Science Unit: ***Plants and Ecosystems***

Lesson 2: ***Super Seeds Super Graines***

School Year:	2006/2007
Developed for:	Queen Elizabeth Annex Elementary School, Vancouver School District
Developed by:	Sara Harbord (scientist), Joanne Lloyd & Karine Pharand (teachers)
Grade level:	Presented to grades 2-3; appropriate for grades 1 – 4 with age appropriate modifications; Présenté au niveau de la 2e et 3e année; approprié aux niveaux de la 1re à la 4e année en y apportant les modifications nécessaires.
Duration of lesson:	1 hour and 20 minutes
Notes:	The school in which this lesson was taught is a dual track French Immersion and English speaking school. The lesson was delivered to students in an English speaking class and a French speaking class.

Objectives

1. Learn the function of a seed and its parts.
2. Learn how seeds germinate.
3. Learn the different ways seeds can be dispersed.
4. Apply scientific reasoning to a science activity.

Background Information

Plants produce seeds to pass on their genetic information to the next generation. Within the seed is the endosperm and the embryo. Essentially, the endosperm is a food supply to make a new plant. The embryo is the early plant, the genetic material to make the new plant. You can think of the embryo as the blueprint and the endosperm as the building materials necessary for making a new plant. The more endosperm provided within a seed, the less a seed requires outside nutrients for growth, the less it needs to rely on growing quickly enough to produce its own food. However, the more endosperm, the fewer seeds a plant can produce and the harder those seeds are to disperse. A seed that falls too close to its parent plant may not be able to access the sunlight by being in the parent plant's shade. The new plant may also compete for the soil's nutrients if it is too close to its parent. Since a plant cannot move to other locations, it needs to disperse its seeds far from itself to avoid these situations. Different plants disperse their seeds in different ways. The types of seed dispersal are wind dispersal, mechanical dispersal, water dispersal and animal dispersal. Each way has advantages and disadvantages. For wind dispersal, seeds must be relatively small but can be more numerous (e.g. dandelion seeds, maple keys). Often such plants have adapted ways of helping them "fly" and such seeds can end up hundreds of kilometers from its parent plant. For animal dispersal, the size of the seed can be larger, but fewer seeds can be made. There are three ways that animals can disperse seeds for a plant. A plant can make a fruit to entice an animal to eat it, but protect the seed itself in a hard shell. The seed will then be dispersed through the excrement of the animal (e.g. cherry, apple). A plant can make a lot of tasty seeds to attract animals like squirrels, counting on the fact that they will forget a few of the seeds that they have buried for storage (e.g. oak acorns). Some plants make burrs that stick to animal's fur and thus get dispersed in this way (e.g. Burdock). Mechanical dispersal is where a plant physically launches the seeds in some way (e.g. some cucumber family members burst open when ripe to scatter its seeds). Some plants that are situated near the water disperse their seeds by water dispersal (e.g. coconut). When a seed is dispersed, it still needs to be in an environment that will allow it to grow and germinate. For a seed to germinate, or start the growing process, it needs a kickstart, which is usually exposure to moisture, since the seed is

very dry at the beginning. Water, oxygen and temperature are the three factors that need to be right in order for a seed to germinate, but the levels of each will vary in different plants. This lesson will be used to explore the different methods of seed dispersal, the parts of a seed and how a seed germinates.

Vocabulary

Word:	Brief definition.
Seed coat:	The seed coat is the outer packaging of the seed that surrounds the embryo and the endosperm.
Endosperm:	The endosperm is the stored food, rich mainly in starch and also oil and protein, which surrounds the embryo and is used by the germinating plant as a food reserve.
Embryo:	An embryo is the earliest form of the plant, from which a whole plant will grow under the necessary conditions.
Germination:	Germination in plants is the beginning of the process of growth from a dormant (or inactive) seed.
Seed dispersal:	Seed dispersal is the way a plant spreads its seeds away from itself to ensure that it won't have to compete with its offspring for food or sunlight.
Dissection	Dissection is the disassembly of a biological specimen in order to observe it in greater detail.

Vocabulaire

Mot:	Brève définition.
L'enveloppe de la graine	L'enveloppe de la graine est la partie extérieure qui recouvre l'embryon et l'endosperme.
L'endosperme	L'endosperme contient de la nourriture riche en féculent, en huile et en protéine. L'endosperme entoure l'embryon et est utilisé lors de la germination de la plante comme une réserve de nourriture.
L'embryon	L'embryon est la première forme de la plante, à partir duquel toute la plante grandira si certaines conditions sont présentes.
La germination	La germination est le début de la période de croissance de la plante à partir d'une graine inactive.
La dispersion des graines	La dispersion des graines est la façon dont la plante disperse ses graines loin de la plante pour s'assurer que les nouvelles pousses n'auront pas à compétitionner pour la nourriture ou la lumière.
La dissection	La dissection est la mise en pièce d'un spécimen biologique afin de l'observer plus en détails.

Materials

For Activity 1:

- lima beans (enough for each student)
- magnifying glasses
- activity sheet (to identify parts of the seed)
- microscope (if available)

For Activity 2:

- different types of seed bearing fruits
- magnifying glasses
- activity sheet (for estimates of numbers of seeds within each fruit)
- Petri dishes (or other container for seeds)

For Activity 3:

- 5 large balls
- 30 small balls
  Note: use balls if you play the game outdoors, use beanbags if you play the game indoors.

2 hula hoops

Large paper to record results

Matériaux

Pour l'activité 1

- des fèves de lima (une par élève)
- des loupes
- une feuille d'activité (pour identifier les parties de la plante)
- un microscope (si disponible)

Pour l'activité 2

- une feuille d'activité (pour estimer le nombre de graines dans chaque fruit)
- des petites assiettes ou autres contenants pour deposer les graines
- différents types de fruits porteurs de graines
- des loupes

Pour l'activité 3

- 30 petites balles
  Note : Utiliser les balles à l'extérieur, utiliser des sacs de sable à l'intérieur.
- 5 gros ballons
- 2 cerceaux
- De grandes feuilles de papier pour y inscrire les résultats

In the Classroom

Introductory Discussion

1. HOOK:
   - Look at examples of seeds that have germinated (if you have done lesson extension 1). Ask the students what has happened to their seeds. Talk with them about why they think germination has occurred.
   - If you haven't done lesson extension 1, show and discuss a picture of the life cycle of a plant. Talk about how a plant starts and ends with seeds.
2. TO REVIEW:
   - Review what a seed is and its purpose.
   - Remember what the parts of a plant are and think about how a seed becomes a plant that then produces seeds (i.e. the life cycle).
3. SCIENCE ACTIVITIES:

   Activity 1: Each student will dissect a soaked lima bean seed to observe the seed parts.

   Activity 2: Groups of students will count the number of seeds present in different kinds of fruits and think about the reasons to make few or several seeds.

Activity 3: Two students will act out two common ways to disperse seeds, wind dispersal and fruit dispersal as a demonstration for the class.

4. SECURITYMEASURES:

   - If the teacher or the scientist brings a knife to class for vegetable cutting, make sure that the students are instructed not to touch the knife.
   - Raw lima beans are toxic if ingested.

Science Activity/Experiment

Activity 1: Seed Dissection (Examining the parts of a seed)

Purpose of Experiment:

Methods:
Set-up prior to experiment: Soak the lima beans the night before dissection.

Instructions

1. Give the students each an activity sheet (see attached). On this activity sheet are the different parts of the seed.
2. Give each student two lima beans (one that has been soaked and one that has not) and a magnifying glass. Have them examine the outside of the lima beans and note the differences.
3. Compare the dry vs. the soaked lima bean and write the differences on the activity sheet. You may wish to have the students trace the dry seed and the soaked seed.
4. Have the students carefully dissect their soaked lima beans with a finger nail or tweezers. Have them examine the interior of the seed and note the parts. You may wish to have extra soaked lima beans available as they are fragile.
5. Go over the names of the parts and have them draw the parts on the activity sheet and label them. Explain what each part is for.

Activity 2: Fruit dissection (Estimating seed numbers)

Purpose of Experiment: To have the students grasp the idea that different fruits produce different numbers and types of seeds.

Methods:
Set-up prior to experiment: Buy different fruits that have different numbers and sizes of seeds. Ensure that you buy fruits that are not seedless.
Instructions

5. Give the students each an activity sheet (see attached). In the first column is written all of the types of fruits that are going to be examined. In the second column, get the students to estimate how many seeds they think will be in each fruit. In the third column, get the students to estimate if the seeds will be large or small.
6. Give groups of 2-3 students a piece of each different fruit. They can use magnifying glasses first to examine the fruit and its seeds. You can also give each student enough Petri dishes in which to collect the different seeds.
7. Add up all of the seed counts from each group. Go over their estimates together.
8. Questions to ask: Why do you think some fruits have lots of seeds and some have few (or only one)? What differences are there between the seeds that come from fruits with several seeds and fruits with few seeds? What are the advantages of having lots of seeds compared to advantages of having few seeds?

Note: Strawberry has been included on the fruit dissection activity sheet. Actually, the seeds on the outside of the strawberry are the true fruits, while the flesh of the strawberry is not a fruit. Generally, strawberries reproduce via runners that shoot from the original plant and establish a new plant nearby.

Activity 3: Seed Dispersal Game

Purpose of Experiment: To see that different plants use different dispersal methods and this corresponds to the size and the number of seeds that it produces.

Methods:

Set-up prior to experiment: Place two hula-hoops on opposite sides of a centre line. Gather 5 large balls and 30 small balls.
Instructions

1. After activity 2, the students should have an idea as to why some plants make big seeds and some make small seeds. Talk to the students about two different ways to disperse seeds, wind dispersal (only useful for small seeds) and fruit dispersal. Explain why plants need to disperse their seeds (see background information).
2. Have one person represent wind dispersal and one represent fruit dispersal. Have the two people line up on a centre line between the two hula hoops.
3. Give the wind dispersal person 30 small balls (or bean bags) and the fruit dispersal team 5 medicine balls. The balls/bean bags represent the plant's seeds.
4. The fruit person has to carry their seeds between their knees directly into the hoop. Ensure that their seeds are large to illustrate the point. The hula hoop represents an area that has optimal conditions for growth (i.e. enough light, water, nutrients from soil).
5. The wind team cannot move from the line. They have to try to throw their seeds into the hula-hoop.
6. After 30 seconds, compare the number of seeds that have succeeded from each method.
7. Talk about which method the students think is best.
8. You can repeat with different students if you'd like, and keep a tally of the success of both methods. The goal is to show that both methods, though very different are both successful

Optional Questions

1. What does dispersal mean? (scatter of seeds)
2. How do dandelion seeds disperse? (wind)
3. How do apple seeds disperse? (by animals)
4. What fruit has bigger seeds, a papaya or a kiwi? (papaya)
5. What fruit has more seeds, an apple or a papaya? (papaya)
6. How do animals disperse seeds? (through their excrement)
7. When you dissect a seed, what are the parts of the seed? (seed coat, embryo or new/baby plant and endosperm or food for the new plant)
8. When you dissect a seed, what is most of the seed made of? (endosperm or food for the new plant)
9. What is the endosperm? (food for the new plant in the seed)
10. What is the embryo? (the new/baby plant)
11. What is the difference between a big seed and a small seed? (the amount of endosperm)

Closure Discussion

- Review what a seed is, what it is for and the parts of a seed.
- Review the different strategies plants use to make and disperse their seeds.

References

1. Burnie, David. 1991. How Nature Works: 100 Ways Parents and Kids Can Share the Secrets of Nature. Pages 38-51, The World of Plants and Fungi. Reader's Digest Association Inc. ISBN**:** 0895773910
2. B.C. Agriculture in the Classroom Foundation. 1993. Beans and Their Buddies. Pages 35-38. Pacific Edge Publishing.
3. http://en.wikipedia.org/wiki/Seed Wikipedia, the free encyclopedia, [Information about Seeds].
4. **Notes**: A related lesson for English speaking students is available from the Scientist in Residence Program website http://www.scientistinresidence.ca; see the Plants science unit, Lesson 1 *Seed Structure and Seed Dispersal*.

Extension of Lesson Plan

1. (Before the lesson); A week before the lesson you can grow three different types of seeds (corn, bean and sunflower) in clear plastic glasses to observe the process of germination. Place a piece of blotting paper in a clear cup and fill it with cotton balls. Place a seed between the glass and the blotting paper. Fill the cup with water to, but not covering, the seed. Check the water level every few days. By day 5, the seeds will have begun to germinate. This is a good intro to explaining the purpose of a seed.

2. Art extension: can use the leftover fruit to make prints.

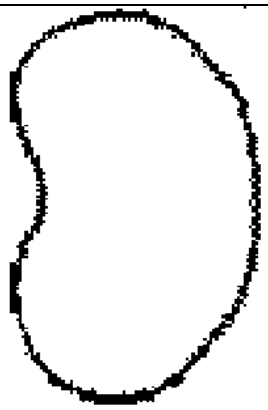
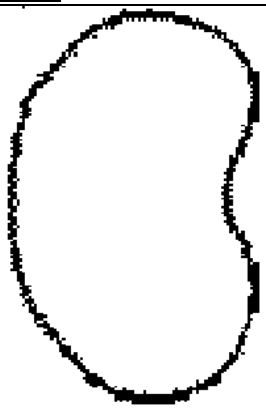
Scientist:_____

Date:_____

Activity 1: The parts of a Seed

Purpose: To observe the inside of a seed and identify its parts.

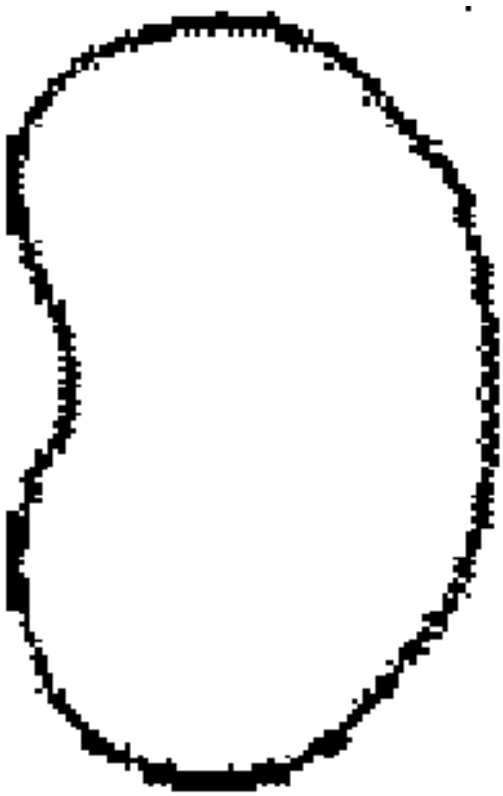
Draw and label the parts of a seed.

The Dry Seed 	The Soaked Seed
Exterior	**Interior**
	

Scientifique:_____
Date:_____

Activité 1: Les parties d'une graine

But: Pour observer l'intérieur d'une graine et identifier les parties.
Dessinez et marquez les parties d'une graine.

La graine sèche	La graine mouillée
Extérieur	**Intérieur**
	

Scientist:_____
Date:_____

Activity 2: Fruit Dissection and Seed Counting

Purpose: To compare the numbers and sizes of different seeds from different types of fruit-bearing plants.

	Estimates		Actual Values	
Fruit	**# of seeds**	**Size of seeds (*Draw a seed*)**	**# of seeds**	**Size of seeds (*Trace a seed*)**
Mango				
Apple				
Orange				
Kiwi				
Papaya				
Strawberry				

Scientifique:_____
Date:_____

Activité 2: La dissection de fruits

But: Pour comparer les nombres et les tailles de graines différentes de plantes différents.

	Les estimations		*Les nombres réels*	
Fruit	**# de graines**	**La taille d'une graine**	**# de graines**	**La taille d'une graine**
Une mangue				
Une pomme				
Une orange				
Un kiwi				
Une papaye				
Une fraise				