Grade 1 STEM Unit 2: Engineering Nightlights

Content Area: **STEM**
Course(s): **Science Grade 1**
Time Period: **MP3**
Length: **27 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.
1-PS4-2	Make observations to construct an evidence-based account that objects can be seen only when illuminated.
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.DA.1	Collect and present data, including climate change data, in various visual formats.
1-PS4-3	Plan and conduct an investigation to determine the effect of placing objects made with different materials in the path of a beam of light.
1-PS4-4	Use tools and materials to design and build a device that uses light or sound to solve the problem of communicating over a distance.
8.1.2.AP.4	Break down a task into a sequence of steps.
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.1	Identify products that are designed to meet human wants or needs.
8.2.2.ITH.2	Explain the purpose of a product and its value.
8.2.2.NT.1	Model and explain how a product works after taking it apart, identifying the relationship of each part, and putting it back together.
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.

Science and Engineering Practices

Constructing Explanations and Designing Solutions

Make observations (firsthand or from media) to construct an evidence-based account for natural phenomena. (1-PS4-2)

Use tools and materials provided to design a device that solves a specific problem. (1-PS4-3)

Planning and Carrying Out Investigations

Plan and conduct investigations collaboratively to produce evidence to answer a question. (1-PS4-3)

Analyzing and Interpreting Data

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

Developing and Using Models

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

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)

Disciplinary Core Ideas

PS4.B: Electromagnetic Radiation

Objects can be seen if light is available to illuminate them or if they give off their own light. (1-PS4-2)

Some materials allow light to pass through them, others allow only some light through and others block all the light and create a dark shadow on any surface beyond them, where the light cannot reach. Mirrors can be used to redirect a light beam. (Boundary: The idea that light travels from place to place is developed through experiences with light sources, mirrors, and shadows, but no attempt is made to discuss the speed of light.) (1-PS4-3)

PS4.C: Information Technologies and Instrumentation

People also use a variety of devices to communicate (send and receive information) over long distances.

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

Simple tests can be designed to gather evidence to support or refute student ideas about causes. (1-PS4-2, 1-PS4-3)

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 act as optical engineers to solve a real-world problem presented in the context-

setting narrative story, A Bright Idea. In the story, two cousins sharing a bedroom have contrasting light preferences—Yazmin prefers a bright room, while Nasir prefers darkness to sleep. Additionally, they need a way to remember whether the following day is a school day. Working in collaborative pairs, students apply science concepts regarding light and material properties to design, test, and refine a functional two-sided nightlight. Their final technology must deliver different levels of light to each side of the room while incorporating an illuminated reminder system that communicates "school day" vs. "no school day."

Enduring Understandings

Objects can only be seen when light illuminates them or when they produce their own light.

Different materials block all light, let some light pass through, or let all light through.

Technology is created to help people, meet their needs, and resolve conflicting preferences.

Engineers imagine, plan, build, test, and share their ideas to find solutions.

We can use light, colors, and symbols to share visual information without words.

Essential Questions

How does light help us see the world around us?

How do different materials change the way light moves?

How can we use light to send a message without using words?

How do engineers turn a problem into a working solution?

How do we choose the right materials to solve a specific problem?

What can our mistakes teach us about making a design better?

How can one design satisfy two people with completely different needs?

Why is working together and sharing ideas better than working alone?

Content - What will students know?

- Light is necessary to see objects; without a light source illuminating an object or room, it remains invisible to the human eye.
- Materials interact with light in three distinct ways: transparent, translucent or opaque.
- Light can be encoded to transmit visual messages across distances using color, intensity, symbols, or simple state changes.
- Engineering relies on a structured, multi-step cycle: Ask, Imagine, Plan, Create, Test.
- Criteria are the specific goals a design must meet to be successful.
- Constraints are the limits placed on a design, such as available materials, light source size, or time.
- Physical properties of materials dictate how and where they should be used in a design to solve a specific functional problem.
- First attempts ("prototypes") rarely work perfectly; testing reveals weak points that provide data for redesigning and improving the product.

Skills - What will students be able to do?

- Perform hands-on light tests using flashlights to observe and compare how light moves through different physical materials.
- Sort materials into categories based on light behavior (transparent, translucent, opaque).
- Test light brightness inside a model environment to evaluate if light levels meet specific visual preferences.
- Identify specific goals and limits based on a context-setting problem.

- Sketch individual design ideas and collaborate with a partner to create a joint, labeled engineering design plan.
- Safely manipulate, shape, and assemble crafting supplies and flashlight bases to build a functional multi-sided nightlight.
- Test prototypes against criteria, collect visual performance data, and identify areas of failure or weakness.
- Analyze test results, learn from peer solutions, and modify an initial design to build an improved version.
- Incorporate functional symbols, colors, or structural toggles into a device to visually communicate information.
- Work effectively with a peer to compromise on design choices, share tools, and build a shared solution.
- Present final nightlight prototypes to peers, explaining how chosen materials and structures solve the users' conflicting light preferences.

Activities - How will we teach the content and skills?

- Engineering Nightlights Lesson 1: What is Engineering?
- Engineering Nightlights Lesson 2: What is the Problem?
- Engineering Nightlights Lesson 3: Investigate Light
- Engineering Nightlights Lesson 4: Investigate Materials
- Engineering Nightlights Lesson 5: Imagine and Plan
- Engineering Nightlights Lesson 6: Create and Test
- Engineering Nightlights Lesson 7: Improve
- Engineering Nightlights Lesson 8: Communicate with Light
- Engineering Nightlights Lesson 9: Reflect and Share

Formative Assessments

- Engineering Nightlights Lesson Reflections
- Engineering Nightlight Lesson Discussions

- Engineering Nightlights Engineering Notebook

Summative Assessments

- Completed Engineering Nightlights project
- Completed Engineering Nightlights 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

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.1.2	With prompts and support, write informative/explanatory texts to examine a topic and convey ideas and information.

RI.AA.2.7	Describe and identify the logical connections of how reasons support specific points the author makes in a text.
W.WR.1.5	With prompting and support, generate questions through shared research about a topic and determine possible sources to obtain information on that topic.
W.SE.1.6	With guidance and support from adults, gather and select information from multiple sources to answer a question or write about a topic.
W.WR.2.5	Generate questions about a topic and locate related information from a reference source to obtain information on that topic through shared and independent research.
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.