Science Unit: ***Plants 'n' Bugs***

Lesson 3: ***Pollination Experiment***

School year:	2008/2009
Developed for:	False Creek Elementary School, Vancouver School District
Developed by:	Shona Ellis (scientist), Angela Cotter and Geraldine Miles (teachers)
Grade level:	Presented to grades 2; appropriate for grades 2 – 5 with age appropriate modifications.
Duration of lesson:	3 hours
Notes:	The flower models can be made in advance of the lesson. The experiment should be done later in the day when it is warmer and the pollinators are out. A day should be selected that is not cool, cloudy, or rainy. Introduce the use of compass and thermometers to the class with a worksheet (their use will also be demonstrated outside when the experiment is being set up).

Objectives

1. Learn how to design an experiment.
2. To demonstrate to students that science is all around us and that anyone is able to participate in scientific investigations (i.e. do science).
3. To identify the key elements of science and experimentation.
4. To emphasize the importance of observation and developing questions in science and the role of experimentation.

Background Information

The students have learned about floral structure and role of insects in accomplishing reproduction. They have also learned about the structural features of insects and how they are modified (particularly mouthparts) to gain the rewards provided by flowers. They have learned to distinguish between the different types of pollinating insects. Flowers must attract the insect as well as reward them.

Because children get restless if they must sit and observe, an extra activity is useful to keep them engaged. Site conditions data (wind and temperature) will also be collected so instructions for use of thermometers and compasses should be given in advance of experiment set-up.

Vocabulary

Word:	
Control	A sample that is treated the same as the rest of the samples, but has not been exposed to the condition/variable being tested.
Data	Qualitative and quantitative information obtained from an experiment.
Experiment	An exercise designed to determine if a hypothesis is true or false.
Hypothesis	In science, a prediction for the outcome of an experiment or an explanation to a question.
Observations	To watch and record something that is happening, such as a natural phenomenon.

Replicate A repeat of an experiment to collect more data.

Materials

- Flower models (made with bamboo stakes, construction paper, duct tape, and glue), diagramed below.
- compass
- thermometer
- Assorted fruit including cucumber, tomato, orange, apple…
- Examples of non-fruit plant foods including carrots, celery,

In the Classroom

Introductory Discussion

1. Review.
    - The students share their observations about the pollinators they have seen since the last class.
    - Ask students if they have any questions that came up while they were observing pollination. Lead them to discuss the attraction of the pollinator to the flower.
2. An experiment on colour preference of pollinators will be set up and data collected. Students will also collect data on site conditions.
3. Students will make a prediction/hypothesis about colour preference of pollinators. They will make, observations, recording results, and draw conclusions. In the exercises they will learn how to use a thermometer and compass.
4. Safety/health issues
    - Prior to lesson identify any student who may have allergies to plants/pollen.
    - Students are warned to not disturb the insects as they are making their observations.

Science Activity

Activity Title: Pollination Experiment

Purpose of Activity: To determine if pollinating insects have colour preferences.

Hypothesis: Pollinators are attracted to colours other than green (the hypothesis may be different based on the class discussion).

Hypothesis: Two controls: stalk without flower, green flower model.

Methods and Instructions:

Set-up prior to experiment: Students constructed simple flower models using bamboo stakes and different coloured construction paper.

Part 1 – Introduction – in large group
Review: What do you remember from last lesson? Flowers, insects, pollination?

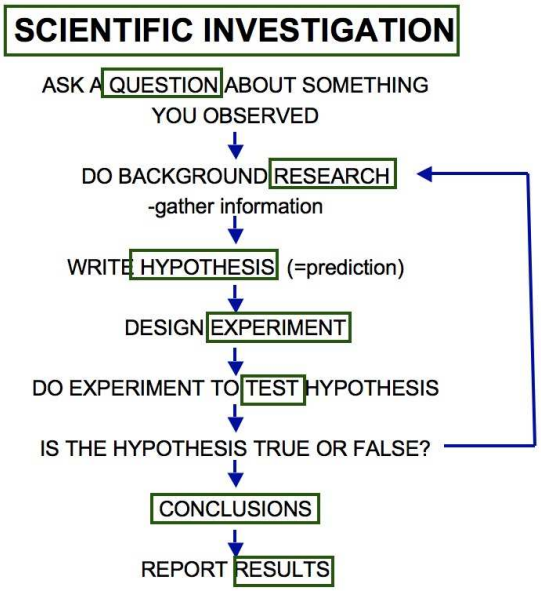
While doing the lessons you have been scientists:
- learned about flowers, plant reproduction, pollination, insect biology (acquired background knowledge)
- made observations
- asked questions

All of these activities are very important in science and science research.

How do you answer your question? Investigate - library…or run an experiment
- Design experiment to find the answer(s)
- Set up experiment
- Collect data (often done in a table format)
- Make prediction about what will happen under a set of conditions. This prediction is called a hypothesis (it is based on what you already know).

Part 2 – Overview of science investigation

Draw outline of scientific investigation on the flipchart or board.
Go over each concept sequentially (see next section for explanations).



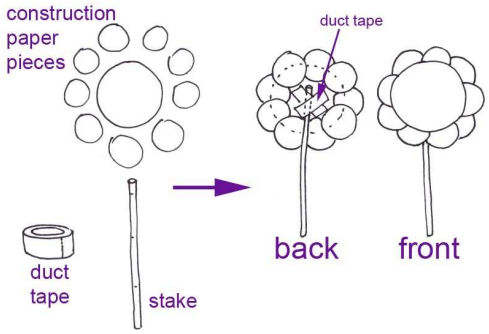
Part 2 – Overview of science investigation

1. Observations:
   So far we have investigated aspects of flowers, plant reproduction, pollination, insect biology

2. We developed a question: What colours attract pollinators?
- Background research to get information to help answer the question.

3. Hypothesis: Pollinators are attracted to colours other than green.

4. Experiment:
   Each group of 5 students will construct a set of flower models of six different colours (including one green):
   - construction paper is used to make six flowers (each of one colour) and standardized design.
   - each flower is attached to a one-foot long stake with duct tape (or other strong tape).



What is a control?
What will be our controls?
- green should not attract pollinators as it is the colour of vegetation.
- what happens if the shape of the flower attracts the pollinators?
The controls will therefore be a green flower and then a flowerless stake

5. Set up and run experiment
Each group will set up their flower models plus one flower-less stake in a row, one foot apart by poking the stake into the ground with the front of the flowers all facing the same direction. They will sit in front of the flowers and record data. Once student is assigned to collect pollination information (Data Sheet A) while the other collects Site Condition data (Data Sheet B). Each group is given one compass and one thermometer.

(a) Data Sheet A: Record pollination activity around flower models – document if the insect flies close to or lands as well as the type of insect (bee, butterfly, moth, etc).

(b) Data Sheet B: Site conditions
Temperature
Wind – Is it windy, if so from what direction is the wind coming?
Light – shade verses light
Presence/absence of Pollinators in the area.

Part 3 – Overview of science investigation
Large Group in classroom:
Put all data on one large data sheet
- What is our conclusion?
- Did everyone have the same results? Why not?
- Discuss the importance of replicates.
- Discuss flaws to study and how to improve it.
- Discuss why the site condition information was important to collect.

Closure Discussion

1. What other kinds of questions does our research present? How do we go about finding answers to these questions. In some cases we can set up an experiment.

References

1. <http://www.blm.gov/nstc/soil/Kids/incred.html> Pollination Canada. [Food web and biological organisms in soil.] Accessed Aug. 15, 2009

2. < **http://www.isu.edu/outdoor/maplong.htm**> The Art of Teaching Map and Compass: Instructional Techniques, Curricular Formats and Practical Field Exercises By Ron Watters, Director Idaho State University Outdoor Program [This site is a good reference for introducing students

of all ages to maps and compasses.] Accessed Aug. 15, 2009

3. < http://www.msnucleus.org/membership/html/k-6/wc/weather/1/wcwe1_2a.html> Water Cycle the Earth;s Gift – Water Cycle Weather Lab [Interesting site with lots of other environmentally related activities] Accessed Aug. 15, 2009

Extension of Lesson Plan

1. Additional experiments could be done incorporating flavoured water, patterning, etc.

Name of Group: _____

DATA COLLECTION SHEET

Flower Colour:	_____	_____	_____	_____	_____	**Green**	**No flower**
Poll. **Visits**	___ _____	___ _____	___ _____	___ _____	___ _____	___ _____	___ _____
	___ _____	___ _____	___ _____	___ _____	___ _____	___ _____	___ _____
	___ _____	___ _____	___ _____	___ _____	___ _____	___ _____	___ _____
	___ _____	___ _____	___ _____	___ _____	___ _____	___ _____	___ _____
	___ _____	___ _____	___ _____	___ _____	___ _____	___ _____	___ _____
	___ _____	___ _____	___ _____	___ _____	___ _____	___ _____	___ _____

Data recording:
If an insect approaches the flower, but does not land put an “A” on the short line.
If the insect lands on the flower put an “L” on the short line.
On the longer line put the type of insect (bee, butterfly, moth, hoverfly, wasp, etc). If you do not know what type it is just put a “?”.

Notes or Observations:

Name of Group: _____

SITE CONDITIONS

CONDITION:	MEASUREMENTS:
Temperature	_____ ^{o} C
Wind	**How windy is it today? Circle one of the following:** **No wind** **Slightly windy** **Very windy** **Direction of wind:** _____
Light	**Are your flower models in the sun or shade?** _____
Pollinators	**Do you see any pollinators at this site?** _____ **Circle the ones you see:** **bees, butterflies, moths, wasps, hoverflies**
Other Insects	**Do you see any other insects at this site?** _____ **If so, what type?**

Site Description: Look around and note any other features of the site (Are there flowers or shrubs nearby?).