Science Tech Trek: Biomimicry in Engineering

Teacher Post Trip Guide

Post Trip Overview

After completing their Science Tech Trek, students will have the opportunity to reinforce and extend their understanding of biomimicry in engineering with post-field trip learning activities in the classroom. Teachers will guide their learners through a review of students' underwater robot designs. Then, learners will get to share and revise their designs and begin to explore conservation.

Supported Amplify Science Lessons

3rd Grade Amplify Unit: Environments and Survival

Lessons:

4.1 Cockroach Robots
4.2 Planning Designs
4.3 Making and Testing Designs
4.5 Presenting Design Arguments

Supported NGSS Standards

3-5-ETS1-2: Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.

Science and Engineering Processes	Disciplinary Core Ideas	Crosscutting Concepts
Constructing Explanations and Designing Solutions • Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design problem. (3-5-ETS1-2)	**ETS1.B: Developing Possible Solutions** • At whatever stage, communicating with peers about proposed solutions is an important part of the design process, and shared ideas can lead to improved designs. (3-5-ETS1-2)	**Influence of Engineering, Technology, and Science on Society and the Natural World** • Engineers improve existing technologies or develop new ones to increase their benefits, decrease known risks, and meet societal demands. (3-5-ETS1-2)

Supported Common Core Standards

CCSS.ELA-LITERACY.L.3.4a: Use sentence-level context as a clue to the meaning of a word or phrase.

STT Central Phenomenon Questions	Science Tech Trek Learning Objectives
How can we keep trash out of our water?	Students will be able to... • Investigate structure and function of animal body parts and traits to inform their design of a trash collecting robot • Use observation and inference techniques to investigate questions about animals and engineering design • Observe animals, investigate scientific questions, and use tablets to document their explorations

Post-Trip Guide

Logistics

Facilitated by classroom teacher at school

Time: 25-30 minutes

Learning Objectives

Students will be able to...

- Investigate structure and function of animal body parts and traits to inform their design of a trash collecting robot
- Use observation and inference techniques to investigate questions about animals and engineering design
- Revise a design to add improvements

Materials

- Printed Science Tech Trek summaries (examples on last page)
- Pencils
- Crayons/colored pencils/markers
- Computer/projector/speakers
- ROV video link: https://www.youtube.com/watch?v=bbMNJXYFwPc
- The Problem with Plastics video link: https://www.youtube.com/watch?v=526gMLHDVLg

Prep

- Print two copies of each Science Tech Trek summaries (one for each partner)
- Pull up ROV video online
- Pull up The Problem with Plastics video online

Facilitation Outline

Quick Outline

1. Reviewing learning objectives and Science Tech Trek concepts
2. Expanding on students' robot design
3. Conservation connection

1. Reviewing Learning Objectives and Science Tech Trek Concepts

5 minutes

- Review the learning objectives for students' exploration of using biomimicry in engineering.
- Remind students of what they did during their Science Tech Trek:
    - Explored how a tortoise or turtle uses a shell to protect itself and how this can help to design a robot frame
    - Explored how sea stars, engineer gobies, or seahorses grab onto things and how this can help to design a robot attachment to pick up trash
    - Explored how sharks and sting rays can swim and how this can help to design a robot motor
    - Designed an underwater robot to pick up trash from the bottom of Lake Michigan
- Make sure students have their Science Tech Trek summaries and a writing utensil.
- Review the functions of different parts of an underwater robot, using a combination of partner sharing and whole group response:

    Guiding Questions:
    - What does the robot's frame do? (*the robot's frame provides structure and protects the insides of the robot*)
    - What does the robot's attachment do? (*the robot's attachment grabs onto things*)
    - What does the robot's motor do? (*the robot's motor moves the robot around*)

2. Expanding on Students' Robot Design

15 minutes

- Make sure students have their Science Tech Trek summaries and a writing utensil.

- Have students pair up with the person they did their Science Tech Trek with. Then, put pairs into groups of four and have teams share their robot design with one another. Remind students to explain which animals they modeled their robots after and why they chose those animals.
- Students should also complete questions 1 and 2 on their Science Tech Trek summaries.
- Facilitate a whole group sharing time where teams share out what they like about other teams' robots.
- Watch the ROV video to learn how students in Chicago created real underwater robots.
- Have students answer question 3 on their summaries, basing their improvements off of another group's robot or the robots they saw in the video.
- Have students draw their modified robot on their summary for question 4.
- Ask students to share their modifications with the whole group and explain why they want to make those modifications.

3. Conservation Connection

5-10 minutes

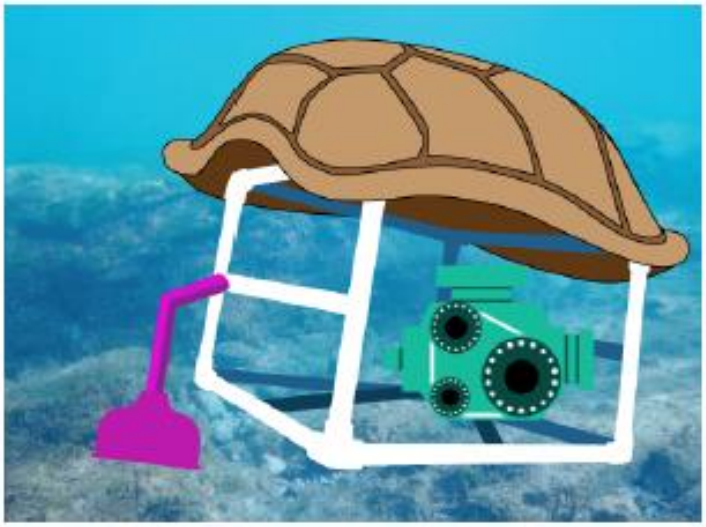
- Explain that students' goal was to design underwater robots to pick up trash from the bottom of Lake Michigan. In addition to using robots to pick up trash, there are other actions students can take to keep waterways clean.
- Watch The Problem with Plastics video to learn about ways students can conserve.
- Facilitate a discussion about The Problem with Plastics:

  Guiding Questions:
  - What bodies of water do we live near? (*Great Lakes, Lake Michigan, Chicago River*)
  - Why is it important to keep our waters clean and healthy? (*animals live there, people drink or use water, etc.*)
  - What are some actions we can take to keep bodies of water clean? (*use reusable bags, lunch bags, and water bottles, recycle and throw away trash properly, pick up trash outside, reduce use of straws and other single-use plastics*)
- Have students share with a partner about an action that they want to take or already do to keep waterways clean. Then, have each student share with the whole group.
- Share photos of your students' post-trip learning with #SheddLearning via Twitter, Instagram, or Facebook! Or email the photo with your school name to learning@sheddaquarium.org and for Shedd to tweet from @SheddLearning.

Science Tech Trek Summary Example

Shedd AQUARIUM

Student A.



My robot helps to remove trash from the bottom of Lake Michigan. This is important because trash can...

kill wildlife

The frame of my robot is shaped like a turtle shell because...

it'll protect the robot

My robot can use its attachment to...

pick up trash

My robot uses its motor to...

move forward

1) Whose robot did you compare to?

_____

2) We like that their robot _____

because _____

_____

3) After seeing another group's robot, we want to improve our robot by

_____

_____

4) In the space below, draw your robot with the improvements or modifications you want to make.