

## BIOMIMICRY AND BATS

**OBJECTIVE:**

**The students will use the Engineering Design Process (EDP) to create a prosthetic wing for an injured bat.**

**NGSS:** MS-LS1-8, MS-ETS1-1, MS-ETS1-2, MS-ETS1-3, MS-ETS1-4

**NGSS CONNECTION:**  
MS-PS4-2, MS-PS4-3

**MATERIALS:**

- Construction paper
- Straws
- Thin string
- Scotch tape
- Scissors
- Toothpicks and popsicle sticks
- Coffee filters
- Copy paper
- wax paper
- pipe cleaners
- Paper towel rolls
- Any other materials on hand that could support student's thinking



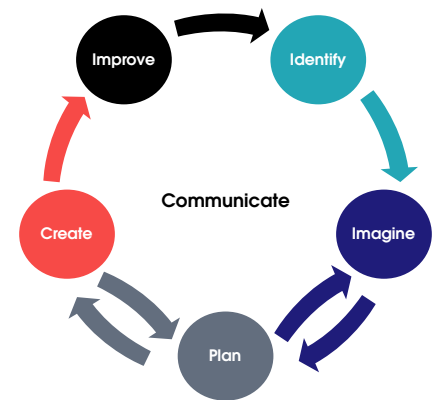
**TIME:** 2 hours

## Teacher preparation

- Teacher will gather the materials needed such as: construction paper, straws, thin string, scotch tape, scissors, toothpicks, popsicle sticks, coffee filters, copy paper, wax paper, pipe cleaners, and paper towel rolls. Any other materials on hand that could support student's thinking.
- Teacher will need to display the Engineering Design Process diagram.
- Teacher will need the Biomimicry and Bats! Powerpoint.

## Teacher directions

1. Before class time, determine if you want students to complete this engineering challenge individually or in groups. You should gather supplies in advance so that students will know what materials are available as they plan their design.
2. Show PowerPoint Biomimicry and Bats! Be sure to stop and discuss when prompted to do so. At slide #19, the engineering problem will be revealed. You can use the power point to guide the students through the engineering process.
3. The TEA Engineering Design Process is used in the engineering lesson.
4. The student will **identify** the problem. This part of the EDP provides students with the basic information they need to move forward in the challenge. Teacher sets the expectations for the problem the students are solving by introducing the criteria and constraints.
5. The teacher will read the problem and the criteria and constraints aloud to the students.



**The Problem:** Create an invention inspired by bats that will help humans.

» Criteria and Constraints:

Your design and written description must include:

**(Determined by teacher.)**

6. Before the Imagine starts, teacher will show students the materials they are allowed to use.
7. In the **imagine** part of the process, students brainstorm solutions to the problem/challenge. This part of the process is mainly about cooperation and communication to come up with a group design.
8. Each student will use their imagination to come up with ideas to solve a problem on their own paper. They will draw a model of their prototype and include labels for what materials are being used to build their prototype. After the students have recorded their imagine prototype, they will do a Think-Pair-Share to generate ideas from other students
9. After sharing their imagine, the next step is to **plan**. The team comes up with **one** plan that they will agree to try. The students will draw their final design in their notebook before they receive their materials. The final plan must have ideas from each team members imagine. The budget sheet must also be filled out to get approval.
10. The **create** part of the process is where the students create their prototype, test, and re-test it. Students create their prototype based on the plan they made as the group.
11. The next step is to **improve** their design. This stage allows students to observe and think critically about their prototype. Students should understand that failure is really a learning opportunity. Kids should learn to expect it and accept it.
  - » Students will make observations of their prototype.
  - » Students use critical thinking to identify what works well and what does not work well.
  - » Students should be given the opportunity to make improvements to their design based on observations and then re-test their prototype.
12. Throughout the engineering design process, students **communicate** with each other. A

teacher will want to make time for students to share their prototype either with another team or as a whole group. Each team will present its prototype. The other teams will provide feedback and make sure the other team included all the constraints. Remind teams they should say something they liked about the other team's prototype as well.

## Reflection

As a class, you will want to discuss the questions below as a whole group.

Questions:

- Did your prototype meet the required criteria?
- What was the easiest part in building the prototype?
- What was the hardest part in building the prototype?
- What would you change if you built another prototype?
- Tell about one thing you learned.
- Describe your teamwork. Was it positive? Negative? Both?

## Elaborate

Have students identify the type of wave is used in echolocation and describe how the energy is transferred.

This is an opportunity to review the characteristics of waves.

## ELPS

Check with students for understanding about what the engineering lesson is.