

ENGINEERING A BAT HABITAT FOR THE HOUSTON ZOO

OBJECTIVE:

The students will use the Engineering Design Process (EDP) to create a bat habitat for a section of the zoo.

NGSS: MS-LS2-1, MS-LS2-3, MS-ETS1-1, MS-ETS1-2, MS-ETS1-3, MS-ETS1-4

**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



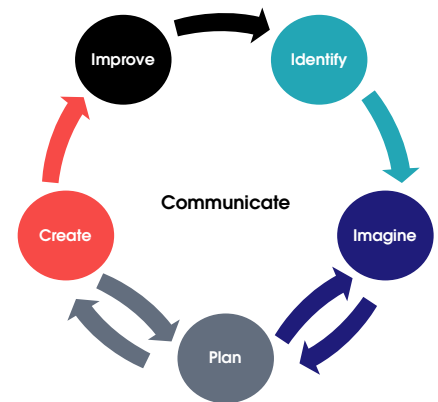
TIME: 2 hours

Teacher preparation

- Teacher will gather the materials needed.
- Teacher will need to display the Engineering Design Process diagram.

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. The TEA Engineering Design Process is used in the engineering lesson.
3. 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.
4. The teacher will read the problem and the criteria and constraints aloud to the students.



The Problem: The Houston Zoo has decided to redesign the zoo. They want to create a section of the zoo with a variety of North American bats to attract visitors from across the globe. To ensure a variety of bat habitats are included, Zoo Officials want our class to design and create prototypes to represent the caves, rock crevices, caverns, trees, bridges, tunnels, and buildings where bats roost. They want us to ensure insectivores and nectivores are included in the bat habitats along with bat nesting areas.

Can your group design a prototype of a bat habitat for the Houston Zoo?

» Criteria and Constraints:

Your design and written description must include:

- the basic needs of food, water, shelter, air, and enough space for bats to thrive.
- the dimensions of the habitat should be included (to make

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- sure there is enough space) for a colony of bats to roost.
- must have space for a small bat colony and include the needed plants.
 - address at least one adaptation of the bats and plants involved. Example: Nectar bats need a lot of energy, and feed on nectar which is high in sugar.
5. This part of the engineering process sometimes requires background information and research such as:
 - » Students search, view, and read about North American bat habitats.
 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 member's 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, discuss the questions below as a whole group.

Questions:

- Did your prototype meet the required criteria?
- Could your habitat support the bat in the enclosed space?
- What was the hardest part in building a zoo habitat for a bat colony?
- What would you change if you built another prototype?
- Tell about one thing you learned.
- Describe your teamwork. Was it positive? Negative? Both?

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Elaborate

The teacher may have the students sketch/draw a redesign of their zoo habitat and build an improved solution to the problem explaining the reasons for their redesign.

ELPS

Check in with students for understanding about what the engineering challenge is about, what a prototype might look like, and pair the students strategically in groups.