Solve Problems Like a Scientist

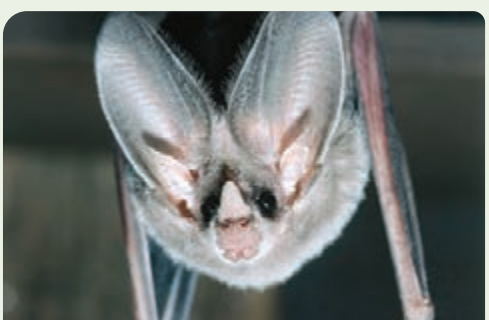
Unit Project: Bat Chat

In this project, you will research bats to learn how their adaptations help them to navigate and communicate.

Read the text about echolocation. **Underline** the ways bats use sound.

Chattering Bats

Many creatures use sound to communicate with each other. But sound can be used for other purposes. For example, bats use sound to communicate with each other. They also use sound to move around in the dark.



The Bat

Photo Credit: inigolai-Photography / Shutterstock.com

Bats also communicate with each other using sound. Bats make different sounds that mean different things, just like people communicate with words.

Most of the sounds are too high for humans to hear. Researchers use recording devices that can measure the sound. They have decoded many of the sounds bats make and have found that most of the sounds are arguments. Bats argue almost constantly. They argue about food. They argue about where they get to sleep. They argue about which bats they get to have as mates.

Echolocation

Research bats further by using print or online sources. **Learn** about the ways bats have adapted to use sound to navigate, hunt, and communicate. Then, **draw** a diagram of about using sound to avoid obstacles and find prey.

Label all relevant parts of the diagram. Be sure to include the way the sound interacts with the bat, the obstacles, and the prey.

Life Skills **I can work to meet expectations**

Bat Chat

Bats communicate by using different sounds to mean different things, like humans use language. Bats also hunt and fly in the caves where they live some times of their life, and they do so using echolocation.

Explain why it is helpful for bats to have different sounds that mean different meanings and things, given these facts. **Use** a Claim-Evidence chart to organize your thoughts.

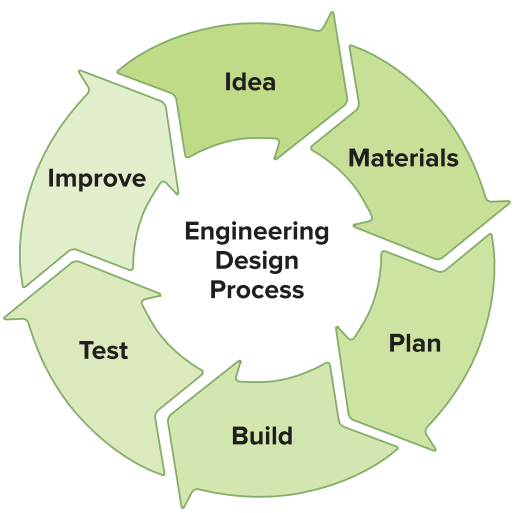
Claim

Evidence

Interdisciplinary Project: To Get to the Other Side

Quick Code: egs4430

In this interdisciplinary project, you will use your science and math skills to find a solution to a real-world problem. First, you will read a story about a fictional group of characters, called the STEM Solution Seekers. Then, you will study some background information, and you will design, test, and refine a solution to the overall challenge. You will go through the steps of the Engineering Design Process, as shown below. You will also do some additional work in your math class related to this challenge.



The project "To Get to the Other Side" challenges you to think about all of the members of a community and how we as humans affect other living organisms. In the story, you will read about a population of desert lizards, called the blue Sinai agama, who have been impacted by a new sidewalk. You will learn more about the habitat and needs of the agama, and then you will design a solution to help them survive.

To Get to the Other Side

Maher, Laila, and Galal are looking for the Sinai agama lizards that they usually see on their walk home from school.
"I can't find any. Where'd they all go?" asks Laila.

"Professor Hassan said there were lots of them here," says Maher. He is using a stick to poke in the sand and gravel at the edge of the sidewalk.

Photo Credit: inigolai-Photography / Shutterstock.com

They keep searching but don't find any lizards. As they grow tired of looking, Laila says, "I wonder why we can't find them. I think we need to ask Professor Hassan." Maher and Galal smile as all three start to run down the sidewalk to her house.

The friends talk over each other as they explain the problem to Professor Hassan. "There were plenty of Sinai agamas in that area before they built the new, wider sidewalk a few months ago," she says thoughtfully.

Galal thinks a minute and then wonders, "Why don't we get rid of the sidewalk and see if they come back?"

"The sidewalk helps everyone. Now we can walk and ride bikes and scooters to school and other places," Laila says. "My mom said the sidewalk helps keep us safe."

"The path is a good thing," says Professor Hassan nodding. "I think we need to find out more about the Sinai agama and why you couldn't find any there," she says. She starts tapping on her computer.

A woman in a lab coat pops up on the screen and says, "How can I help?" The children smile and Galal starts asking questions. Maher begins to tell the woman about their search for Sinai agamas. Professor Hassan motions Galal and Maher to be quiet so Laila can explain the problem to the woman.

Photo Credit: inigolai-Photography / Shutterstock.com

"Laila, did you and your friends notice anything else that is different in the area?" Laila thinks for a moment and reflects, "We remember seeing a lot more rocks in the area before the sidewalk was widened."

After chatting for a few more minutes, Laila signs off and turns to her friends. "Professor Hassan's friend told me that the new sidewalk may have disturbed the Sinai agama's habitat," Laila announces. "We need to figure out what the lizard's habitat looks like" says Galal.

"We need to be sure the sidewalk allows access to plenty of tall rocks that the Sinai agama like to sit on and hide under while looking for prey," Laila says.

Maher looks at some extra, unused items and says, "Maybe we can use some of this stuff to model a better habitat for the Sinai agama."

"I think you three are ready to figure out how to help the Sinai agama in our community!" says Professor Hassan as Maher, Galal, and Laila begin to talk about how they might help.

The Sinai Agama

(Blue agama)

(Blue agama)

The Sinai agama is a lizard that can be found in the dry and rocky environments of Eastern Egypt. In order to survive the hot, arid climate of this region, this little reptile has developed unique features and behaviors that allow it to live and hunt in this harsh environment. Some of these adaptations include standing on the top parts of its toes so that its belly stays high above the hot rocks, scaly skin that traps in water and having a long, thin body that helps it climb and run quickly.

The Sinai agama is active during the hottest parts of the day and likes to hang out in areas with many rocks, hard gravel surfaces, and volcanic boulders. They save energy as they wait in the dark spaces between the rocks for their prey to come by so that they can launch an attack. Males often perch on lookout rocks to guard their territory. During the late spring breeding season, the males turn a vivid blue color in order to attract a mate. Females remain the grey-brown color that helps these lizards to camouflage in the desert

Their diet consists mainly of ants, grasshoppers, beetles, termites and other insects. Tongues with surfaces that are as sticky as bubble gum allow the lizard to catch and hold on to their prey. The number of Sinai agama lizards in the wild is negatively affected by humans. Whether it is people making changes to their natural habitats or catching them so that they can be sold as pets, these little lizards would prefer to be left alone so that they can sit and wait for the next unlucky insect to come their way.

Hands-On Investigation

Engineering Your Solution

Challenge

You have been asked to create a solution for a sidewalk design that meets the needs of both humans and Sinai agama lizards. This activity will guide your team through the Engineering Design Process.

Objectives

In this activity, you will . . .

- Review the challenge requirements and assign roles to each member of your team
- Create three or four sketches to brainstorm solutions
- Agree upon one final blueprint for your prototype
- Create a prototype of your solution that helps the Sinai agama return to their habitat

A Desert Agama Habitat

What materials do you need? (per group)

- Building materials, such as craft sticks or small pieces of wood
- Construction paper or cardboard
- Pebbles, small rocks, and/or clay
- Sand, small sticks, leaves, dirt
- Toy animals or figures to represent living organisms in the habitat (optional)
- Blank paper or poster board

Procedure

Follow these steps with your teammates:

1. **Review the Challenge** Study the requirements from the school and the needs of the Sinai agama.
2. **Assign Group Roles** Decide the roles for the members of your group and record the names next to each role.
3. **Sketch Ideas** After brainstorming, as a team, select three or four ideas to plan out in the Sketching Our Design boxes. Review your sketches and decide on one design to fully develop. Add more details to make it your blueprint that you will use to help you create your solution.
4. **Plan and Build** Gather materials and begin building your prototype. Make sure to keep track of your steps and process.
5. **Reflect and Present** When finished, review your product and your process. Identify ways you could improve. Prepare to share with your class.

Design Requirements

- [ ] Your solution must include a diagram and small prototype of your sidewalk design, as well as a presentation sharing both your prototype (product) and how you worked together as a team (process).
- [ ] Your solution can only use materials the school has available: planks of wood, concrete, gravel, and natural materials found near the path, such as different size rocks, sand, dirt, sticks, and fallen leaves.

Life Skills **I can review expectations.**

Sketching Our Design

Within your team, discuss these two questions for your ideas:
What do you like about these ideas? Where can you make improvements to the designs? Circle your final design to create.

Plan and Build

STEP 1 Now that you have selected one design idea, create a separate diagram with additional details that you will share during your presentation. This detailed diagram is the blueprint for your prototype. Identify any materials you will use on the detailed diagram.

STEP 2 Gather the materials you identified in your blueprint. You may need to make adjustments to these materials as you are building. Keep track of what you actually use.

STEP 3 Begin building your prototype. As you build, you may run into problems

Life Skills **I can use information to solve a problem**

or challenges. Focus on one problem at a time and use your group's creativity and collaboration skills to find solutions. Engineers use notebooks and documentation to troubleshoot when things go wrong so that they can look for places to make improvements.

STEP 4 Once your prototype is complete, work with your team to create a presentation to share both your product and your process. Be sure to explain the parts of your prototype that help all of the living organisms in the habitat. Also make sure to prepare to share how your team worked together, if you encountered any problems, and how you worked to make improvements.

Analysis and Conclusions

Reflect on the following questions:

1. How does your solution meet the needs of people and Sinai agama?

2. How do you know your design is successful? What could you do to test your design?

3. What improvements would you make to the design process or to your final prototype?

4. What was your role on the team? What did you do well?
   What improvements could you make?

Assess your learning

Choose the correct answer from the following:

1. .....is considered a behavioral adaptation in living organisms.
   A- Long ear B- Live in burrows
   C- Big eyes D- Color contrast

2. ..... is considered a structural adaptation in living organisms.
   A- Birds migration B- Panting
   C- Brown fur D- Inflating the body to make it appear larger

3. The following animals are structurally adapted except for .....
   A- penguin B- fennec fox
   C- arctic fox D- polar bear

4. Some plants have very wide leaves in order to.....
   A- To prevent tearing due to wind
   B- To prevent animals from eating it
   C- Reduce water loss
   D- Get sunlight

5. Which of the following groups reflects light well when it falls on it?
   A- A mirror - A wooden board - A metal spoon
   B- a metal spoon - a cardboard box - a mirror
   C- Mirror - aluminum foil - metal spoon
   D- Aluminum paper - brick - mirror

6. The aluminum..... feature helps to see yourself in the mirror.
   A- refraction B- reflection
   C- absorption D- density

7. When exposed to danger, the ..... system helps to recognize it and avoid it
   A- circulatory B- digestive
   C- respiratory D- nerve

Compare each of the following:

1. The inhaled air and the exhaled air when the breathing process occurs in a person.
2. Structural adaptation and behavioral adaptation of a living organism.
3. Communication in humans and communication in animals.

Read the statements and determine if each is true or false. Write "true" or "false" on the line next to each.

1. Your sense of hearing allows you to see the light from a flashlight. ☐
2. The stomach is an important organ of the digestive system. ☐
3. Your sense of touch allows you to feel the heat from the stove. ☐
4. The esophagus is an important organ of the respiratory system. ☐
5. The ear is the organ of feeling that allows you to hear birds singing . ☐
6. The lungs are important organs of the respiratory system. ☐
7. The eye is the organ of feeling that allows you to taste the bitterness of a lemon. ☐
8. The heart is an important organ of the nervous system. ☐
9. Skin is the sensory organ that allows you to feel the softness of the fabric. ☐
10. The diaphragm is an important organ of the digestive system. ☐

Complete the sentences using the correct words from the following words in brackets:

(Touch - Hearing - Light - Eye - Ear - Heart - Brain - Respiratory System - Lung - Stomach - Digestive System)

1. The sense of _____ allows you to notice noise, _____ sends a signal through the nerves. The signal goes to _____, and you interpret that sound as the song of a bird.
2. The system that digests food to produce energy is _____. The most important member of this system is _____, and the system responsible for providing the body with oxygen is _____

Answer the following:

1. Why is vision different at night between cats and humans?
2. Bats cannot see in the dark, but they can hunt their prey at night