Grade 1 STEM Unit 1: Engineering Pumpkin Pollinators

Content Area: **STEM**
Course(s): **Science Grade 1**
Time Period: **MP1**
Length: **29 days**
Status: **Published**

NJSLS - Science

2-PS1-1	Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties.
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.
8.1.2.CS.1	Select and operate computing devices that perform a variety of tasks accurately and quickly based on user needs and preferences.
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.DA.1	Collect and present data, including climate change data, in various visual formats.
8.1.2.DA.3	Identify and describe patterns in data visualizations.
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.
2-LS2-2	Develop a simple model that mimics the function of an animal in dispersing seeds or pollinating plants.
8.2.2.ITH.4	Identify how various tools reduce work and improve daily tasks.

Science and Engineering Practices

Analyzing and Interpreting Data

Analyze data from tests of an object or tool to determine if it works as intended. (2-PS1-2, K-2-ETS1-3)

Developing and Using Models

Develop a simple model based on evidence to represent a proposed object or tool. (2-PS1-2, 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

PS1.A: Structure and Properties of Matter

Different properties are suited to different purposes. (2-PS1-2)

LS2.A: Interdependent Relationships in Ecosystems

Plants depend on animals for pollination or to move their seeds around. (2-LS2-2)

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

Simple tests can be designed to gather evidence to support or refute student ideas about causes. (2-PS1-2)

Structure and Function

The shape and stability of structures of natural and designed objects are related to their function(s). (2-LS2-2, K-2-ETS1-2)

Rationale and Transfer Goals

In this hands-on engineering unit, students step into the role of agricultural engineers to solve a real-world problem: a decline in natural bee populations that is preventing pumpkin plants from producing fruit. Guided by a story-based context involving two friends and their pumpkin patch, students explore how pollination works, investigate the specialized relationship between bees and pumpkin flowers, and examine the functional properties of common materials. Using the 5-phase Engineering Design Process (EDP)—Ask, Imagine, Plan, Create, Test, and Improve—student pairs iteratively design, test, and refine a physical hand-pollinator tool capable of picking up model pollen from one flower and successfully depositing it into another.

Enduring Understandings

Engineering is a purposeful problem-solving process.

Failure and iteration are central to learning.

Plants and animals rely on each other to survive and reproduce.

Ecosystem disruptions have cascading effects.

Form follows function in nature and engineering.

Material properties dictate performance.

Engineers rely on data, observation, and testing—not guessing.

Essential Questions

How do engineers thoughtfully solve problems?

Why are fewer pumpkins growing, and how does this affect the community?

How does the number of pollinators affect fruit production?

What physical features make bees the best pollinators for pumpkin flowers?

Which material properties work best for picking up and dropping off pollen?

How can we imagine, plan, test, and iterate a hand pollinator to meet design criteria?

Content - What will students know?

- Flowering plants cannot form seeds or fruits unless pollen is transferred between flowers.
- Animals and insects, especially bees, act as essential carriers that move pollen from one plant or flower to another.
- A drop in local pollinator populations directly leads to fewer pollinated blossoms and a decrease in harvested crops or fruit.
- Bees possess specialized body structures that make them exceptionally effective at picking up and transporting sticky pumpkin pollen.

- Engineers design tools, technologies, and procedures to address challenges related to farming, plants, and food production.
- Solving a complex challenge requires following systematic steps: Ask, Imagine, Plan, Create, Test, and Improve.
- Engineering solutions must be designed to meet specific goal requirements (criteria) while working within set limitations like available materials or physical space (constraints).
- Prototypes rarely work perfectly on the first try, and analyzing failure points provides necessary data to improve a design.
- Different materials have distinct physical properties that dictate how well they perform specific tasks.
- Selecting the right material for a tool handle or tip requires hands-on testing rather than guessing.
- Engineered technologies can copy or mimic the functional structures found in nature to perform similar jobs.

Skills - What will students be able to do?

- Systematically move through the steps of Ask, Imagine, Plan, Create, Test, and Improve to develop a physical tool.
- Draw individual schematic ideas and convert a unified written/drawn plan into a working 3D model using physical craft and recycled materials.
- Use controlled testing procedures to evaluate tool performance.
- Identify specific failure points in a design and make targeted modifications to improve results.
- Perform empirical investigations to classify materials based on functional traits like texture, flexibility, stiffness, and pollen attraction/release.
- Analyze natural structures and transfer those functional concepts to engineered tools.
- Measure, record, and evaluate quantitative performance data to determine tool efficiency.
- Use observation data from material testing to justify design choices during the planning and improvement phases.
- Negotiate ideas, share responsibilities, and reach consensus with a partner when merging individual ideas into a single group plan.
- Express scientific and technical concepts orally and in writing using key unit terminology.
- Explain how a finished tool works, share test results, and communicate how iterative changes improved the tool's performance.

Activities - How will we teach the content and skills?

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

Formative Assessments

- Engineering Pumpkin Pollinators Lesson Reflections
- Engineering Pumpkin Pollinators Lesson Discussions
- Engineering Pumpkin Pollinators Engineering Notebook

Summative Assessments

- Completed Engineering Pumpkin Pollinators project
- Completed Engineering Pumpkin Pollinators 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.
RI.AA.2.7	Describe and identify the logical connections of how reasons support specific points the author makes in a text.
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.