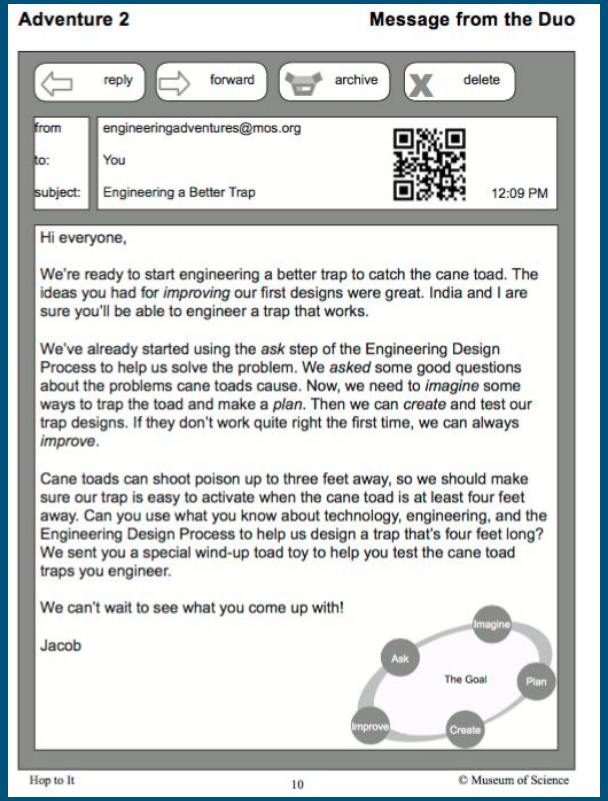
(For right now, there is no budget)

Improve (share out)

How does your group's trap work?

How do you think you could make this trap better?

Ask (audio)



Adventure 2 **Message from the Duo**

reply | forward | archive | delete

from: engineeringadventures@mos.org
to: You
subject: Engineering a Better Trap
12:09 PM

Hi everyone,

We're ready to start engineering a better trap to catch the cane toad. The ideas you had for *improving* our first designs were great. India and I are sure you'll be able to engineer a trap that works.

We've already started using the *ask* step of the Engineering Design Process to help us solve the problem. We *asked* some good questions about the problems cane toads cause. Now, we need to *imagine* some ways to trap the toad and make a *plan*. Then we can *create* and test our trap designs. If they don't work quite right the first time, we can always *improve*.

Cane toads can shoot poison up to three feet away, so we should make sure our trap is easy to activate when the cane toad is at least four feet away. Can you use what you know about technology, engineering, and the Engineering Design Process to help us design a trap that's four feet long? We sent you a special wind-up toad toy to help you test the cane toad traps you engineer.

We can't wait to see what you come up with!

Jacob

What is the technology that Jacob is asking you to help engineer?

How far away from the part of the trap that catches the toad does the starting point need to be? Why?

Imagine

What are some solutions?

How can we build it?

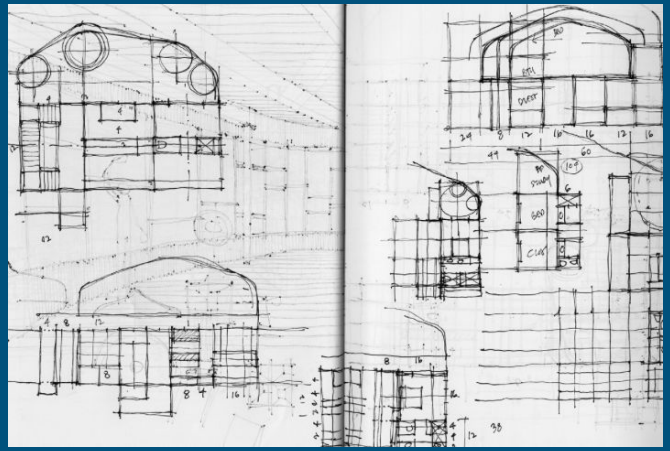
Plan

Draw a diagram of your proposed solution

in your journal.

Make your shopping list for the “STEM Store”.

You have $250 to spend.



Create

Send your Materials Manager to get your supplies.

You have 20 minutes to create your improved trap.

Reflect

Complete page 11 of your journal.

Engineering Showcase

Which step of the EDP helped you most with this activity? Why?

How would you improve even more next time?

(My Next Engineering Adventure p. 16)

Key Points

- Asking questions about design choices instead of fixing the problem yourself encourages kids to think through their own problems.
- Questions focusing on the design process can help all kids talk about their successes, even if their design isn't yet meeting its goals.
- Asking every group how they might improve emphasizes that there is always room for improvement.

Engineering is Elementary

- Free kits
  - Engineering Adventures (3rd-5th)
  - Engineering Everywhere (6th-8th)
- Paid curriculum/kits
  - NCESA lends out:
    - Designing Plant Packages
    - Solid as a Rock
  - Show Low teachers (WR)
    - Almost every kit!

Saturday Agenda

- Thank you!
- Engineering Project (seed dispersal)
- Closer Look at the EDP
  - Where did we see the 8 Science and Engineering Practices?
- Success vs. Failure
- Dive into PBL
    - Lunch/Smackdown
- Integrating Math
- Integrating Literacy
- Science Notebooks
- 21st Century Skills (4 C's)
- Grade Level Planning Time

Let’s Get Moving!

Inclement recess

Cancelled ancillary

Modified lock down

Calm down after recess

Just need a brain break

How did a tree travel halfway around the world?

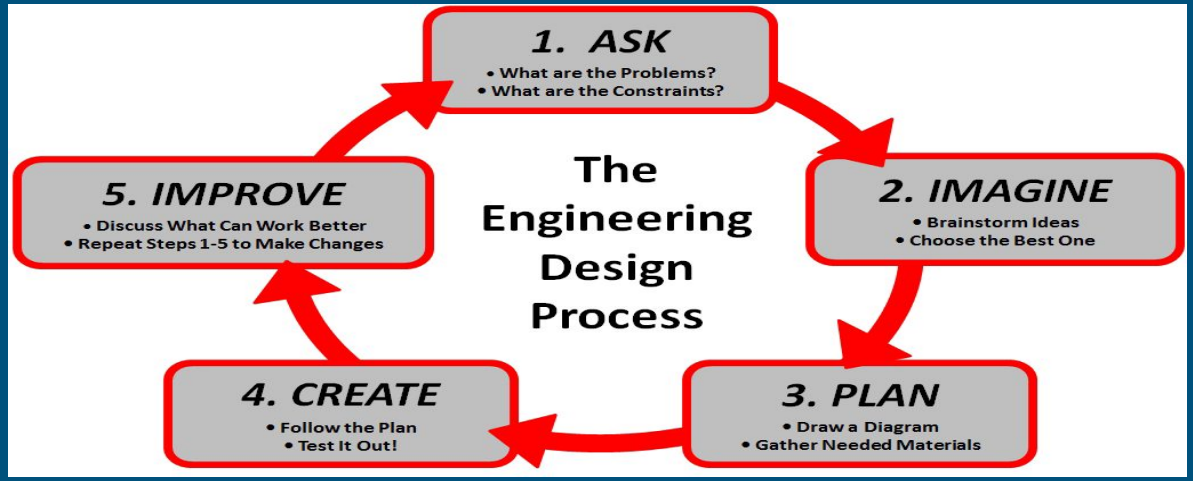
MYSTERY science

Plant Adventures (2nd Grade NGSS)

AZ Standards

Adaptable

Engineering Design Process

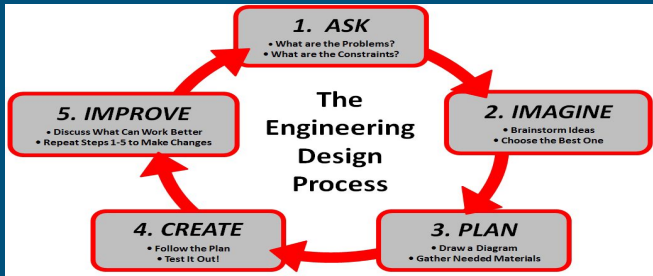


Note the process is cyclical. Make sure to allow time for students to communicate their products and challenges along the way.

Ask

Problems: Engineers solve problems
- This is a perfect opportunity to embed Problem-Based Learning

Constraints: Limitations
- Budget
- Materials
- Time
- Specifications
- etc.



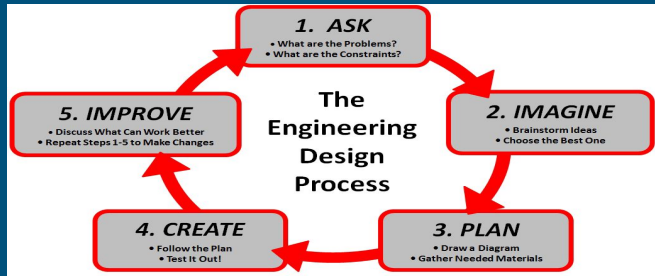
Imagine

Brainstorm Ideas:

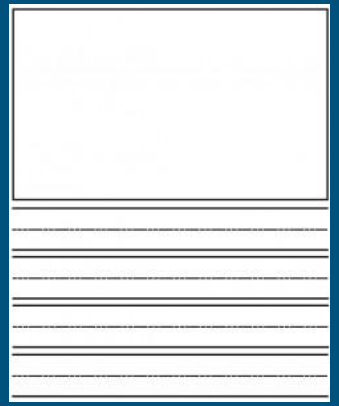
- Has this problem been solved before?
  - Research other ideas
  - Bio-Engineering

Pick the one you will do first:

- Prioritize your list
- Find ways to combine features



Plan

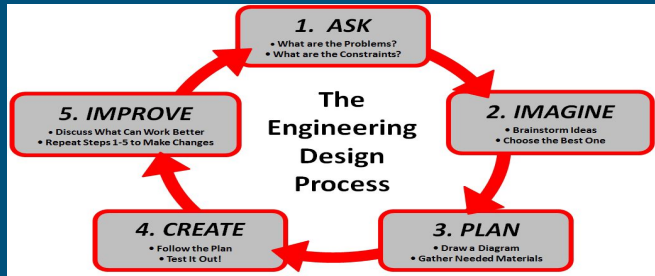


Draw a Diagram:

- Engineering Journal
  - Some competitions require it
  - lined paper, grid paper, blank paper, combo
- Labels and Dimensions
  - Measure twice, cut once
  - ABCD

Gather Materials:

- Budget
- Roles: Accountant



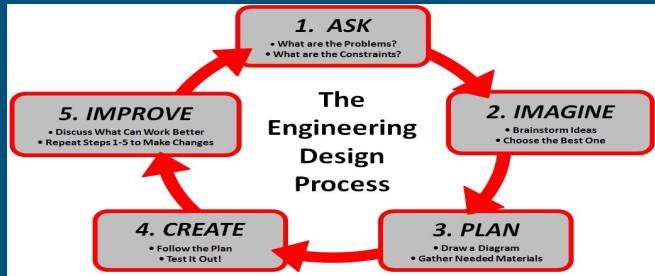
Step 4: Create (What the students do)

Follow the Plan:

- Build your design
  - May take more than one class session

Test it Out:

- Test multiple times
  - Science Fair
  - Car Safety
- Observe and record

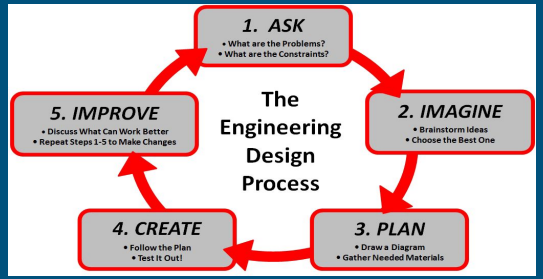


Step 4: Create (What You Do)

Ask the students if their design meets the goal of the challenge? How?

Engage the students in dialogue about their observations.

Encourage students to use their Scientific vocabulary where appropriate.



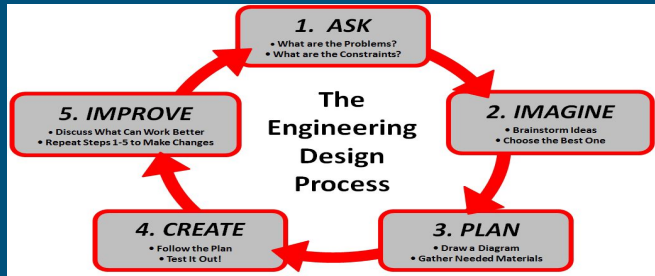
Step 5: Improve

Discuss What Can Work Better: (Evaluate)

- Did the design meet all the criteria?
  - Brainstorm
- Sometimes, simpler is better

Modify:

- Make needed changes
- Re-test
- Observe and modify



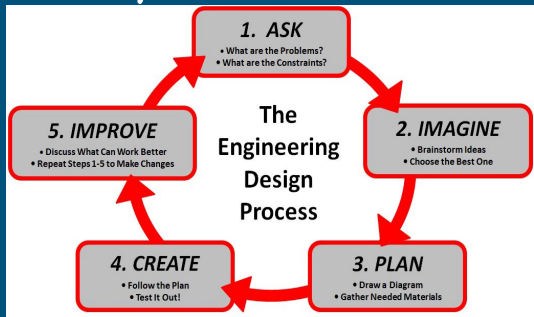
Step 6: Reflect (What the Students Do)

Display Your Design:

- Demonstrate how your design works

Explain:

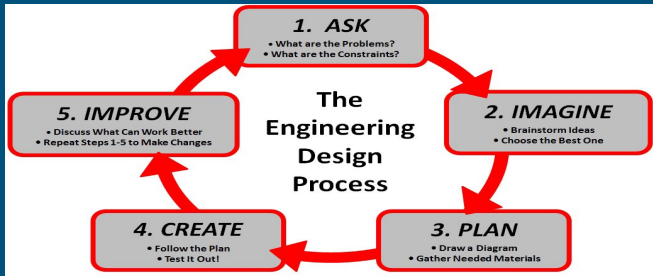
- How does your design meet the criteria?
- What is the best feature of your design? Why?
- What did you learn from others?
- Given more time, how would you improve even further?



Step 6: Reflect/Evaluate (What You Do)

How can you encourage your students to communicate what they have learned?

What are some ways you can showcase your students' designs and learning?



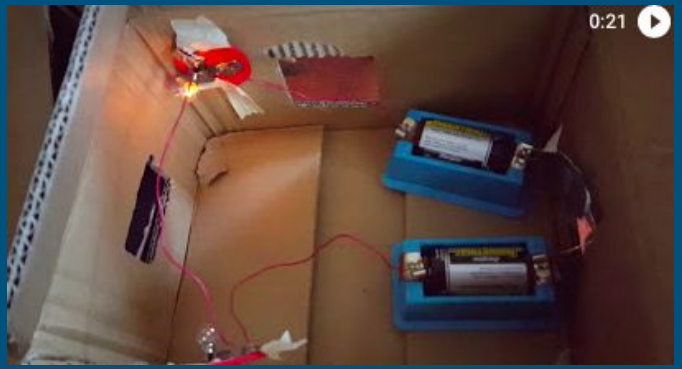
What Does Success Look Like?

How will students know they have designed a successful solution for the challenge?

How will you help students change their thinking about what the word failure means?

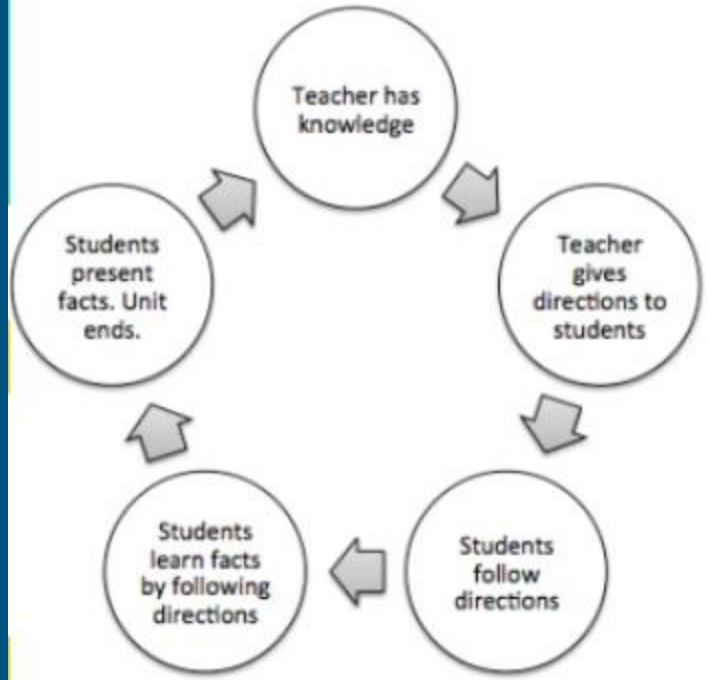
What does success look like?

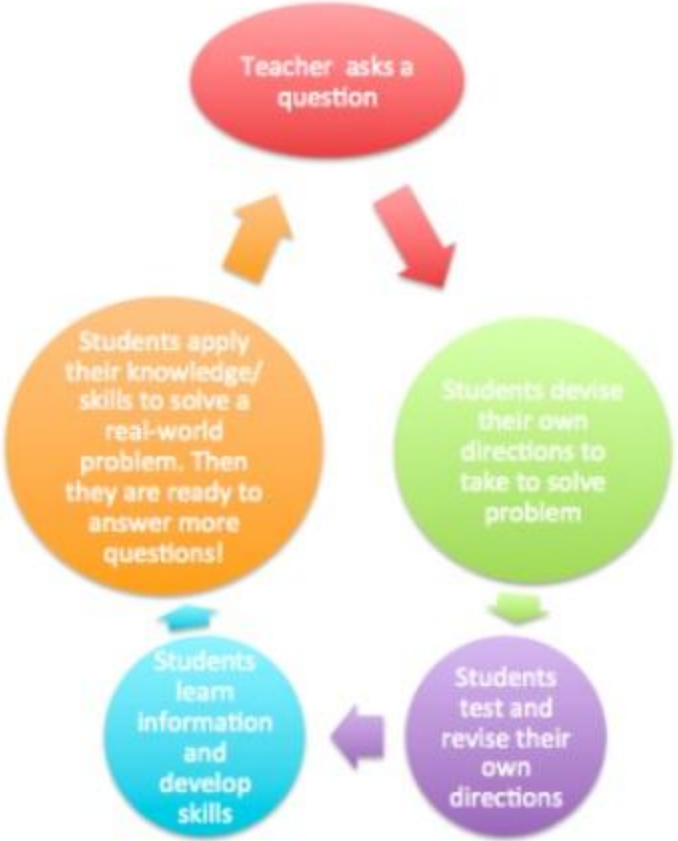
- Kids are engaged and challenged
- Kids share their ideas
- Kids value their engineering work as a process, not just as the end result



Failure?? REALLY??

"Doing Projects" vs. Project-Based Learning



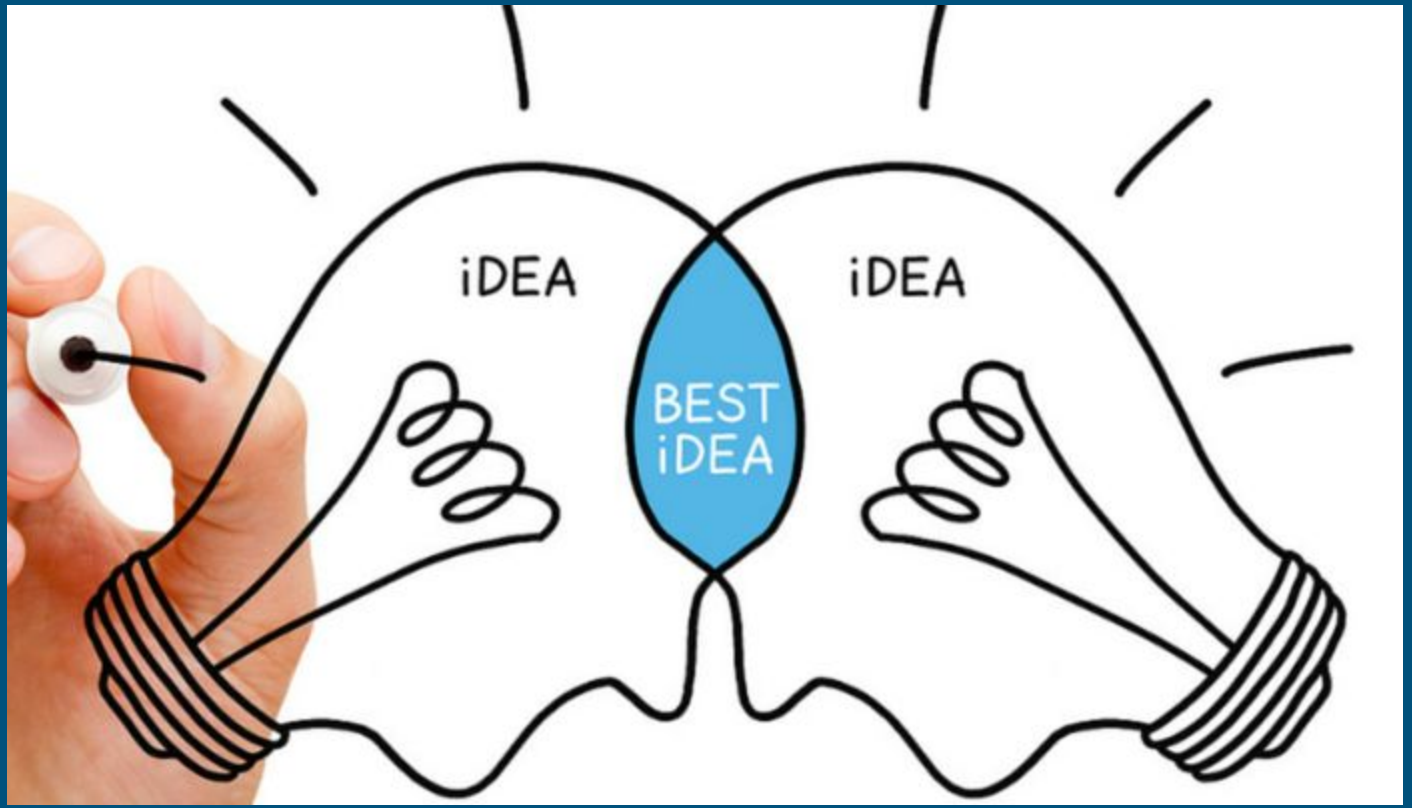


Real-world connections (video)

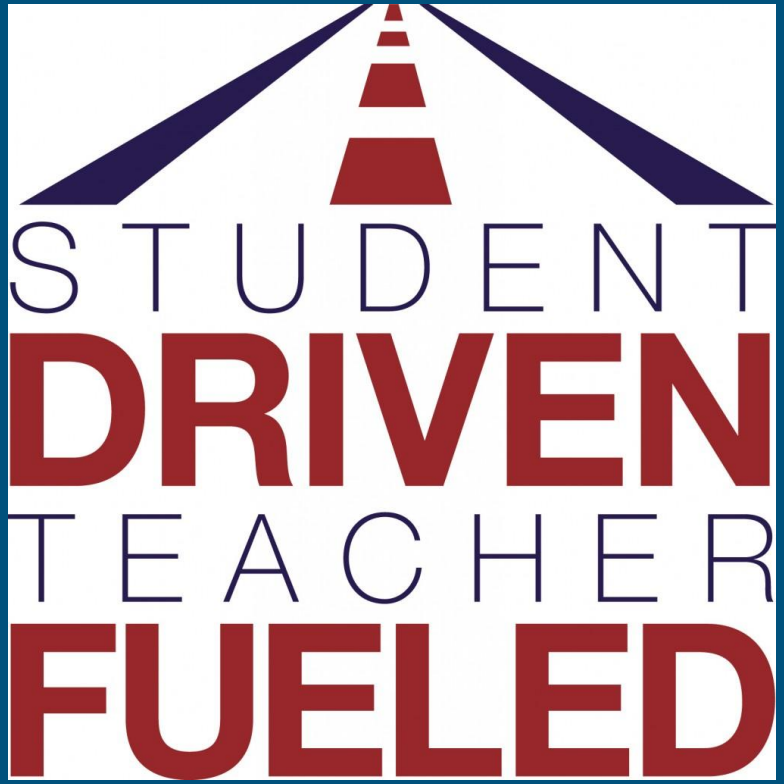
Not just dessert (video)

Strengthen your focus

Collaboration (video)



Learning (video)



3 W’s

In your notebook, answer these questions:

- **What** did we learn today?
- So **what**? (relevancy, importance, usefulness)
- Now **what**?
  - how does this fit into what we are learning,
  - does it affect our thinking,
  - where am I going to take this?

PBL Smackdown!

2 minute

Share a PBL resource:

- Website
- Book
- Curriculum

Create one huge shared resource

How do I embed Math?

Practices in Mathematics, Science, and English Language Arts*		
Math	**Science**	**English Language Arts**
M1. Make sense of problems and persevere in solving them.	**S1.** Asking questions (for science) and defining problems (for engineering).	**E1.** They demonstrate independence.
M2. Reason abstractly and quantitatively.	**S2.** Developing and using models.	**E2.** They build strong content knowledge.
M3. Construct viable arguments and critique the reasoning of others.	**S3.** Planning and carrying out investigations.	**E3.** They respond to the varying demands of audience, task, purpose, and discipline.
M4. Model with mathematics.	**S4.** Analyzing and interpreting data.	**E4.** They comprehend as well as critique.
M5. Use appropriate tools strategically.	**S5.** Using mathematics, information and computer technology, and computational thinking.	**E5.** They value evidence.
M6. Attend to precision.	**S6.** Constructing explanations (for science) and designing solutions (for engineering).	**E6.** They use technology and digital media strategically and capably.
M7. Look for and make use of structure.	**S7.** Engaging in argument from evidence.	**E7.** They come to understanding other perspectives and cultures.
M8. Look for and express regularity in repeated reasoning.	**S8.** Obtaining, evaluating, and communicating information.	

* The Common Core English Language Arts uses the term "student capacities" rather than the term "practices" used in Common Core Mathematics and the Next Generation Science Standards.

NGSS@NSTA
STEM STARTS HERE

Budget$

- Earn STEM Buck$ for Homework and Journals
  - Embedding reading and writing

Grade	Literary	Information
4	50%	50%
8	45%	55%
12	30%	70%

The percentage of **nonfiction text** increases as students move up the grades

Grade	To Persuade	To Explain	To Convey Experience
4	30%	35%	35%
8	35%	35%	30%
12	40%	40%	20%

as well as the percentage of **nonfiction writing projects**.

Budget$

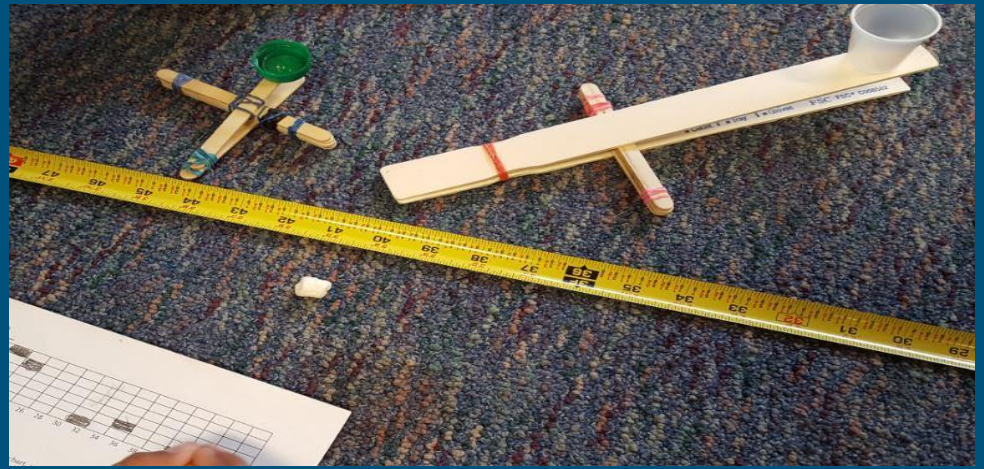
- Class competitions (warm-up or ice-breaker activities)
- Family projects

Budget$

- Own economy
  - Offered tutoring
  - Selling excess equipment

Various Units

- Vary your units
  - Inches and centimeters
  - Horizontal and vertical
  - Parallel and perpendicular

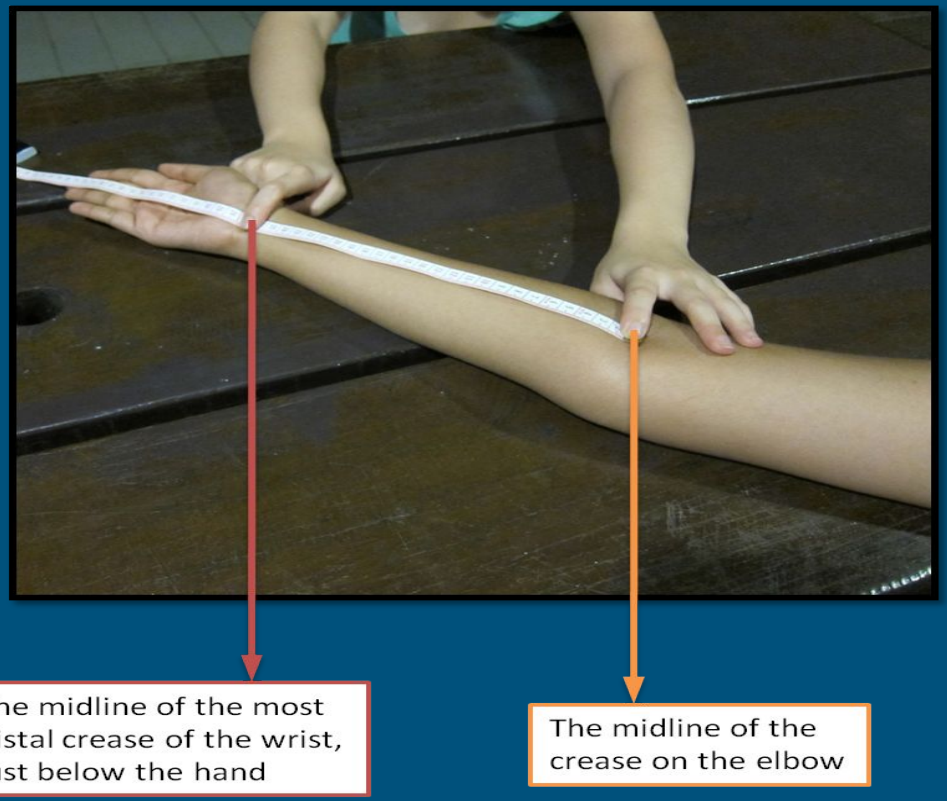


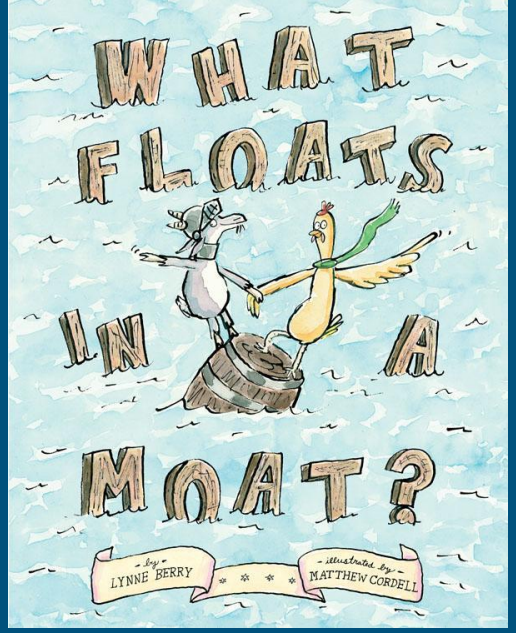
Various Units

- Vary your units
  - Linear feet, square feet, cubic cm
  - Area and perimeter (haunted houses and castles)

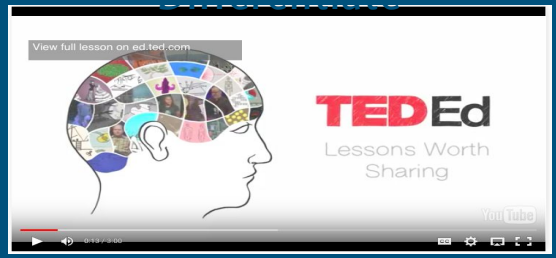
Various Units

- Non-standard units
  - Floor tiles
  - Body parts
  - Paper-clips
  - Counting bears





Challenge!



The queen wants butter, but she is in the castle, surrounded by a moat.

- Use your budget to engineer a prototype of a boat that can hold 500 grams for at least 30 seconds.
- Budget: $250

CHallenge

Engineer a boat that can hold 500 grams for 5 seconds without sinking

Page 2 us cm

	Length		width		Height		weight
green	7	×	7	×	2	=	100
blue	20	×	12	×	4	=	960
red	23	×	21	×	4	=	1932
orange	23	×	17	×	6	=	2346

What is Literacy and how do I embed it?

http://prezi.com/mr_jgjmtk7ag/?utm_campaign=share&utm_medium=copy

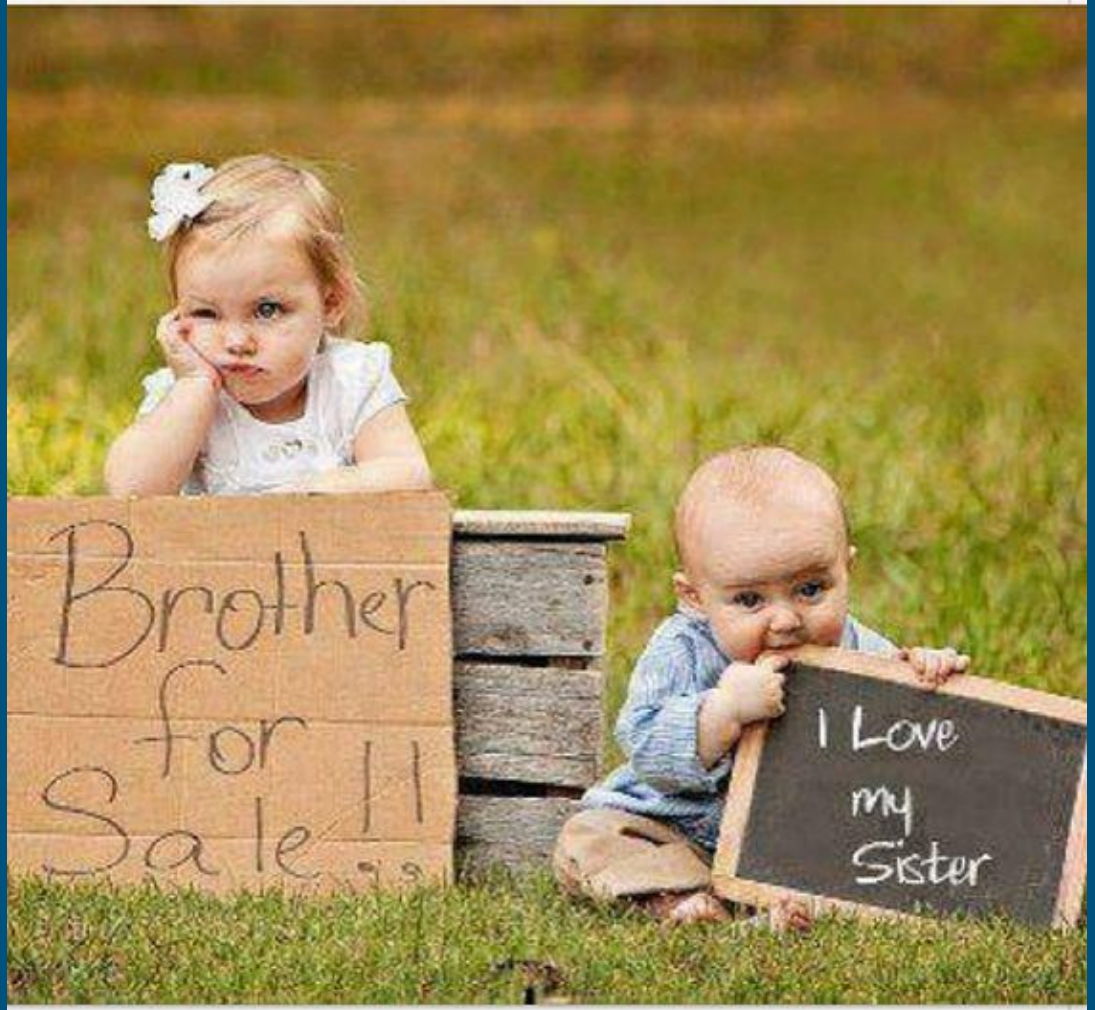
Vocabulary Rotation Stations!

- Word Splash (picture)
- Vocabulary Roll-A-Word
- Vocabulary Dice
- Memory (matching game)
- Foldable
- Vocabulary Word Wall Menu (free choice)

Vocabulary Rotation Stations!

- Habitat
- Invasive species
- Native species

*they are on your video viewing activity sheet



Word Splash!

Use your 3 vocabulary words to describe this picture. Write your sentence in your journal.

What are Science Notebooks?

Each grade level will

- Read a section
- Make a poster about that section
- Share out

All decked out! A student-grouping method

- Take the top card off the deck as it comes around.

- Find the other people in the room who have the same NUMBER as you
  - (example, 2s go with 2s, regardless of suit)

- Sit somewhere together where you can read and talk.

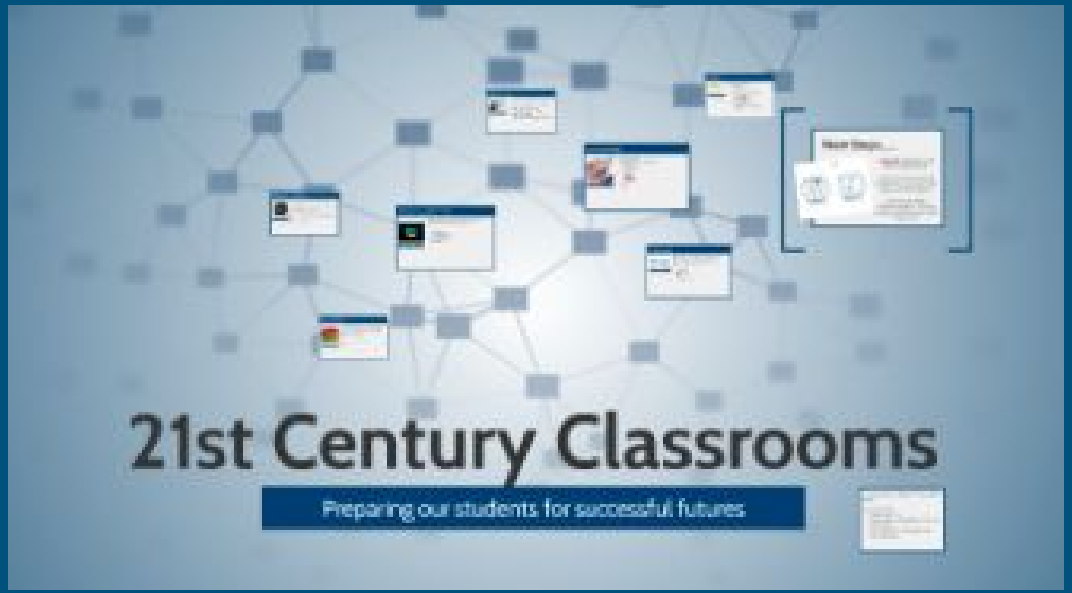
All decked out!

- Find your section of the article and read it. (ex., Aces are reading the 1 section)

- When everyone finishes, discuss the main idea of your section. What is the most important information in that section?

- Make a poster summarizing your section.

What are the 21st Century Skills?

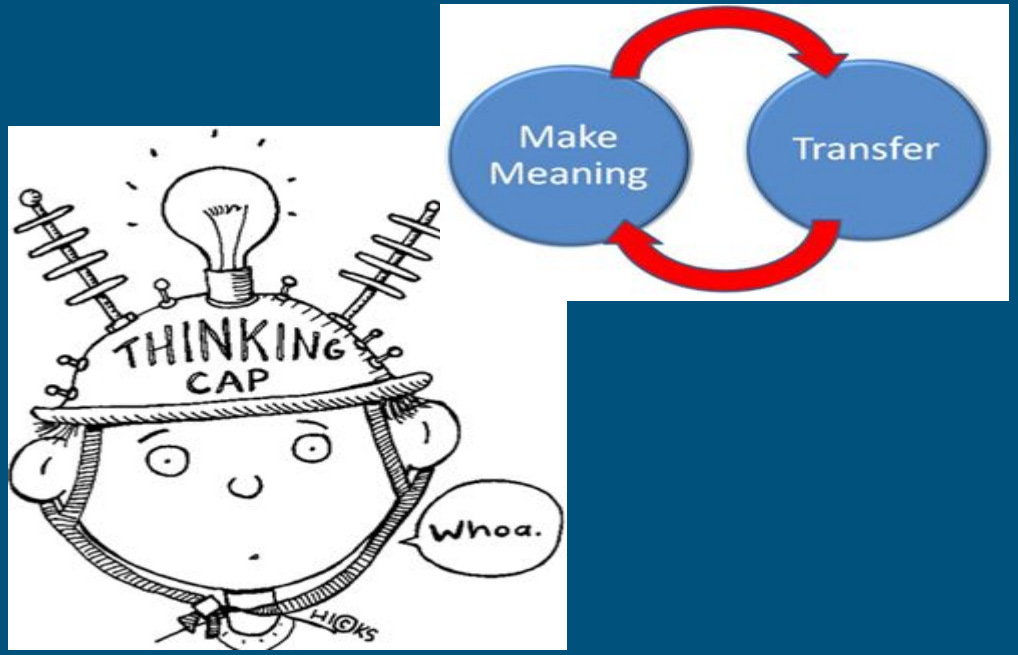


http://prezi.com/dbscth2tylzh/?utm_campaign=share&utm_medium=copy


I've failed
over and over
and over again
in my life.
And that is why
I
succeed.
MICHAEL JORDAN

“Transfer of Learning”

Students should be able to take the knowledge and skills learned in one context and apply them to new domains.



STEM Planning Template

STEM Lesson Template for Grade:

Title:	**Dates**: When will you start this lesson/unit? How long will it last?

Driving Question: A single over-arching question. It should be open-ended (students are not directed to a single correct answer).
What is the big idea you want the students to know when they finish the project?
Be specific enough that the question is interesting to the students, but broad enough that it is open-ended, leading to many solutions.
Ex. Why is it important to understand the life cycle and how can we help living things as they make their way through the life cycle?
Ex. Why should we be concerned about renewable and non-renewable resources?

Science Standard(s):

Quick Write #2

Write to the prompt

Pencil must be writing the entire time

"I have nothing else to write."

Timer goes off=pencils down

What is engineering and how can I embed that into my classroom?

Write to the prompt

Pencil must be writing the entire time

"I have nothing else to write."

Timer goes off=pencils down

What is engineering and how can I embed that into my classroom?

Count how many words you wrote.

Cannot count "I have nothing else to write."

Put number in top right corner.

Graph your number (QW#2).

September 9/10: Game and Fish
- PBL and Protecting Endangered Species

October 14/15: NPC
- Population Analysis & Interpretation of Data

November 4/5: Frontier Room (Show Low)
- Petrified Forest and Erosion

December 3: Webinar
- Educational Technology

January 13/14: NPC
- Plant Diversity

February 4: Webinar
- Formative Assessments

March 31/April 1: Frontier Room (Show Low)
- Presentations and DTAMS post-test

On-going:
- Meeting with your grade level team to co-write a STEM unit.
- Integrating STEM into your classroom
- Videotape yourself teaching your STEM lesson
- Analyzing student work
- Observe teaching your STEM lesson (with Gail or Steve in late February/March)
- Present your STEM unit with your team