



Lesson #9

You are the Microbiologist

Objectives:

- The learner will demonstrate comprehension of basic lab techniques by properly using these techniques in preparing a laboratory investigation.
- The learner will demonstrate synthesis of prior lab experiences by solving a new problem using those lab experiences.
- The learner will demonstrate evaluation of pollutants by testing the effects of a specific pollutant and reporting on possible alternatives to the uses of that pollutant.

National Science Education Standards:

UCP 1, UCP 2, SAI 1, SAI 2, PS 3, LS 3, ESS 1, ST 1, ST 2, SPSP 3, SPSP 4, HNS 2

Benchmarks:

1A, 2B, 3B, 5E, 9E, 11A, 11B, 11D, 12A, 12D, 12E

Materials:

Materials for making the Winogradsky Bottle
Materials for any test you plan for students to carry out
Sample pollutants (see the list of ideas below)

Background:

More than just understanding content, students need to have the skills necessary to think independently. This activity is designed to allow students to follow the scientific method in researching problems in their community.

Preparation:

Possible pollutants: laundry detergent, dish soap, fertilizer, Windex, hair products, motor oil, cooking oil, soda, iced tea, tap water, car wax, the list goes on. Basically, anything goes as long as it is not harmful to the students.

Discuss student ideas for their “pollutants” before they bring them in. Many of the materials may be collected from students’ homes. It is also important to check students’ lab procedures before allowing them to begin.

It will be important for students to have a control in this experiment so that they can compare their results. If all students will be working on different pollutants, but with everything else the same, you may want to set up one control bottle as a class control. All groups would then be able to use that bottle to compare their results to. Otherwise, the individual groups may need to set up control bottles of their own.

Warm-Up:

What is pollution? Spend a few minutes defining pollution as a class. You may want to share this definition with the class, “Pollution is something that has undesired consequences



associated with its presence.” Ask students if this definition changes their ideas about pollution. Discuss some of the undesired consequences associated with pollution.

Procedures:

1. Students will be writing their own labs for this activity. After the warm-up, allow students some time to think about the pollutants which they want to study. You may want to group students into research teams so that they can work together on this task.
2. Once students have decided on their chosen pollutant, have them confer with you to be sure it is safe for use in the classroom.
3. Students should discuss their problem, research their background information and form a hypothesis. Again, it is extremely important to stay in constant contact with each group to ensure that they are on task.
4. Students will then write their procedures. Once this is completed, it will be necessary to confer with them again. During this conference, be sure to address any safety issues in their procedures and modify with them as necessary.
5. Experiment! Because of the nature of this activity, the time necessary for the experimental stages will depend on the problem and procedures posed by each group. Be sure to keep students on task and encourage their scientific thinking.
6. After students have completed their experiments, they will be writing up their lab. The student form will help them in organizing this assignment from beginning to end and can be used as the guide when they write the lab on their own.

Variations and Follow-Up Activities:

This lesson is the culmination of the module, but there are still follow-up activities which can be done. Once students have completed their research, you may have them create power point presentations on their research. These could be presented in class or on a science night for parents to watch. This activity may also spark more questions for students and further research projects may be planned.

Assessments:

Students will be assessed throughout this module, yet this activity will serve as a larger assessment of students’ growth during these lessons. Assessments can be made on a regular basis during the conferences with the groups. Students’ work can also be collected on a regular basis during the project to allow for assessments. The final project will provide a wonderful assessment piece for assessing various aspects of students’ learning including content, group skills, individual skills, lab skills, and scientific thinking skills.



Observations:

As in earlier lessons, I urge you to consider group size before beginning this lesson. While it may sound wonderful to have each student working individually on a bottle, the logistics may not allow for that. It is also important to remember the need for students to interact with each other when working on a project like this. I have found that my students learn more from each other than they do from working alone. Science is a collaborative effort, and learning to work together is an important scientific skill at any age.

Consider sharing a model lab report with the students. Because they will be working more independently in this project, they may need some guidance in regards to the types of information and data which should be included in the lab report.

The most important lesson that I have learned from observing my students working on this project is to allow my students to use their creative thinking. There were times when students thought of ideas that I would have never imagined. By allowing my students the freedom (within reason when safety was concerned) to explore their ideas, no matter how outlandish, I was able to help them to become independent thinkers. It is through activities like this that students learn to go out on a limb and take risks with their ideas. Some ideas worked and others didn't, but it was those failed attempts that taught them the most. Let your students explore their ideas and you will find they will be on their way to becoming independent thinkers.



Name _____

Date _____

You are the Microbiologist

*** Note to Student - This is the format you will be using in your research project. You will be writing your own problem (put this problem in your own words), background (you will have to find the background information on your own), procedures, results and analysis, and conclusion. Be sure to have the procedures approved by your teacher before beginning your experiment.

Problem:

You have just been hired as a microbiologist assigned to study the effects of pollution on a pond. Specifically, your job is to find out how pollutants effect this environment.

Background:

You know from previous activities that there are many changes occurring in an environment which you can not see. These changes can have a big impact on the components of the environment that you can see. You will be using the methods you have practiced in the previous activities to conduct a research study of the effects of pollution on pond sediment. From your results you will infer what effects these changes in the sediments will have on the larger environment. It will be important to look back at your findings from the Winogradsky Bottles to help you in your research. The pollutant you will be studying is _____

Hypothesis: If _____,

then _____,

because _____

Materials:

You will need to decide on your materials based on your research plan.

**Procedures:**

You will be writing your own procedures based on your research plan. It is advised that you look back to the procedures for the Winogradsky bottle as a guide. Remember, you must have your procedures approved by your teacher before continuing.

Results and Analysis:

You must keep a detailed record of all measurements and observations. It is advised that you use a table whenever possible to help you organize your data. It will be important to show any calculations that you make as well as any changes that you may have made in your procedure as you proceeded with your research.

Conclusions:

You will be writing your own conclusion for this lab. Remember to write in complete sentences and give specific details. It may be helpful to refer back to tables and charts in your results and analysis section as you explain your findings. Be sure to look over your previous labs for assistance. It is also important to remember to include some information about your hypothesis and whether or not you were able to support it. Any changes you made in your procedures should also be addressed with a brief explanation of why those changes were necessary.

Some Questions to consider in your conclusion:

- What have you learned about this pollutant?
- How do you believe this pollutant effects our environment? (using your model as a source of information)
- Is anything being done currently to minimize the effects of this pollution?
- What would you do to change the ways this pollutant effects our environment?