Kindergarten STEM Unit 1: Engineering Sunhats

Content Area: **STEM**
Course(s): **Science Grade 1**
Time Period: **MP1**
Length: **29 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.
K-PS3-1	Make observations to determine the effect of sunlight on Earth's surface.
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.
K-PS3-2	Use tools and materials to design and build a structure that will reduce the warming effect of sunlight on an area.
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.

Science and Engineering Practices

Planning and Carrying Out Investigations

Make observations (firsthand or from media) to collect data that can be used to make comparisons. (K-PS3-1)

Constructing Explanations and Designing Solutions

Use tools and materials provided to design and build a device that solves a specific problem or a solution to a specific problem. (K-PS3-2)

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

PS3.B: Conservation of Energy and Energy Transfer

Sunlight warms Earth's surface. (K-PS3-1, K-PS3-2)

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-PS3-1, K-PS3-2)

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, highly collaborative unit, students step into the shoes of engineers to solve a relatable, real-world problem: staying safe and comfortable in the hot sun. Using a structured storybook narrative as their anchor, students are introduced to the Engineering Design Process. Through active investigation, students test physical material properties (such as stiffness, flexibility, and opacity) using flashlights to determine which materials create the most effective shade. Working in collaborative pairs, students negotiate their partners' individual shading needs (e.g., shading ears vs. neck), draw up blueprint plans, and construct a functional, wearable sun hat prototype. The unit culminates in a "test and improve" cycle and a final presentation where students share and justify their design choices.

Enduring Understandings

Engineers follow a step-by-step process (Ask, Imagine, Plan, Create, Test, Improve) to find solutions. Failing and improving is a normal, valuable part of designing.

The physical properties of a material (whether it is floppy, stiff, see-through, or solid) directly impact how well it can do a job.

Combining different ideas and taking turns leads to stronger, more inclusive design solutions.

Essential Questions

How do engineers solve problems to help people?

How does the material we choose change how a design works?

How can we work together to build a solution that meets everyone's needs?

Content - What will students know?

- An engineer is someone who uses creativity, math, and science to solve practical problems and help people.
- The six sequential steps used to solve a design problem: Ask (What is the problem?), Imagine (What are some solutions?), Plan (Draw and choose materials), Create (Build the model), Test (Does it work?), Improve (How can we make it better?).
- Light travels in a straight line, and shade is created when an object blocks light.
- Different materials have different physical properties that make them useful for different jobs.
- The sun emits light and heat, and physical barriers (like hats) protect our skin and eyes from getting too hot or sunburned.

Skills - What will students be able to do?

- Actively use a visual engineering design process map to identify which step of the process they are currently in (Ask, Imagine, Plan, Create, Test, Improve).
- Physically arrange story cards to reconstruct the chronological steps of an engineering narrative.
- Draw, label (using phonetic spelling or initial sounds), and dictate a detailed plan of their sun hat before building it.

- Use scissors, tape, and fasteners to assemble a wearable, three-dimensional sun hat.
- Use a flashlight to simulate "sunlight" and evaluate whether their hat successfully casts a shadow over a target area (like their partner's ears or neck).
- Identify at least one weakness in their first design and physically modify their hat to make it work better.
- Test various materials (paper, felt, plastic, foil) to classify them as stiff vs. floppy or opaque vs. translucent.
- Choose specific materials based on evidence from their testing (e.g., choosing an opaque cardstock because they proved it blocks flashlight light).
- Work in a pair to combine two distinct design ideas into one unified hat blueprint, practicing turn-taking and compromise.
- Verbally explain why they chose a specific shape or material, using evidence (e.g., "We used foil because it blocked all the light").
- Stand before peers and teachers to audibly and clearly describe their finished sun hat, pointing out its crown, brim, or flaps and explaining how it protects their partner.
- Analyze different types of hats and explain how their form (brims, crowns, flaps) impacts their function (making shade).

Activities - How will we teach the content and skills?

- Engineering Sunhats Lesson 1: What is Engineering?
- Engineering Sunhats Lesson 2: Experience the Problem
- Engineering Sunhats Lesson 3: Explore Hats
- Engineering Sunhats Lesson 4: Explore Brims
- Engineering Sunhats Lesson 5: Investigate Materials
- Engineering Sunhats Lesson 6: Imagine and Plan
- Engineering Sunhats Lesson 7: Create and Test
- Engineering Sunhats Lesson 8: Improve
- Engineering Sunhats Lesson 9: Reflect and Share

Formative Assessments

- Engineering Sunhats Lesson Reflections
- Engineering Sunhats Lesson Discussions
- Engineering Sunhats Engineering Notebook

Summative Assessments

- Completed Engineering Sunhats project
- Completed Engineering Sunhats 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

K.M.A.2	Directly compare two objects with a measurable attribute in common, to see which object has “more of”/“less of” the attribute, and describe the difference.
L.VI.K.3	With guidance and support from adults, explore word relationships and nuances in word meanings.
RL.CR.K.1	With prompting and support, ask and answer questions about key details in a literary text (e.g., who, what, where, when, why, how).
RI.CR.K.1	With prompting and support, ask and answer questions about key details in an informational text (e.g., who, what, where, when, why, how).
RL.CI.K.2	With prompting and support, identify the central message and retell familiar literary texts, including key details (e.g., who, what, where, when, why, how).
RI.IT.K.3	With prompting and support, describe the connection between two individuals, events, ideas, or pieces of information in a text.
W.AW.K.1	Use a combination of drawing, dictating, and writing to compose opinion pieces on topics or texts (e.g., My favorite book is…).
W.IW.K.2	Use a combination of drawing, dictating, and writing to compose informative/explanatory texts to convey ideas.
W.WR.K.5	With prompting and support, generate questions through shared research in response to a topic, text, or stimulus (e.g., event, photograph, video, book).