

Lesson Title:

Scientific Method in Action

Lesson Submitted by:

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Grade Level:

High school 9-12

Content Areas:

Science, Environmental Science

Time Allotment:

1 class period per week for 5 weeks

Academic Standards:

NJ 5.1 A, B, and C

NJ 5.10 B2

Abstract:

Montgomery Townships Schools are making the environment a priority this next school year, and by that the school will be trying to "go green". From trying to encourage students to recycle and using environment -friendly cleaning supplies, the school board wants every teacher to help. This past week at the school there has been noticeable trash and bottles all over the school and the school grounds. During my Earthwatch experience I helped clean up the harbor with the PSRF staff and I found the best method to do it. They cleaned the harbor, but asked us to keep track of the type of trash and where it was found to hopefully propose different methods to keep future trash out of the harbor. I found this methodology to be very similar to what I teach every year, the scientific method. The scientific methods in its most basic steps are: observation, hypothesis, experiment, and conclusion. Instead of passively passing this information to the students, they will have to use this method to propose and hopefully test ideas to help clean-up around the school.

Goals:

We are learning...

to gather data, analyze the data, and report results in a coherent manner.

to display problem solving, decision-making and inquiry skills.

to draw scientific conclusions based on observed data.

Background Information:

Students will have basic knowledge of scientific method from prior science courses.

Materials:

Garbage bags

Clipboards

Maps of school and school grounds

Technology:

Computers to create proposals to solve littering problems

Instructional Procedure:

Introduction: 15 min

On my Earthwatch trip we did a day where we cleaned the harbor. The surfriders foundation gave a small presentation about why they were cleaning the harbor, which included information about the North Pacific Gyre. I had never realized that there was even an area like this on earth. (While I am explaining this, I will be showing pictures from the clean-up day). I will start student off with reading the article "The World's Largest Dump: The Great Pacific Garbage Patch" from discovery online magazine.

(<http://discovermagazine.com/2008/jul/10-the-worlds-largest-dump>) Students will be asked to read through the article and come up with a reaction paragraph about the article.

Activity:

*Observation and Data Collection:* 30 min one day a week per class (each class on a different day of the week)

Hopefully the students' reaction will prompt them to be more aware of plastics and other litter, especially the trash left in and around the school. Students will be given maps and as a class we will split the school into zones. A group of students will be in charge of collecting trash in that zone one day a week. A record will be kept of the type of trash collected that day. Each class will share their results with the other classes on whiteboards. Each class will be able to use the data collected by other classes too.

*Hypothesis/ Prediction:* 20 min (one class period)

Students will be able to analyze the data and try to come up with ways to decrease the litter in the area or to promote the recycling of the trash. Students will come up with possible strategies and using a "If .....then ....." statement will give their hypothesis. For example: If there is a recycling bin in the cafeteria then students will put their cans and bottles in the bin rather than the garbage.

*Experiment:* 30 min (one class period)

Students will write a proposal that explains their experiment to test the hypothesis. Students may have to do a little research about the containers they would need and any other materials to carry out the experiment. Also other staff, especially custodians should be used as a reference and as supporting players in the experiment.

*Final Presentation:* One class period (ten minutes per group)

Students will have to include the observations, hypothesis, and experiment in the presentation. Students will have to organize all of the material into a presentation for other classmates, custodians, and administrators. They will need the administrator's approval and the custodians help to carry out the experiment. Students may do their presentation using a variety of media: posters, power point, and videos. Students will be graded with the attached rubric.

*Conclusion:* Depends on project

This part of the project will not be graded but if it is possible to carry out any of the experiments then the class can work as a whole and collect the data. Then report the results to the administration as a whole.

Assessment: Individual grades will be given. The group will be assessed with the following rubric. The last part will be based on feedback by peers in the group.

Connection to Other Content Areas:

Language Arts: Persuasive writing to allow project to proceed and correct grammar in presentation

Public Speaking: Public speaking skills will be utilized

Mathematics: Graphs and charts may be used to display the data collected.

Extensions:

Actually carrying out the experiment and reporting the results would be part of the extension. Also students may see other areas of the school where this method could be utilized.

Students may want to get involved in helping organizations, such as the Surfrider's foundation, in New Jersey.

Acknowledgements:

Pelagic Shark Research Foundation

[www.pelagic.org](http://www.pelagic.org)

Discovery Magazine

The World's Largest Dump: The Great Pacific Garbage Patch

<http://discovermagazine.com/2008/jul/10-the-worlds-largest-dump>

Surfrider's Foundation

Monterey Chapter

<http://www.surfrider.org/monterey/>

New Jersey

[http://www.surfrider.org/stateofthebeach/05-sr/state\\_summary.asp?zone=MA&state=nj](http://www.surfrider.org/stateofthebeach/05-sr/state_summary.asp?zone=MA&state=nj)

Evaluation Rubric

	0	2	4	
Data/ Observations	Data and observations were not presented	Minimal data and observations are presented.	All data and observations from all classes is presented	
	0	2	4	6
Hypothesis	No hypothesis is given.	Hypothesis is given, but there is no connection to the data that was collected.	Hypothesis is given and connected to the data but an “if ....then...” statement is not used.	Hypothesis is given and connected to the data and an “if ....then...” statement is used.
	0	2	4	6
Experiment	No experiment is presented	Experiment is presented but does not test the hypothesis.	Experiment does test the hypothesis, but aspects of the experiment like cost, materials, and support are not presented.	Experiment does test the hypothesis, and all aspects of the experiment like cost, materials, and support are not presented.
	0	2	4	
Individual Grade	Did not participate in group	Effort was shown in the group but behavior was a problem	Worked well with group.	