Engineering in Action: Fish Assist

Grades: K - 6
Time: 50 minutes

Rationale and Context:
Students will learn about the characteristics of one of Vermont's endangered species the Lake Sturgeon. Students will also use the Engineering Design Process (EDP) to define and construct a playful solution to a presented problem facing breeding Lake Sturgeon. 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:

Lake Sturgeon Ecology:
Lake Sturgeon are ancient fish. Fossils of sturgeon have been aged at over 60 million years. They can live for over 150 years and grow to be 7 feet in length and weigh upwards of 300 pounds. Armored with bony plates called scutes along their backs, they have very few predators as adults and have whisker-like barbels under their snouts that help them locate their food along the bottom of the lake.

Sturgeon were once abundant in Lake Champlain, with an estimated historic population of 3,000 adults. World demand for their eggs (caviar) and smoked sturgeon meat led to a time of intense overharvesting in the early 1900's which along with the loss of spawning and nursery habitat caused by the construction of dams along their spawning corridors devastated the population in Lake Champlain. They are now listed as an endangered species in Vermont and it is unknown how many sturgeon are in the Lake today.

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,

Build, Evaluate, and Revise. 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.

Vermont Standard(s): Next Generation Science Standards

Standard	**K - 5**
LS1.A -1	All organisms have external and internal parts that serve various functions
LS1.C -1	All animals need food in order to live and grow
LS4.D-1	Animals live in a variety of habitats, and change in those habitats affects the organisms living there.
ETS1-1	Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.
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 a problem.
ETS1-3	Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.
Science and Engineering Practices	Define a simple problem. Generate and compare solutions to a problem. Engage in the design cycle to construct a solution that meets a specific design goal. Plan and carry out fair tests in which variables are controlled. Communicate information and design ideas with others.
Cross Cutting Concepts	Systems and Models Structure and Function

	Cause and Effect: Mechanism and explanation

P21 21st Century Skills

Skills	**K - 5**
Think Creatively	Elaborate, refine, analyze and evaluate their own ideas in order to improve and maximize creative efforts.
Work Creatively with Others	Be open and responsive to new and diverse perspectives; incorporate group input and feedback into the work. View failure as an opportunity to learn; understand that creativity and innovation is a long-term, cyclical process of small successes and frequent mistakes.

Learning/Behavioral Objective(s):

1. We 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. Through testing and group discussion, students will evaluate their designs.
4. Students will revise their solutions, considering how the structure of their original designs impacted their function.
5. We will reflect on the EDP and its application in everyday life.

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

Barbels	Spawn	Juvenile
Anal fin	Dorsal fin	Larva
Pectoral fin	Caudal fin	Heterocercal Tail
Pelvic Fin	Scutes	Gills
Engineering Design Process		

Focusing Question(s):

What makes a fish a fish?
What are the defining structures of a lake sturgeon?
What are the stages of Lake Sturgeon development and migration?
What can we do to help insure the growth of endangered lake sturgeon populations?

How can we use the Engineering Design Process to solve problems in everyday life?
How do groups of people work together to solve problems?