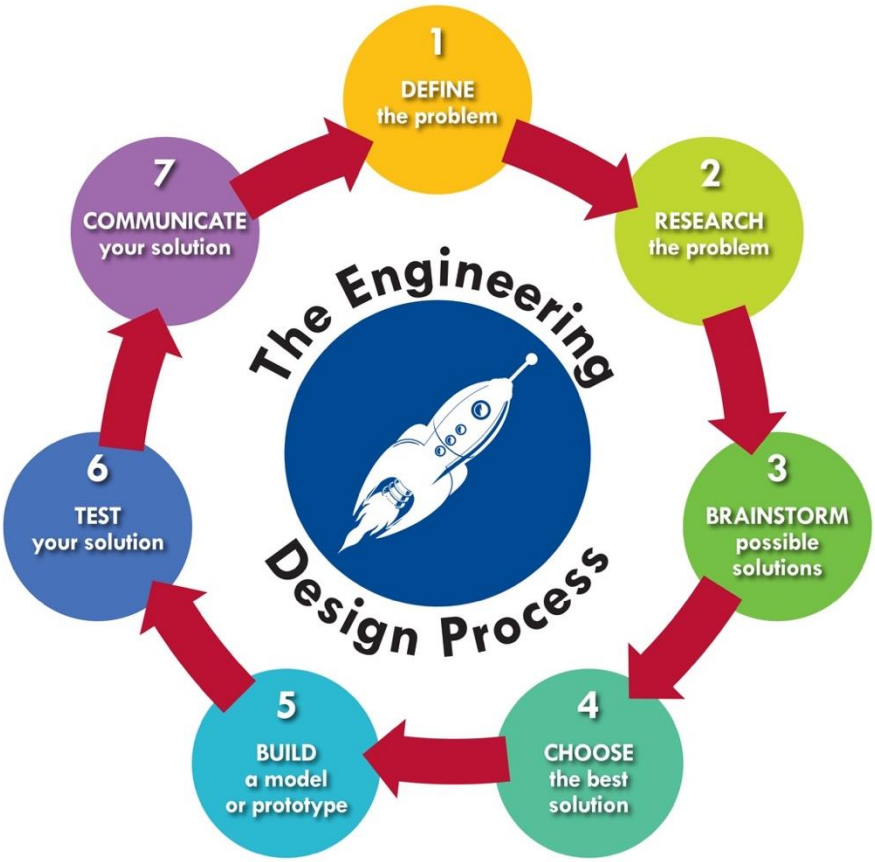
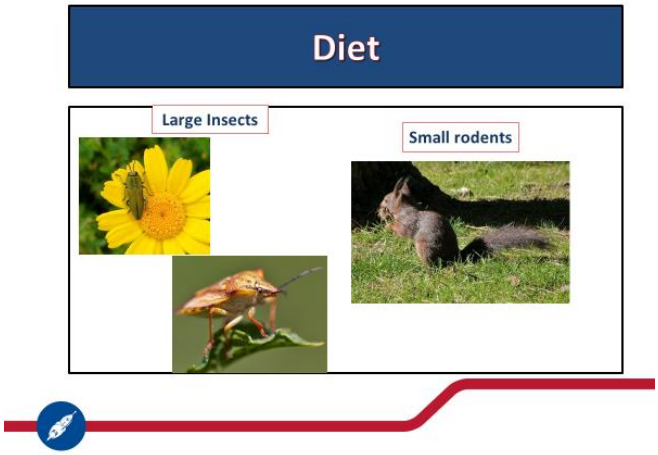
Solve It: A Student STEM Challenge



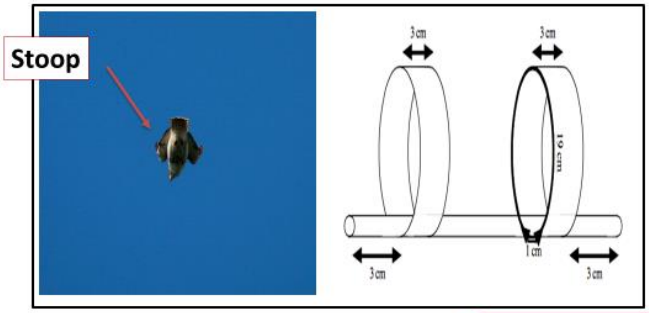
Topic: AZ Wildlife Rescue	**Materials:** • Computers for research • Graph paper • Scissors • Tape • Drinking straws • Fan
Challenge: To research the types of animals that are found in your neighborhoods and design a solution to either help Rescue without harming, rehabilitate if injured, provide temporary shelter until ready to be Released.	

Real World Connection:

- Liberty Wildlife: http://libertywildlife.org/
- Arizona Game and Fish: https://www.azgfd.com/Wildlife/
- Arizona Field Ornithologists: http://www.azfo.org/namc/aznamc.html
- Important Bird Areas: https://www.audubon.org/important-bird-areas/state/arizona
- AZ Important Bird Areas Program: http://www.aziba.org/
- Migratory Bird Treaty Act: https://www.fws.gov/birds/policies-and-regulations/laws-legislations/migratory-bird-treaty-act.php
- National Environmental Policy Act: https://www.fws.gov/birds/policies-and-regulations/regulations/national-environmental-policy-act.php
- Google Earth: https://www.google.com/earth/
- STEM Pro Live! with Liberty Wildlife: https://schoolsup.org/stemprolive/

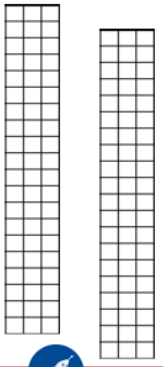
Intro Activity: To get started, you want to give your students an experience with understanding how animals and the environment are affected by human impact. One option is to use an activity that I have modified from the American Modeling Teachers Association called the Loop Bird. Students will begin by investigating how the circumference of the bird's wings affect the distance it is able to fly. The bird itself is made up of tape, centimeter grid paper, and a drinking straw.	
Possible Slides	Teacher Notes
	My suggestion is to infuse some of the natural inquiry processes to make the activity more real. For example: I usually start by asking the students to make some observations about a picture of an environment. Next, I ask them to predict what type of animals would live there? What kind of characteristics would be necessary to survive?
	Then I show them pictures of "food", usually insects or small mammals and ask them what kind of animal would hunt this type of food? What physical characteristics would it have?

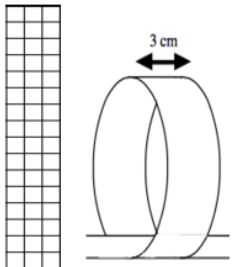
Meet the Loop Bird



At that point, I introduce them to the bird. My goal in doing this is to create a mindset that we are studying an organism and not just playing with a flying straw.

Build and Practice





Cut 2 strips of graph paper (3cm x 22cm).

Loop each strip w/ an overlap and tape to the straw.

I use 1cm graph paper to help make building the bird with precision easier.

Practice Flight

*Place a marker on the ground

Flight specialist:

- Release w/ gentle, overhand pitch
- Keep feet and hands behind marker
- Throw as uniformly as possible

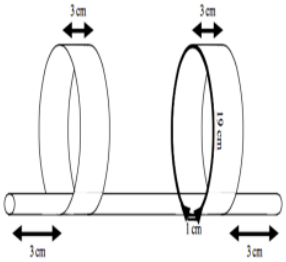
Rest of the group:

- Make observations about the flight

You can encourage your students to all throw the same way or let them experiment and choose their own style.

Practice, Modify, and Observe

As you are testing your bird, make as many modifications as you can to the design…*don't forget to record your changes!*



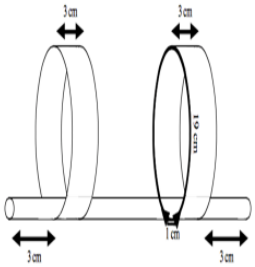
After giving the students time to build and practice flying the bird, they are asked to make a prediction about how the size of the wings (circumference measured in cm) will affect how far it will fly. They then conduct an experiment to test their hypothesis.

The Challenge

Only birds that can successfully fly the long distances between the sparsely spaced islands will be able to find enough food to live long enough to breed successfully.

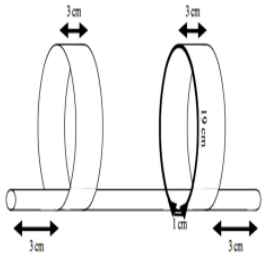
It is important to give them a challenge that is more than just testing a variable to see how it impacts the flight. This continues to build the mindset that this is an organism that we are working with.

The Question



What **variable** will have the greatest impact on improving the birds flight?

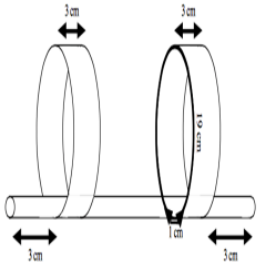
Your Question



What **variable** will you test?

Write a **testable question** to reflect your variables.

The Hypothesis

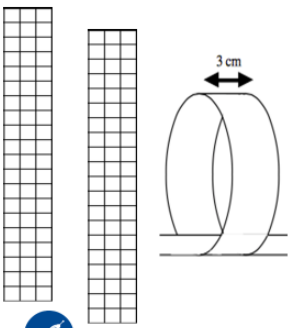


What do you think the effect of changing (your variable) will be on the distance (cm) flown?

Please follow the…

If _____ then _____ because _____.

The Build



Cut 2 strips of graph paper (3cm x 22cm).

Loop 1 strip w/ a 6cm overlap and tape so the circumference is 16cm.

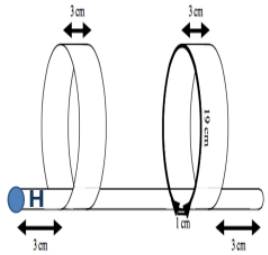
Have all the students start with the same bird and then let them vary their design based on what they choose as their independent variable.

The Build

Repeat for 2nd strip

Use marker to designate one end of the straw the "head"

Tape each loop 3cm from the end of the straw



Trial #1

Throw each bird one time from behind the line.

Record the distance (cm) and ***2*** *additional qualitative observations.*

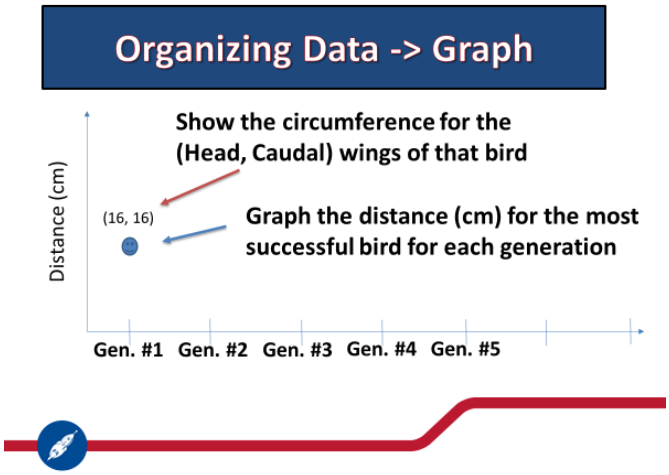
*farthest flight is the most successful bird

Observation:
1 Quantitative- distance (units)
2 Qualitative- describe the motion of the flight

Record Observations

Encourage at least 5 variations which we refer to as *Generations* of birds

It is always good for students to design their own data table but to save time, it is okay to provide one for all of the students to use.

	Having the students make a graph is optional but should be used if you plan on having the students compare results between groups.
	Once the students have their results, start to make changes to the environment and have them either predict or test what will happen to the loop bird: • The environment changes and high winds make flying very challenging. • Humans cut down the trees that the birds live in to build a village. • Humans bring an invasive species to the island that competes for the same food source but can also hunt at night.

Define the Problem:	
Guided Questions	Teacher Notes

• What do you have available to work with when designing your solution?
• What would a successful solution look like? How will you know if your design is successful?
• What are your constraints or limitations?
	• Establish your parameters (groups, roles, time limit, # of trials, amount of material allowed to use, etc.).
	• Taking your students through the Engineering Design Process will vary depending on what problems you identify that will need a solution:
	  • Are there animals found in your neighborhood/community that need to be rescued safely?
	  • Animals that are injured that need a creative solution to help rehabilitate?
	  • Animals that need a temporary shelter until they can be relocated or

	naturally migrate out of the area?
Research the Problem:	
Guided Questions	Teacher Notes
• What is already known about the problem? • What are some current solutions that can be built upon/improved? • What technology is available to help you understand the problem better? • What are some obstacles, challenges connected to your problem?	N/A
Brainstorm Possible Solutions:	
Guided Questions	Teacher Notes
• How many ideas can you come up with individually? • How many ideas can you come up with as a group? • How can you use/build on the groups ideas to refine your own?	• Have students individually come up with at least 4 possible designs that they could use in their solution • Have students share designs with a group. **Encourage a variety of ideas and a safe environment.* • Encourage reflection and refinement of ideas
Choose the Best Solution:	
Guided Questions	Teacher Notes
• Which solution(s) could you build using the materials/time you have available? • Which solution(s) could you build considering the constraints/ limitations? • Which solution do you think has the best chance to be successful?	• Have students choose an idea to design and make a plan to build/create (*even if you have no intention to actually build). • Have students draw a model of their prototype and label the parts (*if applicable). • List the materials that will be needed to build (*if applicable). • Describe how the materials will be used.
Build a Model or Prototype:	
Guided Questions	Teacher Notes
• What materials will you need? • Does your design meet the lesson objective? • Does your design clearly communicate your selected solution to the problem?	• Revisit the objective and make sure the student's design matches what they chose for their solution to the problem.
Test your Solution:	
Guided Questions	Teacher Notes

• Did you record your observations? • How will you know if your design worked as intended? • How will you know if your design was successful?	• Have students make and record observations during their trial(s). • Encourage students to stay true to their design and not make modifications while testing.
Communicate your Solution:	
Guided Questions	Teacher Notes
• Did your design work as intended? How do you know? • Did it solve the problem that you identified? How do you know? • Do you still think your solution is the best one for the problem? Why or why not? • What would you different if you could do it again? Why?	• *Have students reflect individually first and record responses.* • *Have students share responses with their group then whole class.* • *To make iterations, you will want to re-enter the Engineering Design Process and begin thinking about defining the problem(s) they had with the initial idea.* • *The purpose is to provide a process for them to formalize their thinking and not rely on trial and error to merely accomplish a task.* • *Share your students' designs and ideas with us at: info@mcesa.maricopa.gov*