Science Unit: ***The Earth Around Us: Air, Water & Soil***

Lesson 7: ***The Scientific Method***

School Year:	2009/2010
Developed for:	L'École Bilingue, Vancouver School District
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Grade level:	Presented to grades 1 - 2; appropriate for grades 1 - 7 with age appropriate modifications.
Duration of lesson:	1 hour and 20 minutes

Objectives

1. Recognize examples of science around us and how it improves our lives
2. Describe the steps involved in the application of the scientific method to a given question or to everyday thinking.
3. Perform a basic observational experiment.

Background Information

One way to help our students improve their scientific reasoning is to use the scientific method: a process of thinking through possible solutions to a problem and testing each possibility to find the best solution.

Vocabulary

Variables:	Anything that can effect the outcome of your observations. To best understand your observations and summarize your results, all but one of your variables should be kept constant during an experiment.
Hypothesis:	A possible explanation for an observation. By performing your experiment, you will be testing whether or not your hypothesis is correct.
Data:	Pieces of information (measurements or observations) collected during your experiment. The data is then used to help determine whether or not your hypothesis is correct.
Conclusion:	The results of your experiment and how they relate to your hypothesis.

Materials

- plastic cubes ($1x1x1cm^3$)
- large sheet of paper
- felt markers

In the Classroom

The teacher should participate in the discussion and write down the steps to the scientific method as the scientist discusses them.

Introductory Discussion

1. Begin the discussion by brainstorming with the students: What is science? What does a scientist do? Why do science? Do you use science? Be sure to emphasize that we are all scientists.

2. Shift the discussion to the science which is around us. Draw examples from everyday life (e.g., medicine, technology, construction/architecture, nutrition, etc.).

3. Introduce "thinking like a scientist" as using the scientific method, which is the best method people know about for understanding the real and objective world around them. This kind of thinking is not always easy, but does become more natural with practice. Using the scientific method includes many (or all) of the following steps.

    a. Start with a **problem** or ask a **question** – what is it that you are curious about?

    b. Define your **variables** – this will help you to understand your results.

    c. Make a **hypothesis** – predict what you think will be the outcome of your experiment and, importantly, why you think this will be the outcome.

    d. Do your **experiment** – to test your hypothesis (determine whether or not it is correct or not). Be careful that your experiment only tests one variable, while the others are "controlled" (held constant). Your experiment might also require replication (to be done again), to be certain that the same observations result.

    e. Collect your **data** and/or make your **observations**.

    f. **Summarize** your results – use a graph or table to communicate what you have learned. It also helps to write down one or two important sentences that summarize what you have learned from your experiment.

    g. State your **conclusions** – how do your results relate to your hypothesis? Does your hypothesis remain a possible explanation to what you have observed or do you need to think of a new hypothesis to test.

Science Activity/Experiment

The concepts behind the scientific method are best reinforced through practice. Use a simple observation experiment to provide examples and help student understanding. Student hypotheses and results will be recorded in their science worksheets.

a. **Question**: Who is taller, boys or girls?

b. **Variables**: Gender, age, shoes, etc.

c. **Hypothesis**: For example, "I think that boys are taller than girls because my Dad is taller than my Mom."

d. **Experiment**: We will measure the heights of, say, ten students: 5 boys and 5 girls. Control all variables except the one we are testing (e.g., have students remove their shoes, and be sure to have an equal number of boys and girls). To help explain why replication can be important, start by picking a taller girl and a shorter boy, then ask if this results could be due to chance. Measurements will be done in non-standard units of cubes (actual dimensions of cubes are 1cm x 1cm x 1cm)

e. **Data/Observations**: Measure the heights of the students (equal number of boys and girls) as they lie down on the long sheet of paper. Line up cubes next to the student, from head to toe. Have the remaining students help in measuring out the heights of their fellow

students and counting up the cubes to get the total height. Record the heights of the children “in cubes” on the large sheet of paper.

f. **Summarize**: Calculate the total height of the boys and the total height of the girls “in cubes”. Be certain to summarize explicitly for the students the results of the experiment.

g. **Conclusions**: For example, “Boys are taller.” Discuss which restrictions apply to our conclusion (e.g., might not be true for another class).

Closure Discussion

1. Review the scientific method (e.g., ask questions, collect evidence, draw conclusions, and always be willing to change your mind) with the students. Get them to identify the steps of the scientific method as they were just performed in the observational experiment.
2. Introduce the upcoming unit on air.

References (examples of the format to use for different types of references are below)

1. http://scientistinresidence.ca The Earth Around Us: Air Water & Soil: Introductory Activity - Thinking Like a Scientist, by Linda Hansen, Scientist in Residence Program, See Science Lesson Plans, Earth Science Lessons.
2. <http://en.wikipedia.org/wiki/Scientific_method> 'Scientific Method' entry on Wikipedia [Detailed explanation of the scientific method, with many examples].

Extension of Lesson Plan

1. Perform the same observational experiment with the whole class, rather than simply a sub-population.