Guilty as Charged: Gaining Analytical Skills Through Understanding *Vibrio cholerae* in Kenya and Haiti.

or

All are welcomed except YOU

**Abstract**

The thrust of this action proposal is to sample cutting edge research-based approaches of teaching science to culturally diverse scholars, especially the English Language Learners (ELL). Students will utilize scientific thinking to analyze published articles on *Vibrio cholera* cases from Kenya and Haiti, and they will extend their reasoning with probing inquiries relating to social change. They will perform hands-on biotech experiments, such as PCR, DNA Fingerprinting, and the Cholera Conundrum, which will aid in generating their own experimental ideas. Furthermore, they will utilize the acquired data from these experiments to write their own laboratory reports including peer-reviewed literature references. This educator will solicit university professors as guest speakers to empower students deciding on science career tracks.

**Rationale**

Critical thinking is a crucial component in ascribing merit to new knowledge. This project will accentuate four essential competencies. First, the nucleus of this unit is to actively incite 10th biology students to translate published information, generate new ideas, conduct experiments, and derive reliable and valid conclusions. Next, this project will attempt to minimize the disparities in science education of students from different cultural groups through more inquiry-based, hands-on laboratories that emphasize the use of biotechnology. Thus, implementing these two approaches may help to bridge the gap in science achievement scores between the students who are predisposed to the subject with the English Language and the ELL. Then, students will be inspired to explore career related vocations through laboratory visits and invited guest speakers in the science field. Finally, required reading synthesis and writing connections will reinforce language acquisition.

This unit of study will encompass scientific inquiry, the significance of utilizing data to make informed decisions, and the benefits and risks in biotechnology. In cell structures and functions, students will differentiate between prokaryotic and eukaryotic cell features. They will acquire a better understanding of the symbiotic relationships between organisms, and the impact of pathogenic agents in public health and social interactions. Biotechnology applications will incorporate learning pipetting techniques, steps and execution of PCR, and the cholera conundrum. This unit with various biotechnology and real-world approaches may attract students to become more interested in science related careers.

**Description of teaching unit and benchmarks**

- SC.912.N.1.1. Identify the different elements of scientific inquiry; evaluate the importance of biology in making informed decisions, and summarize the benefits and risks of the application of biotechnology.
- SC.912.L.14.3 Differentiate between prokaryotic and eukaryotic cells
- SC.912.L.18.10 Explain why fermentation and its products are important
- SC.912.L.16.5 Describe how prokaryotes can turn genes on and off.
- SC912.L.16.10 Outline the three-step PCR process.
- SC.912.L.17.6 Compare and contrast the relationships among organisms, including predation, parasitism, competition, commensalism, and mutualism.
- SC.912.L.17.2 Explain the general distribution of life in aquatic systems a function of chemistry, geography, light depth, salinity, and temperature.
- SC.912.L.14.6 Pathogenics Agents and public health

Expected outcomes/Learning Goals
- Students will…
- Compare and contrast prokaryotic and eukaryotic cells.
- Apply the elements of scientific inquiry, and evaluate the importance of biology in making informed decisions, and summarize the benefits and risks of the application of biotechnology.
- Identify methods used to identify pathogens, and describe the different pathogens and how they enter the body.
- Explain how viruses, bacteria, viroids, and prions can cause infectious diseases and their social implications.

Lessons, Activities and Laboratory Experiences

I would like all my biology students to read the book “Hot Zone” by Richard Preston throughout the first semester, so I will acquire copies through the reading or the ELL department resource person. Topical questions will guide students through critical thinking and language acquisition.

**Lesson 1**: In “How did you get that?” Students work in triads (Alkaline metal, nonmetal, metalloid) on chart paper (draw a line from top to bottom); activate prior knowledge on types of cells and features on one side. Compare prokaryotes to Eukaryotes on the other side. Giant Microbes activity. (bacteria, viruses, viroids, and prions). Create laminated cards using the information from Emerging Infectious Diseases by Jorge R. Rey (IFAS)

**Lesson 2**: “It is really blue?” Students will work in triads (nonmetals, transition metal, synthetic). Each group will receive a set of markers and a folder (assign a function to each group member (researcher, writer, and spoke person). Cut the article, “The Mystery of the blue death: A case study in Epidemiology and the history of science” into equal parts (2 groups for each part). “Experts on board,” Each group becomes an expert of their assigned section (HOT questions are included. Each group will utilize components of the scientific thinking process). Perform pipetting and designing plates.

**Lesson 3**: In “Enough already” Outbreak (Watch the 1995 movie). This movie is over two hours in length. Students will view 40 minutes of it in lesson 3 and view the remainder during lesson 4 and 5. Complete the movie viewing guide assignment—which will assist you with your writing prompt. Perform the first part cholera conundrum with google earth. Assign reading articles as homework.
Lesson 4: Outbreak continues. Spend 25 minutes view the movie. Team Kenya and Team Haiti should have equal positive cases—further testing tomorrow before the debate. Assign equal amount of students these articles to read as homework from lesson 3 (Kenyan Advocacy Firm and Haitian Advocacy Firm). 50% read the article about Haiti and 50% focus on Kenya. Divide the class into two groups with multiple triads (KAF vs. HAF). Teacher will disseminate a scenario involving Mr. William Yates who would like to donate $500 million towards research to eradicate cholera. Within each Firm, a triad (Economic Advocacy Triads, Social Advocacy triads, and Health Advocacy Triads) will present evidence on why their country should get the funding to eradicate cholera. Perform the second part of cholera conundrum. Complete group discussion questions

Lesson 5: Outbreak! Fingerprinting lab and write (lab report).

Lesson 6: (small amount of DNA from the bacteria cell). Perform Simulated PCR – PCR Dash lesson (borrow as a locker from CPET) from Viral Quest Curriculum on E-Learning resources (Labs and Curriculum)

Lesson 7: I would like to invite Dr. Thomas Alex Weppelmann and Dr. Richard Rheingans to skype with my students where they present key information about recent cholera cases from both countries. Students will finish the movie and complete their prompt (rubric). From the list of emergent infectious disease list, each student will select one to perform further research. They will write a research paper and present their findings to the class (guidelines and rubric)

Data collection techniques and/or student assessments
- Prior knowledge responses
- Written responses to prompts (lesson 2)-return with feedback
- Lab reports
- Discussion questions
- Written final prompt
- Research paper and presentation

If applicable, use of equipment lockers and/or UF visit (either in the classroom or UF campus)
- Giant microbes (Please see Dr. Jorge Rey list for more to include)
- Pipetting Stations Lockers (plates, tips and pipettes)
- Cholera Conundrum (experiment only I will create my own story)
- Simulated PCR – PCR Dash lesson (borrow as a locker from CPET) from Viral Quest Curriculum on E-Learning resources (Labs and Curriculum)

ICORE summer institute elements specifically included (UF connections)
- Giant microbes
- Pipetting Station Locker
- Cholera Conundrum
- Simulated PCR
- Dr. Reingans and Dr. Weppelmann Notes
Pedagogical Similarities/Differences

I normally introduce bacteria and viruses within the book chapter and briefly give students an overview of their shapes. Then, they would work on the key terms within that lesson with biohop (hopscotch) and write a story with the terms. Furthermore, they would perform a cinnamon lab to help them understand that some bacteria and viruses are infectious. I will still use the biohop because it kinesthetic learning is important as it gets the blood flow to the brain. Now this unit will be more relevant to students’ lives. They will be equipped with additional laboratory and critical thinking skills.

References


Website Resources

http://www.epi.ufl.edu

http://www.engvid.com


http://www.guardian.co.uk/world/2013/feb/21/un-haiti-cholera-victims-rejects-compensation

Budget and budget justification

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LESSON PLAN
SECONDARY BIOLOGICAL SCIENCE

LESSON TITLE: How Did You Get That?

Content Topic(s) Prokaryote and Viruses
Target Grade Level: 10
Specific Subject: Regular Biology (ELL)

OBJECTIVES
At the end of this lesson, my students will be able to…
1. Differentiate between prokaryotic and eukaryotic organisms.
2. Identify pathogenic and nonpathogenic organisms.
3. Compare/contrast bacteria and viruses.

MATERIALS
I have two biology classes (double the material list)
1. Chart paper
2. Sharpies
3. Giant Microbes (plushies)
4. Laminated Infectious Disease Card (Infectious Disease list by Dr. Jorge Rey)
5. Teacher prepared PowerPoint slides

PROCEDURE AND DISCUSSION QUESTIONS
1. Write the Words METALS, NONMETALS, AND METALLOIDS on the board
2. Divide students into triads (have students select which element they would like to be from the periodic table, and write them according to the aforementioned category) 2 minutes
3. Teacher: Activate prior knowledge. Tell students to record their answers in in their notebook. Then write these questions on the board. 15 minutes
   - What are cells?
- Name two main groups of cells
- How are the two cell types similar and different?
- Identify 3 cell structures and their functions
- What is a bacterium/virus
- How are bacteria and viruses similar or different?

4. Give each triad a chart paper with a box of sharpies (have student assistance pass them out) **3 minutes**

5. Tell each group to elect a “recorder” for their group. Direct the students to divide their chart paper into two columns; write the word prokaryote on one side, and eukaryote on the other side. **3 minutes**

6. Direct students to respond to these two questions. What is a prokaryotic cell? What is eukaryotic cell? Based on their answers, supplement or correct misconceptions. **5 minutes**

7. Then Give a short lecture about the information requested on the prior knowledge activity **10 minutes**

8. Direct students to use the chart paper again, now write the word same and different on it. **10 minutes**

9. Direct the students to cite key similarities and differences between the two groups of cells. Circulate around to assist students **10 minutes**
10. Request each student within each group to pair with a similar (periodic table group) Ex: metalloid-metalloid (pair share) what each their group wrote on their chart paper. 5 minutes

11. Direct students to post their chart papers on the board, and let them know we are transitioning to a new activity. 2 minutes

12. Teacher will distribute laminated cards of infectious diseases to students randomly but in equal amount of questions matching answers, then he/she will place the plushies on the lab bench. Direct students to match answers to questions on their cards. 15 minutes

13. Direct students to locate their plushies and noted whether they had a bacterial or a viral infection.

ASSESSMENT SUGGESTIONS  20 minutes

For objective 1: Oral discussions and written notes in construction notebooks, also asking each group to write short summary on similarities and differences between prokaryotic cells and eukaryotic cells (use as exit note to check understanding)

For objective 2: Oral discussion questions: Take 3 minutes, chair with another group member.
- What is a pathogen?
- Cite similarities and differences between bacteria and viruses?
- Do all pathogenic organisms cause diseases?
- Which of two type of infections is more difficult to cure and why?

Assign homework: From the list of bacteria and viruses activity. Choose one and report the answer to these questions for the next class period: What did you get? Is it pathogenic/or not? What disease does it cause? How do you get that? How can you advise others to protect themselves from it? Tell me one interesting thing you learned from the lesson.

RESOURCES/REFERENCES
CPET locker of Giant Microbes