Kindergarten STEM Unit 2: Engineering Trash Collectors

Content Area: **STEM**
Course(s): **Science Grade 1**
Time Period: **MP3**
Length: **23 days**
Status: **Published**

NJSLS - Science

K-2-ETS1-1	Ask questions, make observations, and gather information about a situation people want to change (e.g., climate change) to define a simple problem that can be solved through the development of a new or improved object or tool.
K-2-ETS1-2	Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.
K-2-ETS1-3	Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.
8.1.2.AP.1	Model daily processes by creating and following algorithms to complete tasks.
8.1.2.AP.4	Break down a task into a sequence of steps.
8.1.2.AP.5	Describe a program's sequence of events, goals, and expected outcomes.
8.2.2.ED.1	Communicate the function of a product or device.
8.2.2.ED.2	Collaborate to solve a simple problem, or to illustrate how to build a product using the design process.
8.2.2.ED.3	Select and use appropriate tools and materials to build a product using the design process.
8.2.2.ED.4	Identify constraints and their role in the engineering design process.
8.2.2.ITH.3	Identify how technology impacts or improves life.
8.2.2.ITH.5	Design a solution to a problem affecting the community in a collaborative team and explain the intended impact of the solution.
8.2.2.NT.2	Brainstorm how to build a product, improve a designed product, fix a product that has stopped working, or solve a simple problem.
8.2.2.ETW.4	Explain how the disposal of or reusing a product affects the local and global environment.
K-ESS3-3	Communicate solutions that will reduce the impact of climate change and humans on the land, water, air, and/or other living things in the local environment.

Science and Engineering Practices

Obtaining, Evaluating, and Communicating Information

Communicate solutions with others in oral and/or written forms using models and/or drawings that provide detail about scientific ideas. (K-ESS3-3)

Asking Questions and Defining Problems

Ask questions based on observations to find more information about the natural and/or designed world(s). (K-2-ETS1-1)

Define a simple problem that can be solved through the development of a new or improved object or tool. (K-2-ETS1-1)

Developing and Using Models

Develop a simple model based on evidence to represent a proposed object or tool. (K-2-ETS1-2)

Analyzing and Interpreting Data

Analyze data from tests of an object or tool to determine if it works as intended. (K-2-ETS1-3)

Disciplinary Core Ideas

ESS3.C: Human Impacts on Earth Systems

Things that people do to live comfortably can affect the world around them. But they can make choices that reduce their impacts on the land, water, air, and other living things. (K-ESS3-3)

ETS1.A: Defining and Delimiting Engineering Problems

A situation that people want to change or create can be approached as a problem to be solved through engineering. (K-2-ETS1-1)

Asking questions, making observations, and gathering information are helpful in thinking about problems. (K-2-ETS1-1)

Before beginning to design a solution, it is important to clearly understand the problem. (K-2-ETS1-1)

ETS1.B: Developing Possible Solutions

Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas for a problem's solutions to other people. (K-2-ETS1-2)

ETS1.C: Optimizing the Design Solution

Because there is always more than one possible solution to a problem, it is useful to compare and test designs. (K-2-ETS1-3)

Crosscutting Concepts

Cause and Effect

Events have causes that generate observable patterns. (K-ESS3-3)

Structure and Function

The shape and stability of structures of natural and designed objects are related to their function(s). (K-2-ETS1-2)

Rationale and Transfer Goals

In this hands-on unit, students explore human impacts on the environment by taking on the role of engineers to solve a real-world problem: removing pollution from a pond ecosystem. Grounded in a context-setting story, students learn that human activities generate trash that harms living things in natural habitats. Working in collaborative pairs, students apply the 5-phase Engineering Design Process (Ask, Imagine, Plan, Create, Test, Improve) to design, construct, and refine a functional trash collector. Through guided scientific investigations, students explore how changing the shape of materials affects their ability to scoop objects and test which materials maintain structural integrity in water. Students use their findings to build and test a prototype designed to scoop trash out of a model pond without collecting excess water, iteratively improving their designs based on test results and sharing their solutions during a final gallery walk.

Enduring Understandings

Human activity, such as littering, has a direct impact on the environment and the living things within it.

Engineers design technologies to solve real problems, including reducing humans' impact on the environment.

The Engineering Design Process is a tool people can use, alongside knowledge of materials and how to shape and manipulate them, to create effective solutions.

Trash collectors are one example of a technology engineered to solve an environmental problem.

Essential Questions

How does trash affect the environment and the living things in it?

What is engineering, and how do engineers solve problems?

How does the shape and material of an object affect its ability to do a job?

How can we use a design process to create, test, and improve a solution?

What can we learn from a design that doesn't work the first time?

Content - What will students know?

- Animals and plants need clean, safe habitats to survive.
- Human activity creates trash, which can enter aquatic ecosystems and negatively affect living organisms.
- Humans can use engineering and active cleanup efforts to protect and restore natural habitats.
- Different materials interact differently with water; some hold their shape or remain durable, while others absorb water, disintegrate, or weaken.
- Changing the shape of a material changes its ability to trap, hold, or pick up objects.
- Specific materials are chosen for tools based on their physical properties.
- Engineers are problem-solvers who use science, math, and specific tools to help people and nature.
- A structured sequence of phases, Ask, Imagine, Plan, Create, Test, and Improve, guides the design of a device.
- A solution must meet specific goals while working within given materials and rule limits.
- Prototype testing provides evidence and data to show what works and what needs improvement.

Skills - What will students be able to do?

- Recognize that trash in aquatic environments poses a problem for wildlife.
- Work with a partner to brainstorm, negotiate ideas, choose materials, and draw a shared design sketch for a trash collector.
- Construct a functional trash collector model using provided craft and household materials based on a planned design.
- Test prototypes in a model pond to measure performance, specifically checking if the device can scoop trash out without catching excess water.
- Analyze test results to identify design flaws and modify/improve their trash collectors to work more effectively.
- Alter the physical shape of materials to make them capable of capturing and holding items.
- Conduct simple hands-on investigations to test how different materials behave when wet.
- Apply findings from water and shape testing to choose the best materials for building a durable water-based tool.
- Articulate why specific shapes and materials were chosen for their trash collector using evidence from their investigations.
- Share completed designs with peers, observe others' solutions, and discuss how different designs solved the same problem.
- Identify how making mistakes and re-testing helped them grow as engineers.

Activities - How will we teach the content and skills?

- Engineering Trash Collectors Lesson 1: What is Engineering?
- Engineering Trash Collectors Lesson 2: Experience the Problem
- Engineering Trash Collectors Lesson 3: Explore Materials
- Engineering Trash Collectors Lesson 4: Investigate Shapes
- Engineering Trash Collectors Lesson 5: Investigate Materials in Water
- Engineering Trash Collectors Lesson 6: Imagine and Plan

- Engineering Trash Collectors Lesson 7: Create, Test and Improve
- Engineering Trash Collectors Lesson 8: Reflect and Share

Formative Assessments

- Engineering Trash Collectors Lesson Reflections
- Engineering Trash Collectors Lesson Discussions
- Engineering Trash Collectors Engineering Notebook

Summative Assessments

- Completed Engineering Trash Collectors project
- Completed Engineering Trash Collectors Engineering Notebook
- Student self assessment

Spiraling for Mastery

Content or Skill for this Unit	Spiral Focus from Previous Unit	Instructional Activity
N/A	N/A	N/A

Career Readiness, Life Literacies, & Key Skills

9.1.2.CAP.1	Make a list of different types of jobs and describe the skills associated with each job.
9.1.2.CR.1	Recognize ways to volunteer in the classroom, school and community.
9.4.2.CI.1	Demonstrate openness to new ideas and perspectives (e.g., 1.1.2.CR1a, 2.1.2.EH.1, 6.1.2.CivicsCM.2).
9.1.2.CR.2	List ways to give back, including making donations, volunteering, and starting a business.
9.4.2.CI.2	Demonstrate originality and inventiveness in work (e.g., 1.3A.2CR1a).
9.4.2.CT.1	Gather information about an issue, such as climate change, and collaboratively brainstorm ways to solve the problem (e.g., K-2-ETS1-1, 6.3.2.GeoGI.2).
9.4.2.CT.2	Identify possible approaches and resources to execute a plan (e.g., 1.2.2.CR1b, 8.2.2.ED.3).

9.4.2.CT.3	Use a variety of types of thinking to solve problems (e.g., inductive, deductive).
9.4.2.IML.3	Use a variety of sources including multimedia sources to find information about topics such as climate change, with guidance and support from adults (e.g., 6.3.2.GeoGI.2, 6.1.2.HistorySE.3, W.2.6, 1-LSI-2).

Interdisciplinary Connections

2.DL.B.4	Draw a picture graph and a bar graph (with single-unit scale) to represent a data set with up to four categories. Solve simple put together, take-apart, and compare problems using information presented in a bar graph.
RI.CR.2.1	Ask and answer questions to demonstrate understanding of key details in an informational text, referring explicitly to the text as the basis for the answers.
W.IW.K.2	Use a combination of drawing, dictating, and writing to compose informative/explanatory texts to convey ideas.
W.SE.2.6	Prioritize information provided by different sources on the same topic while gathering ideas and planning to write about a topic.
SL.UM.2.5	Use multimedia; add drawings or other visual displays to stories or recounts of experiences when appropriate to clarify ideas, thoughts, and feelings.