

The Story of Seeds: Seed Saving Storage Engineering Design

Grade/ Grade Band: 3-5	Literature: <i>The Story of Seeds</i> by Nancy F. Castaldo	Posted: Maureen Foelkl http://straubenvironmentalcenter.org/
Purpose: Seed harvesting, collection and storage are practices to preserve biodiversity in the agroecosystem. Students will explore the practice of seed storage using organic heirloom seeds from their geographical region.		
Performance Expectation(s): 3-5-ETS1-3. Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved		
Disciplinary Core Idea: 3-LS4-4. Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change.		
Prior Student Knowledge: Students need to have an understanding of how a famine can impact a population. A background knowledge of Gregor Mendel, Luther Burbank, Nikolai Vavilov and Dr. El Sheikh will bring understanding to the importance of research in the preservation of seeds. If using technology, students should be familiar with tablet applications.		
Materials: <ul style="list-style-type: none">• <i>The Story of Seeds, from Mendel's Garden to Your Plate, and How There's More of Less to eat Around the World;</i> Nancy F. Castaldo• organic heirloom seeds (this lesson uses Glass Gem Corn) from your USDA Plant Hardiness Zone• bunch of organic, heirloom rainbow carrots. (Available at most natural food centers.)• tablet computers or other devices for data collection and photography• <i>Notability</i> by Ginger Labs, tablet application (cloud storage service, e.g., Google Drive)• student data sheet (download into digital notebook)• communication rubric• hand lenses• student science notebook or digital notebook• color pencils, crayons and other medium for illustrating• glue, scissors, construction paper, duct tape or other materials for creative designing• reused, repurposed and recycled materials for students to create new storage containers• measuring tools, Ex: thermometers, hygrometers, rulers, etc.		
LESSON PLAN – 5-E Model		
ENGAGE: <p>Introduce students to the book, <i>The Story of Seeds</i> by Nancy F. Castaldo. Access prior knowledge on how a seed grows using the visual from the cover of the text. Ask students to discuss what kind of seed is on the cover. "What evidence shows you that this is a corn plant seed?" Have students make connections as they share within a whole group setting. Make sure to record student responses on chart paper for future vocabulary reference.</p> <p>Next, read the first paragraph in chapter one. Clarify the word famine prior to the reading of the text. Focus in on the question, "What if you were facing a great famine, as they did in Ireland?" Have students turn and talk about what they might do if there were a famine in their community? Read pages 34- 36 explaining the crop failure that caused the great hunger in Ireland.</p> <p>Teach vocabulary: genetically identical variety, resistant and blight. Then read the last paragraph on page 37. What does crop diversity mean in this paragraph? What is monoculture farming? What evidence supports your thinking?</p>		

EXPLORE:

Show students a bag of organic, heirloom Glass Gem corn seed or seeds chosen from your geographical area. Using their hand lens, have students draw, color and label their corn seed in their notebook. Next, have the students compare and contrast their seed with a partner using a Venn diagram to create a visual. Give groups an opportunity to discuss their findings and share observations.

Then read pages 45-46, Heirloom Profile: Glass Gem Corn from *The Story of Seeds*, emphasizing the cultural heritage of native people saving maize seeds.

Hold up a variety of organic heirloom orange and rainbow carrots. Have precut small pieces available to allow closer examination. Students will make observations as they sketch each of their carrot samples. Ask students what are some of the common characteristics they noticed in their carrots. What are some different characteristics? Why might it be important to save seeds from both of the carrot samples?

Read page 52 from *The Story of Seeds* to explore additional information about carrots.

Additional background information from <http://www.carrotmuseum.co.uk/>

The cultivated carrot contains genetic variation for many traits which has allowed breeders to produce varieties differing in size, shape and color. For Example, over time varieties have been developed that have different levels and types of carotenoids, giving different varieties either a red, yellow, purple or orange color.

Note: Please remind students to use safety procedures during science inquiries. Reinstate that sampling of food is not safe science practices due to possible contamination.

EXPLAIN:

Explain to the students that scientists believe that farmers realized the need to store and protect their seeds so that they would have a harvest the following year. This practice dates back to 8000 B.C. in Mesopotamia, now called Iraq. There are now more than one thousand seed banks worldwide that protect **biodiversity**.

Read pages 29-31 from *The Story of Seed*. Focus attention on Dr. El Sheikh and how her prompt thinking saved preserved seeds from the Iraq National Seed Bank.

Brainstorm as a group, creating a chart of ways in which seeds could be stored safely. Use if-then statements. For instance, if a flood entered the food storage chambers, then the seed container would need to _____ by constructing it with _____ because _____.

Technology is constantly advancing, assisting in the preservation of seed collections. Students will be given an engineering challenge that requires them to design and generate a model that will house organic, heirloom seeds within a structure. The structures will need to keep temperature and humidity at stable readings. The goal is to keep the temperature below 21 degrees Celsius and less than 40% humidity. A control model, a conventional, transparent container of corn seeds will be placed in an open area for observation and data collection as the teacher models procedures.

Instruct students on how to properly read and record moisture levels using hygrometers. Check to ensure that students are correctly reading the Celsius measurement on a thermometer. Display available materials that students will have access to during the construction phase of the project.

Using background knowledge and the resources available (use tablets or other devices if accessible), the students will sketch a model of a new storage container for their corn seeds. Label and write sentences to show the reader thought processes and technology within the structure.

Once the blueprints are completed, young engineers will then construct a prototype using their drawing as a guide. Create multiple opportunities for discussion during the building phase. Allow students to make changes in their sketches as needed during the building process. Document the progression through photography to show performance evidence and prototype variations from start to completion. Projects should have three seeds in the enclosure and be located in a viewing area where students can complete their data sheet (attached) daily. Provide time for students to discuss their data and make necessary changes to their prototype.

ELABORATE:

Have students research real-world seed banks. In addition to writing, the students can create a customized world map, placing their own creative marker on the geographical location. When students have completed their research, place markers of the location on a world map for future reference.

In-situ conservation, arboretums, seed libraries and the phenomenon of dormant seed are methods to preserve genetic diversity. Invite local experts to expand student understanding of current technologies that effect the increase of seed longevity.

If available, students can plant their seeds in a school garden to predict, explain and observe germination rate of their seeds. Ask them to visualize and give an explanation of how the corn stock might appear in the month of September. As the corn emerges, students can compare the actual plant to the photo from the seed packaging. Next, the seeds can be dried for the following group of students to recreate the lesson.

Students could host a school wide seed swapping event to coincide with a science or STEM event.

EVALUATE:**Formative Monitoring:**

Discussion using science vocabulary, Venn team diagrams, student notebooks.

Summative Assessment :

Through collegial discourse (argumentation) referencing their data, evidence, and models the students will present their prototype to their peers. Record presentation. If available, place communication rubric (attached) with recorded session into the student's Google Drive accompanied by the assessment rubric.

Internet Resources:

Seed Harvesting and Storage

- Harvesting Plant Seeds: Seed Saving Activities for Children; <https://www.gardeningknowhow.com/special/children/seed-saving-with-children.htm>
- The Seed Keepers; <https://www.youtube.com/watch?v=OvHkeaLCYJ0>
- The Seed Keepers Guide; http://theseedkeepers.com/wp-content/uploads/2014/10/Seed_Saving_Guide.pdf
- <https://www.ecoliteracy.org/>
- <http://www.carrotmuseum.co.uk/>
- <http://planthardiness.ars.usda.gov/PHZMWeb/> USDA Plant Hardiness Zone
- <http://www.hic-mena.org/news.php?id=p2hmYw==#.WH5mBxTWtnc> Seed bank destruction
- http://lrrpublic.cli.det.nsw.edu.au/lrrSecure/Sites/Web/about_fieldwork/lo/Humidity/other/hygrometer.htm How to use a hygrometer for humidity readings

Patents

- <https://www.uspto.gov/kids/>
- <https://www.sciencenewsforstudents.org/article/explainer-what-patent>
- <http://www.kidsdiscover.com/teacherresources/student-inventions/>

Articles

- <http://www.livescience.com/52291-first-withdrawal-doomsday-seed-vault.html> A seed vault in the Arctic Circle
- <http://science.howstuffworks.com/environmental/green-science/seed-bank1.htm>

Purchase Seed

- <http://www.seedsavers.org/>
- <https://www.etsy.com/shop/BoxGardenSeeds>
- <http://heirloomseeds.com/>
- <http://www.rareseeds.com/store/whole-seed-catalog/> (Baker Creek Seeds)
- <http://www.seedsavers.org/glass-gem-organic-corn>
- <http://www.territorialseed.com/category/organic-corn-seed>

Note: While choosing seeds, please reference or contact your local master gardeners to ensure the seed chosen is not invasive to your region.