Engineering in Action: Journey to the Sea

Grades: K - 6
Time: 50 minutes

Engineering Challenge: Students will plan, build, and test a transport system that will use air power to move a toy eel up and out of a wind tunnel.

Rationale and Context:

Students will learn about the characteristics and life cycle of the American Eel. Students will also use the Engineering Design Process (EDP) to define and construct a playful solution to a problem related to eel migration. The EDP is a series of steps that engineers employ to develop solutions to a given problem. It is a cyclical process that can be applied to any problem requiring a technological solution. Many of the environmental challenges facing the Lake Champlain Basin benefit from engineered technologies, such as management of invasive species and stream monitoring. Students will come to see that the EDP can be used to solve problems in a diversity of contexts and themselves as possessing the ability to design and improve technologies.

Teacher Background Information:

American Eels are one of very few species that can adapt to either a fresh or salt water environment. After hatching in saltwater in the Sargasso Sea in the North Atlantic, young eels migrate to shorelines on both sides of the Atlantic. Some travel north to the St. Lawrence River, down the Richelieu River, and into Lake Champlain's freshwater environment. Amazingly, eels can travel over land for short distances because unlike other fish, they can absorb oxygen through their skin. At maturity, which can take up to 30 years, eels migrate back to the Sargasso Sea where they breed. Once an important food source for the Abenaki, eels are still part of a healthy food chain in our local ecosystem. Biologists observe the eel population in Lake Champlain as healthy but also notice that there are low numbers of eels entering the lake. It's possible that migration routes are hindered by river dams.

The Engineering Design Process

Engineers improve existing technologies or develop new ones to increase their benefits, decrease known risks, and meet societal demands. The Engineering Design Process (EDP) is a set of steps engineers follow to solve problems. Steps include: Define, Plan, Create, Test, and Improve. The process is designed to be cyclical with students repeating the steps as many times as necessary to refine their ideas. Fundamental to this process is the ability of students to solve problems creatively and work together. Typically solutions involve designing a product that meets certain criteria and possible solutions to a problem are limited by available materials and resources (constraints). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success. Different solutions need to be tested in order to determine which of them best solves the problem.

Next Generation Science Standards

Standard	**K-5**
LS1.A	Structure and Function
LS1.B	Growth and Development of Organisms
ESS3.C	Human Impacts on Earth Systems
PS2.A	Forces and Motion
ETS1.A	Defining and Delimiting an Engineering Problem
ETS1.B	Developing Possible Solutions
ETS1.C	Optimizing the Design Solution
ETS2.B	Influence of Engineering, Technology, and Science on Society and the Natural World
Science and Engineering Practices	Developing and Using Models Constructing Explanations and Designing Solutions
Crosscutting Concepts	Cause and Effect Structure and Function

Vocabulary: Students will gain an understanding of certain vocabulary words through active participation and explanation.

Catadromous	Larvae	Nocturnal
Elvers	Metamorphosis	Spawn
Conservation	Migrate	Weir

Learning/Behavioral Objectives:

1. Students will define a problem facing the Lake Champlain Basin.
2. Students will use the EDP to collaboratively plan and build a solution, taking into account material/time constraints and criteria for success.
3. Students will engineer their own solutions to a problem or challenge.
4. Through testing and discussion, students will evaluate their designs.
5. Students will revise their solutions, considering how the structure of their original designs impacted their function.
6. Students will reflect on the EDP and its application in everyday life.

Focusing Questions:

1. What are the defining characteristics of the American eel?
2. What challenges and threats face American Eels in Vermont?
3. What actions will support the population of American eels in our state?
4. How can we use the Engineering Design Process to solve problems in everyday life?