

Adventures in Emerging Pathogens: Using biotechnology to prepare students for an EOC and beyond.

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Abstract

Biotechnology is a rapidly growing field that can provide researchers one way to identify and study the various pathogens that may emerge amongst the world's species. Students should feel comfortable with the use of basic lab equipment and understand basic science principles in order to keep up with the advances in both academia and public health. With the use of various classroom methods students will not only comprehend biology standards but become more aware of the idea of science being an important field that they may want to actively participate in whether as a possible career or as a better informed citizen.

Rationale

High school biology can be viewed as a "buffet line" of science in which students will receive a sample of information in a wide variety of subtopics. This includes chemistry, human anatomy, human impact on the planet, and ecology. Although this can be a challenge, it can also be a great way to find something that every student can relate to.

The constantly-changing field of biotechnology has provided scientists methods for new discoveries in pathogenic research which can advance medicine and lead to an overall healthier planet. The field is growing and has a wonderful array of career opportunities including entry-level jobs that many students may not be aware of.

My students are almost all sophomores (a handful of juniors) and are lower level on FCAT reading and math. For many of my students, science is not their best subject. The majority of their science education, they've been taught a cookie-cutter type of science where there is always a right or wrong answer. Some may have had science courses where labs or activities fail to engage their natural curiosity. Due to their bad experience with science, their confidence in succeeding in class is low. This will negatively affect their ability to ultimately pass their End of Course exam at the end of the school year. By combining fundamental science concepts with new research information, biotechnology based labs, relevant technology tools, and engaging topics, students should start to become comfortable with their scientific and critical thinking abilities. At the end of the year, the ultimate goal will be for the students to take their EOC with confidence and appreciate science in their daily lives.

Teaching Unit or Module(s) with Expected Outcomes

The majority of the modules/labs will be done toward the second half of the year in order to accommodate the pacing guide provided by Orange County. However, several topics discussed during

ICORE will be incorporated into the PowerPoints provided by the county to expose students to current research discoveries throughout the school year.

I plan on implementing the following strategies, modules, and topics:

- Edmodo
- *Pipetting by Design**
- Student made Pipet design Lab
- *ELISA simulation**
- *Menacing Microbes**
- Twitter
- Case Studies from the University of Buffalo

Lectures on the following:

- *Dengue**
- *E. Coli*
- *Cholera Lecture**

**denotes module or topic directly acquired from ICORE program.*

The expected outcomes from using these various modalities include, but are not limited to:

- Better understanding of biotechnology field
- Comprehension of lab techniques and lab protocol
- Improvement in critical thinking skills
- Mastery of the Sunshine State Standards for anatomy and physiology with a special focus on:
 - SC.912.N.1.1: Define a problem based on a specific body of knowledge, for example: biology, chemistry, physics, and earth/space science
 - MA.912.S.1.2: Determine appropriate and consistent standards of measurement for the data to be collected in a survey or experiment
 - MA.912.S.3.2: Collect, organize, and analyze data sets, determine the best format for the data and present visual summaries
 - SC.912.N.1.2: Describe and explain what characterizes science and its methods. (any biotech lab)
 - LA.910.2.2.3: The student will organize information to show understanding or relationships among facts, ideas, and events (e.g., representing key points within text through charting, mapping, paraphrasing, summarizing, comparing, contrasting, or outlining)
 - HE.912.C.1.3: Evaluate how environment and personal health are interrelated.
 - SC.912.L.14.6: Explain the significance of genetic factors, environmental factors, and pathogenic agents to health from the perspectives of both individual and public health.
 - HE.912.C.1.4: Analyze how heredity and family history can impact personal health.

- SC.912.L.16.10: Evaluate the impact of biotechnology on the individual, society and the environment, including medical and ethical issues.
- SC.912.L.14.52: Explain the basic functions of the human immune system, including specific and nonspecific immune response, vaccines, and antibiotics.
- SC.912.L.16.12 - DNA technology , PCR, etc.
- SC.912.L.16.1 - Mendel’s Laws
- SC.912.L.16.2 - Inheritance Patterns
- SC.912.L.17.20, 17.11, 17.16 - Human Impact on the Environment

Data Collection Techniques

County made tests are provided throughout the school year. The data will be collected and scanned using our school’s testing software, EduSoft. Since all students in all biology classes will be using the same test, I will be able to compare scores with other biology teachers and determine if the use of biotechnology and ICORE-related topics increase student scores.

Specific to my class, surveys will be taken to gauge the students’ awareness of science in their life and as a possible career choice. Short writing samples from case studies will be periodically checked to make note of any learning gains made throughout the year.

Equipment Lockers and UF visit

- Menacing Microbes
- Gel Electrophoresis – E-gel
- UF visit to Cypress Creek High School during preplanning to hold a department wide training on a biotechnology lab/module

ICORE Summer Institute Elements

ICORE has provided many wonderful ideas that can be implemented into the biology curriculum. The impact will be most seen with the use of the lectures provided by UF faculty. Below are the elements incorporated into my lessons and are divided by activity/lab or lecture topic.

Activities/Labs

- Pipetting by Design
- ELISA simulation
- Menacing Microbes
- Gel Electrophoresis – E-gel (to use with heredity – Who-done-it? Scenario)

Lecture Topic

- Dengue
- E. Coli
- Cholera

Difference in Teaching Style and New Pedagogies

Using the biotechnology offered by CPET-ICORE will allow an opportunity to provide students with the chance to use equipment normally not required or provided by the county. Instead of using a powerpoint to teach the biotechnology standard (SC.912.L.16.12), I will be able to do hands-on labs with the students.

The knowledge learned from the lectures during ICORE will be implemented throughout the school year by using the presentations provided as an addition to the presentations provided by Orange County.

Budget and Budget Justification

Item	Vendor	Cost/Unit	Amount	Total
E-Gel® 1.2% with SYBR Safe™, G5218-01	Invitrogen (invitrogen.com)	\$183.92	1	183.92
6" Code 10 Handheld UV Light	Blacklight.com	\$7.99	6	47.94
Invis-ID Medium Point Pen	Blacklight.com	\$5.99	2	11.98
AA Batteries	Blacklight.com	\$2.99	6	17.94
			TOTAL	\$261.78

This doesn't include taxes or miscellaneous materials throughout the year. The majority of the cost will be covered by CPET mini-grant. The extra cost will be covered by lab donations if possible.