



Engineering in Action: Zip Carts

Grades: K - 6

Time: 50 minutes

Engineering Challenge: Students will plan, build, and test a cart that can transport a toy turtle down a zipline.

Rationale and Context:

Students will use the Engineering Design Process (EDP) to define and construct a solution to a presented problem facing the Lake Champlain Basin. 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:

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 the 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
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 the 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. Plan and carry out fair tests in which variables are controlled.
Cross Cutting Concepts	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 Objectives:

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.

Criteria

Constraints

Design

Engineering

Engineering Design Process

Fair Test

Technology

Focusing Questions:

How can we use the Engineering Design Process to solve problems in everyday life?

How does the availability of materials and resources impact the Engineering Design Process?

How should a piece of technology's end user influence its design?

How does the structure of a design affect its function?

How does one determine the success of a design?

What is the role of failure in the EDP?

How do groups of people work together to solve problems?