Title: Drink to Your Health or hiding in plain sight or spot me if you can

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Abstract

This action research project will integrate elements of biotechnology into a standard chemistry curriculum as a means of introducing students to some real life applications where chemistry is used to solve problems. Students will be given opportunities to make connections between the theoretical content they are learning in a classroom setting and the practical applications of the information to create solutions to problems that could greatly impact their quality of life as well as their health.

Rationale

Chemistry as a discipline naturally lends itself to students being exposed to hands on activities via the experimental process. Oftentimes, however, students have difficulty understanding the purpose of the experiment and as such they are not able to demonstrate satisfactorily the skills of analyzing, interpreting and explaining the meaning of their observation and data collected during the experiment. Their ability to make connections between the content covered and the results of their experiment is even more limited. While students enjoy the experimental process, it is often up to the teacher to initiate inquiry into the meaning of what just took place during the lab by designing some kind of post lab activity and then guiding the students through the process of making meaning of the data through hints, reminders and sometimes reiteration and reference to content previously covered. The disconnect in some cases is due to the fact that most often during an experiment, students are working with chemicals with which they have no prior knowledge and so any kind of reaction between these chemicals does not illicit any meaning for the student. The introduction of biotechnology elements into the chemistry curriculum is intended to provide experiments for students to work with chemicals with which they are very familiar and also perform experiments which are of great significance to their everyday life.

Description of teaching unit, including expected outcome

This teaching unit will span approximately four fifty minute class periods and will focus specifically on covering topics related to matter and measurement.

NGSS:

- **SC.912.P.8.1:** Differentiate among the four states of matter
- **SC.912.P.8.2:** Differentiate between physical and chemical properties and physical and chemical changes of matter

- **LACC.1112.RST.1.3:** Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.

The learning outcomes expected at the completion of the unit include the following:

Students will be able to:

- Explain the difference between a pure substance and a mixture
- Explain the difference between a homogenous mixture and a heterogeneous mixture
- List various methods for separating mixtures and explain conditions for which a particular separation method is best suited.
- Test water samples for the presence of chemicals and microorganisms

The lessons which are intended to facilitate the accomplishment of the learning outcomes will include:

- **Day 1**: EPA Virtual tour of a water plant Webquest

- **Day 2:** EPA water filtration activity-students will construct their own water filtration system and perform the same steps done in a water treatment plant to purify water for drinking (**this portion will cover methods of separation**).
- Students will test the water sample they partially purified as well as water samples from other sources (tap, bottled water, canal) for the presence of inorganic chemicals and compare the results of their purified water to the water from other sources (**students will need to be able to state and explain whether the purified water is considered a pure substance or a mixture based on their results)**
- **Day 3**: Students will test for the presence of Coliforms and e-coli in the water samples
- Students will then refer to the EPA website to determine the maximum contamination level for whatever substances they identify in their water, mode by which they were transferred to the water and the health hazard they pose.
- **Day 4:** Students will also access the water quality report for their city and make a graph of the inorganic chemicals and the total Coliforms present in the water
- Students will be introduced to some portions of Dr. Rheingans' powerpoint on water pathogens: *A Social Science Perspective.* Specifically of interest will be the social science piece to get students to think globally and recognize that although clean water is readily available and accessible to us in the United States, this is not true for the vast majority in many other countries.
- Students will create thank you cards to send to the utilities division of their respective city. They will also write a request letter to have a representative come into the classroom and talk about the role of chemistry in the production of safe potable (drinking) water.

Data collection techniques and/or student assessments

- Construction of filtration device and explanation of each separation technique used
- A properly constructed graph (heading, axes label, units)
- Coliform conundrum pre & post lab questions
- Chapter test

Use of equipment lockers

Coliform conundrum locker/Detecting water-borne pathogens through colorimetric methods

Elements included from ICORE Summer institute

- EPA Webquest
- Coliform conundrum
- Dr. Rheingans' powerpoint on water pathogens: *A Social Science Perspective.*

Differences between the proposal and how I normally teach

The method I have chosen to teach various topics within this unit for the upcoming school year differ from the approaches that I have used in the past in that I am using the experimental process as the framework for teaching the content as opposed to lectures, and worksheets. The experiments that will be used are also designed to model actual processes used in a real world setting that have relevance in the life of the students. In the past when I have taught this particular unit, I would introduce students to the content via a lecture to get them acquainted with vocabulary, engage them in some reinforcement activities such as: matching games, visual vocabulary, and section quizzes. Once they demonstrated some understanding of the content then we would move into doing a lab that reinforced the concepts taught. For example the lab on methods of separation, although it was applicable to the content covered and it provided reinforcement to several topics covered within the unit, it was done solely to expose students to the processes they could use to retrieve each component from a mixture. The lab activity lacked a connection to their daily lives and gave students no insight in real life situations where these techniques were used. This year I will use the lab as the spring board for teaching the content by designing essential questions intended to guide students into becoming acquainted with the vocabulary and the content they need to learn as they proceed through the lab. The lab will also be tailored to expose students to the techniques used for separating mixtures through an experimental process that is used in their community and have relevance in their daily life.

Literature cited

http://www.epa.gov/ogwdw000/kids/flash/flash_filtration.html

http://www.epa.gov/ogwdw/watertreatmentplant/flash/index.html

http://water.epa.gov/drink/contaminants/#List

Budget and budget Justification

To create filtration systems for 4 classes consisting of a total of 100 students/25 groups we will need:

Item	Quantity	Estimated cost
Alum	5 lbs	$15
Fine play sand	50 lbs	$10
Coarse sand	50 lbs	$10
Pebbles	10 bags	$35
Reagents for coliform lab	?	?
Total	TBD	TBD