Second Grade Storylines

Students in second grade focus on examining how cause and effect relationships influence change within systems. The focus on systems at this level is conceptual. Students observe pushes and pulls, how water changes the shape of land, changes in the environment, and physical changes in matter. This provides the foundation for understanding how stability affects systems in third grade.

2. Forces and Interactions: Pushes and Pulls

Students investigate the effect of pushes and pulls on the motion of objects. Students examine the relationship between motion and pushes and pulls; and, the relationship between motion and friction. This topic lends itself to conducting investigations on the effect of pushes and pulls on motion, and the relationship between friction and heat. Students extend their understanding of engineering by defining a problem involving friction and developing solutions. This topic provides a foundation for later discussions of forces and interactions, as well as energy. Students are expected to demonstrate understanding that pushes or pulls produce changes in motion, and that objects in contact with each other can produce friction when they move.

2. Earth's Surface Systems: Processes that Shape the Earth

Earth's changing surface and how its surface provides homes for living things is addressed in second grade. This topic builds on kindergarten understanding of needs of plants and animals and where they live and supports later learning in fifth grade when students use fair tests to investigate the effect of different variables on the rate and extent of erosion. This topic lends itself to developing and using models for comparison, investigating and developing explanations from observations, and the crosscutting concept of cause and effect. Students understand the effect that changes to land can have on living things and the problems that this creates. Students develop solutions to these problems building upon design knowledge gained in first grade using the design process. Students are expected to demonstrate understanding of how the shape of land is changed over time and how landforms and bodies of water on Earth's surface provide homes for living things.

2. Interdependent Relationships in Ecosystems

Students study the interdependence of organisms and their surroundings. This topic builds on the kindergarten understanding of the needs of plants and animals, and provides a foundation for understanding of how changes in the environment can affect the types of organisms that live in an area in third grade, as well as interactions in ecosystems in fifth grade. This topic lends itself to defining problems and designing solutions to develop understanding of science concepts. The crosscutting concept of stability and change is highlighted in a life science context and the concept of systems is further developed. Students are expected to demonstrate understanding of the many types of plants and animals that live in, depend on, and meet their needs in particular places in a variety of areas.

2. Structure and Properties of Matter

Students explore measurements of, and changes in, the physical properties of matter. This topic builds on kindergarten understanding of the observable properties of materials and supports later learning of chemical and physical changes and the conservation of weight in fifth grade. This topic lends itself to the use of mathematics, among other practices, as students measure properties of

matter and analyze data. The crosscutting concept of energy and matter only addresses matter, and creates a foundational understanding for later understanding of the particle nature of matter. Students build on their engineering knowledge by testing and analyzing data, which will progress to students testing their own designs. Students are expected to demonstrate their abilities to use data to understand the properties of matter and apply their knowledge to real world problems.

2.Interdependent Relationships in Ecosystems

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Students who demonstrate understanding can:

2-LS2-1. Plan and conduct an investigation to determine if plants need sunlight and water to grow. [Assessment Boundary: Assessment is limited to testing one variable at a time.]

2-LS2-2. Develop a simple model that mimics the function of an animal in dispersing seeds or pollinating plants.*

2-LS4-1. Make observations of plants and animals to compare the diversity of life in different habitats. [Clarification Statement: Emphasis is on the diversity of living things in each of a variety of different habitats.] [Assessment Boundary: Assessment does not include specific animal and plant names in specific habitats.]

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Science and Engineering Practices

Developing and Using Models
Modeling in K–2 builds on prior experiences and progresses to include using and developing models (i.e., diagram, drawing, physical replica, diorama, dramatization, or storyboard) that represent concrete events or design solutions.
- Develop a simple model based on evidence to represent a proposed object or tool. (2-LS2-2)

Planning and Carrying Out Investigations
Planning and carrying out investigations to answer questions or test solutions to problems in K–2 builds on prior experiences and progresses to simple investigations, based on fair tests, which provide data to support explanations or design solutions.
- Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence to answer a question. (2-LS2-1)
- Make observations (firsthand or from media) to collect data which can be used to make comparisons. (2-LS4-1)

Connections to Nature of Science

Scientific Knowledge is Based on Empirical Evidence
- Scientists look for patterns and order when making observations about the world. (2-LS4-1)

Disciplinary Core Ideas

LS2.A: Interdependent Relationships in Ecosystems
- Plants depend on water and light to grow. (2-LS2-1)
- Plants depend on animals for pollination or to move their seeds around. (2-LS2-2)

LS4.D: Biodiversity and Humans
- There are many different kinds of living things in any area, and they exist in different places on land and in water. (2-LS4-1)

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. *(secondary to 2-LS2-2)*

Crosscutting Concepts

Cause and Effect
- Events have causes that generate observable patterns. (2-LS2-1)

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

Connections to other DCIs in second grade: N/A

Articulation of DCIs across grade-levels: **K.LS1.C** (2-LS2-1); **K-ESS3.A** (2-LS2-1); **K.ETS1.A** (2-LS2-2); **3.LS4.C** (2-LS4-1); **3.LS4.D** (2-LS4-1); **5.LS1.C** (2-LS2-1); **5.LS2.A** (2-LS2-2),(2-LS4-1)

Common Core State Standards Connections:

ELA/Literacy –

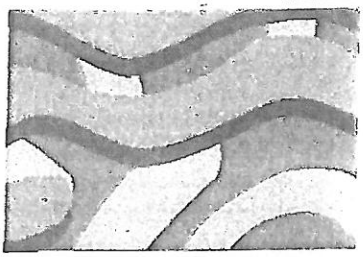
W.2.7	Participate in shared research and writing projects (e.g., read a number of books on a single topic to produce a report; record science observations). (2-LS2-1),(2-LS4-1)
W.2.8	Recall information from experiences or gather information from provided sources to answer a question. (2-LS2-1),(2-LS4-1)
SL.2.5	Create audio recordings of stories or poems; add drawings or other visual displays to stories or recounts of experiences when appropriate to clarify ideas, thoughts, and feelings. *(2-LS2-2)*

Mathematics –

MP.2	Reason abstractly and quantitatively. *(2-LS2-1),(2-LS4-1)*
MP.4	Model with mathematics. *(2-LS2-1),(2-LS2-2),(2-LS4-1)*
MP.5	Use appropriate tools strategically. *(2-LS2-1)*
2.MD.D.10	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. *(2-LS2-2),(2-LS4-1)*

*The performance expectations marked with an asterisk integrate traditional science content with engineering through a Practice or Disciplinary Core Idea.

Overview
A plant is a biological system. Its processes and components enable it to grow and reproduce. This activity will introduce your students to one aspect of a plant's reproductive system: its seeds.



Background

Living organisms are made of systems that enable them to grow and reproduce. All living things have some system for reproducing members of their species.

Most plants reproduce using a system that includes flowers and seeds. In general, seeds develop within the ovary of the plant's flower after either being fertilized by pollen from another plant of the same species or being self-fertilized.

For a seed to germinate and grow into a mature plant, environmental conditions must be just right. Each plant needs a certain amount of sunlight, air, water, and nutrients from the soil. If a seed simply drops from the parent plant, it might compete with the parent for those essentials and have difficulty growing. Therefore, most seed-bearing plants have developed a way to disperse seeds away from the parent, giving the new plant a better chance to find what it needs to grow.

Some plants produce very light seeds with sail-like or hairy outgrowths that enable them to be carried by the wind. For example, a maple seed has papery wings that flutter like a helicopter, while a dandelion seed has a fuzzy parachute that carries it on air currents. Some plants, like beech trees and Queen Anne's lace, produce seeds with spines, hooks, or gooey coatings that catch on an animal's fur or people's clothing and are carried to distant places. Some plants, like black cherry trees and raspberries, develop seeds within an attractive, tasty fruit. Those seeds are eaten by animals, carried in the animals' digestive systems, and deposited in a different location when the animal defecates. Still other plants, like locust trees, violets, and witch hazel, have seeds that are ejected away from their parent plant. For example, witch hazel seeds develop within a pod that squeezes the seeds as the pod dries. When the seeds finally shoot out, they can travel up to 40 feet (12.2 m)!

Getting Ready

If students are to collect seeds from a vacant lot or natural area, be sure to obtain any necessary permission. Also, keep in mind that autumn is the best time for collecting seeds.

Doing the Activity

1. Ask students what seeds are and what they do. Ask for examples. (Don't worry about misconceptions at this point. Step 5 should clarify those ideas.) Tell students they are going to learn more about seeds by gathering and sorting them.

2. Ask your class to gather a collection of seeds. Students might bring in birdseed or seeds saved from fruits, collected from food in kitchen cabinets, or gathered from trees or other plants in their garden. You might also take students to a nearby field or vacant lot full of seed-bearing plants. They can collect seeds in one or more of the following ways:

- Have students walk around the area, pick up any seeds they find on the ground, and collect the seeds in a cup or other container.
- Help students drag an old blanket or other piece of fuzzy cloth through the area. Or have them wear large, old, wool socks over their shoes and walk around the area.
- Have younger students wear bracelets of masking tape with the sticky side out so they can stick small seeds or seed parts directly on their seed bracelets.

LEVELS
Grades K-3

SUBJECTS
Science, Visual Arts

CONCEPTS
- In biological systems, energy flows and materials continually cycle in predictable and measurable patterns. (7.1)
- Populations of organisms exhibit variations in size and structure as a result of their adaptation to their habitats. (10.1)
- Biological diversity results from the interaction of living and nonliving environmental components such as air, water, climate, and geological features. (1.1)

SKILLS
Observing, Classifying and Categorizing, Organizing information, Inferring

OBJECTIVES
Students will: ① sort or classify plant seeds they have collected, ② identify varying methods of seed dispersal, and ③ model or design seeds that use varying methods of dispersal.

MATERIALS
class collection of seeds gathered during Step 2 of activity, cups or other containers (optional), blanket or other piece of cloth (optional), pieces of cardboard (optional), masking tape (optional), binoculars (optional)

TIME CONSIDERATIONS
Preparation: one day to collect seeds
Activity: 50 minutes

- Encourage students to invent other simple seed-gathering techniques that do not harm the environment.

3. Put all seeds into a class collection. Divide students into groups of two to five, and give each group an assortment of seeds from the collection. Ask groups to examine their seeds and invent a system for sorting or classifying. (Younger students may simply sort seeds into two groups so that those in each group are alike in some way.) Invite students to share their methods for sorting.

4. Lead a discussion about the structure and function of seeds. Ask these questions:

- What are seeds? (A seed is a "plant egg." It contains a baby plant and a supply of baby plant food wrapped in a protective covering. You may slice open a plant with a large seed, such as an avocado, to show the parts as depicted in the diagram below.)
- Where do seeds come from? (The plant's ovary, or female part, is located in its flowers or cones.)
- Is there a reason for so many different kinds of seeds? (Every type of plant has a special type of seed designed for the plant's particular habitat and method of distribution—see background information.)

5. Ask students why it might be important for seeds to be dispersed away from parent plants. Invite students to share different ways they have noticed that plants disperse their seeds. Write those ideas on the board. If students have trouble thinking of various ways, you might mention particular seeds to stimulate more ideas. Ask students whether any of the ways they have observed seem similar. For example, they might have said that dandelions blow in the wind and that milkweed floats in the air. If appropriate, help students compile groups of similar dispersal systems so the class ends up with a set of about five to eight categories. Remember there is no one right way to group the seed dispersal systems. Use students' examples to help them create their own categories (see examples of categories).

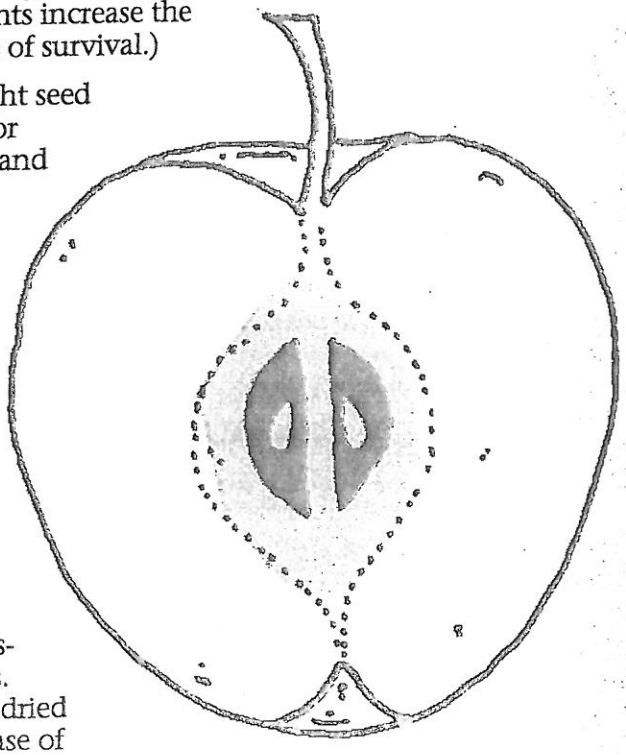
6. Ask students to group their seeds according to the dispersal categories they identified.

7. With older students, discuss these questions:

- How do a seed's shape and size affect its dispersal?
- What other parts of a plant help it reproduce? (Flowers that have male and female parts, and fleshy fruits that encase seeds.)
- Why is it important for seeds to be dispersed in different ways? (Plants have different requirements that are served best by different seed-dispersal systems.)
- How far can a seed be dispersed? (Seeds can glide on the wind for several miles, float on the water for hundreds of miles, or travel on a bird for thousands of miles.)
- Can some seeds go farther than others? (yes) How is distance important? (It reduces competition for a plant's needs in a particular area. Widespread plants increase the species' chances of survival.)
- What value might seed dispersal have for plants, wildlife, and humans? (food, medicine)

CATEGORIES OF SEED DISPERSAL

Floats on air
milkweed, dandelion, cottonwood
Flies through air
maple, ash, tulip poplar
Floats on water
mangrove, coconut, cranberry
Bounces or rolls
acorn, beech, black walnut
Eaten by animals
cherry, apple, pyracantha
Stored by animals
acorns, hickory, beech
Burden
locust, violet, witch hazel, tulip
touchweed
Sticks to animals
beard grass, burdock, cocklebur, foxtail, goldenrod, wild barley



Enrichment

1. Suggest that students plant some of the seeds they collected so they can observe plant germination in action.

2. Challenge students to design their own seeds with specialized dispersal mechanisms. Students can use a dried lima bean as the base of

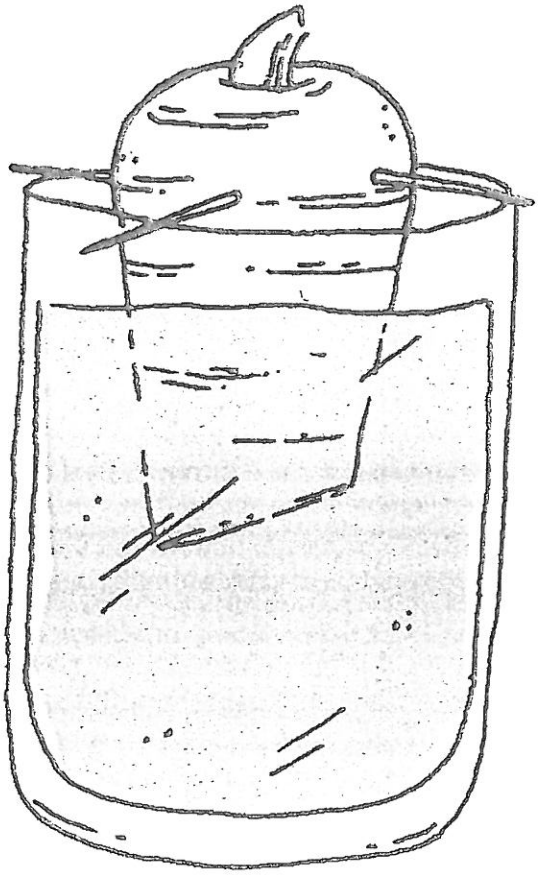
their design, along with "junk" materials (such as popsicle sticks, toothpicks, cardboard, egg cartons, cotton balls, string, and rubber bands), to design a seed that:

- Floats in water for at least five minutes
- Attracts an animal to carry it away
- Floats in air for at least 5 feet (1.5 m)
- Sticks to an animal and can be carried at least 10 feet (3 m)
- Is thrown at least 2 feet (.6 m) away from the parent plant

3. Drop seeds in front of a fan to demonstrate what effect moving air has on various seed designs. Note differences in movement, direction, speed, and rotation. Graph the distance each seed flies.

4. Many animals, including many of our favorite backyard birds, depend on seeds as their food source. By setting up a bird feeder, students can learn which birds like which seeds best. Students can either build or buy a bird feeder. They can make feeders from milk containers, aluminum pie tins, or other used materials. Set a feeder on a window sill or attach it to a tree or post where students can closely observe the birds. Bring to class a bag of mixed birdseed (usually sunflower seeds and millet). Give pairs of students a small handful of birdseed to study. Have them describe the different kinds of seeds. Ask what types of birds might like to eat the different seeds. Then, have students fill the feeder with birdseed and spend a little time each day observing it (try to have a pair of binoculars on hand). They should try to find out ① which birds prefer which seeds, ② what method each bird uses to eat seeds, and ③ the reason the bird uses that method. For instance, a chickadee will usually take one sunflower seed, fly to a nearby branch, and hammer the seed with its beak until the seed opens. Students can periodically check to see which seeds are eaten most often.

5. Not all plants reproduce from seed pollination. Use library resources to find out about plants that don't bear seeds, such as algae, ferns, fungi, mosses, and horsetails, which generally use spores or buds. Compare the reproductive systems of such plants to those of seed-bearing plants. Find out about seed-bearing plants that have additional vegetative methods of reproduction, such as potatoes ("eyes"), strawberries (runners), or roses (cuttings). Some trees reproduce vegetatively when their roots or stump sprout new trees. You can demonstrate vegetative reproduction in the classroom by growing new plants from pieces of carrots, potatoes, turnips, onions, or willow sticks (see illustration below).



END NOTES...

ASSESSMENT OPPORTUNITY

Display examples of seeds that have different systems for dispersal (float, flutter, stick). For each type of seed, have each student think of a human invention that imitates the seed's dispersal system. For example, a helicopter imitates a maple seed or a parachute copies a dandelion. Display the seeds again, and have students give analogies.

RELATED ACTIVITIES

How Plants Grow, Germinating Giants, Tree Lifecycles, Plant a Tree