The Impact of a Two Week Biotechnology Unit Focused on the Scientific Method on Biology Students’ Knowledge and Attitudes

Elizabeth Searl
Duncan U. Fletcher High School
700 Seagate Avenue
Neptune Beach, Florida 32233
burnette@duvalschools.org
Abstract: With the rise of technological advancement, it is important for teachers to stay informed on issues related to technology. As a result, there is a need to impart knowledge on biotechnological skills to students. This paper focuses on the impact of hands-on biotechnology techniques on high school students for the first time in ninth grade at Fletcher High School. It is the role of a school to impart knowledge and inform students about the technological advancements that are used in society and arm them with the right tools to be competent individuals. As a science teacher, the CPET program has definitely outlined a variety of techniques and lectures that will empower me as a teacher to impart knowledge and real world skills on motivating students to study science.

Rationale: Biotechnology is considered to be extremely important for both scientific and economic progress. Topics such as molecular biology of cancer, DNA fingerprinting, biotechnology in agriculture and medicine can be taught in the classroom. I will implement some of the biotechnology techniques in my honors biology class to determine which techniques assist students in understanding biological standards. Zeller(1994) discusses buzzwords such as gene cloning, recombinant DNA that should be included in all biology courses. Moreland(2006) discusses the increasing recognition of biotechnology and the potential to impact students. Barnett(2001) also discusses a model of pedagogical context knowledge. provide more detail. When using the scientific method, some of these biotechnology techniques will be implemented. Oftentimes students are disconnected because they do
not see the connection between theory and the real world. With the rise of new technological advancements, teachers are responsible for delivering and presenting standards mandated by the State of Florida.

**Action Research Intervention:** When I am teaching a two weeks unit on the scientific method, I first plan to interview my Biology Honors students through my own questionnaire as well as a Likert scale to formulate their attitudes toward science. I will use reading articles related to DNA and gel electrophoresis, Mission Biotech game simulation, the ELISA method as well as powerpoints from the CPET presentations to inform students about diabetes, wound healing, glycogen storage disease and PKU. I will also use the research of these articles from the University of Florida. The purpose of this study is to provide students with an opportunity to view real life applications between the scientific world and research. During the last week of September, I will implement some biotechnology applications to grasp student interest as well as provide a sound and firm knowledge and technological approach. I want to provide snapshots of a variety of techniques and topics specifically PKU, diabetes, microarray, and ELISA method so that students will understand how scientists really work. I will revisit some of these techniques again when I specifically work on genetics (DNA gel electrophoresis). The purpose of this study is to provide students with an opportunity to view real life applications between the scientific world and research.

**Connection to Bench to Bedside Summer Institute:** When I first came to the Bench to Bedside institute I was unaware of how many more technological instruments could be used in the classroom. I feel empowered to utilize some of these activities in the classroom so that students can see the connections between science standards and the real life applications. I will use the Mission Bio-tech Video Game and curriculum, the movie “Extraordinary Measures, the pipetting lab, the Elisa and the Microarray Lab.
**Data Collection and Analysis:** I plan to conduct pretests and posttests with my students. The pretest will include interviews and my own teacher made Likert scale. I will also have daily exit quizzes, student journals, lab quizzes, chapter quizzes, tests and projects for evaluation. I will also have a self reflection as a teacher including questions such as: What did I do today that was effective? What strategy was ineffective? What technique could have been completed with more competency? What would I do differently next time? I will also use charts and graphs to chart student progress. My students will write in their journals, complete a skills checklist for the pipetting lab, as well as short exit quizzes.

**Interview Questions:**

1. What do you do when a program that deals with a scientific issue is turned on after watching your favorite show?
2. What do you think a scientist does on a daily basis?
3. Do scientific interventions influence society?
4. How is science related to everyday life?
5. When you read a newspaper are you interested in scientific articles?
6. Are you interested in learning about the history of science?
7. What is your attitude about science?
8. How often have you done labs in your science classroom?

**Familiarity with Biotechnology**
How familiar are you with the concept of:

<table>
<thead>
<tr>
<th></th>
<th>Willing to explain concept</th>
<th>Familiar with concept</th>
<th>Not Familiar with concept</th>
</tr>
</thead>
<tbody>
<tr>
<td>DNA extraction</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Biotechnology</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ELISA method</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Glucose/Wound Healing/Glucocorticoid dynamics</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pipetting</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diabetes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Allergy Test</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Microarray</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Attitude Toward Biotechnology**

<table>
<thead>
<tr>
<th>Item</th>
<th>Statement</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Gene modification of plants, animals and humans is a good thing</td>
</tr>
<tr>
<td>2</td>
<td>Scientists should modify viruses and microbes</td>
</tr>
<tr>
<td>3</td>
<td>Modifying the genes of plants to create a more abundance of fruits and vegetables should be allowed</td>
</tr>
<tr>
<td>4</td>
<td>Adding genes to plants to increase the taste or nutritional value is important</td>
</tr>
<tr>
<td>5</td>
<td>Altering the genes of tomatoes so they are more insect resistant to diseases is a good use of biotechnology</td>
</tr>
<tr>
<td>6</td>
<td>Using microorganisms to decompose human sewage is a good thing</td>
</tr>
<tr>
<td>7</td>
<td>Altering fruits and vegetables to improve the taste is a good thing</td>
</tr>
<tr>
<td>8</td>
<td>The teacher should discuss bioethical issues such as prenatal testing</td>
</tr>
</tbody>
</table>
Literature Cited

Aikenhead, G.S.” Renegotiating the culture of school science”


**Budget and Budget Justification:** I will check out the equipment locker for the microarray lab, the ELISA packet, I will use Biorad as my vendor and purchase the ELISA ImmunoExplorer Kit f#166-2400 EDU or 155.00, the Fisherbrand Clear Polystyrene well plates #12-565-500 For 140.22. I am over budget but my students deserve this experience.

**Permission:** I will talk with my principal about my implementation of my action research project and I will send a letter out to my parents informing them about my action research proposal.
Lesson Plan Template Sample

*Theme: Biotechnology*

<table>
<thead>
<tr>
<th>Lesson Title</th>
<th>Using Biotechnology in Scientific Thinking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade Span</td>
<td>9-12</td>
</tr>
<tr>
<td>Content Emphasis</td>
<td>Science</td>
</tr>
<tr>
<td>Targeted Benchmark(s)</td>
<td>The Practice of Science SC.912.N.1.6 Describe how scientific inferences are drawn from scientific observations and provide examples from the content being studied</td>
</tr>
<tr>
<td>Author(s)</td>
<td>Elizabeth Searl</td>
</tr>
<tr>
<td>School</td>
<td>Fletcher Senior High School</td>
</tr>
<tr>
<td>District</td>
<td>Duval</td>
</tr>
<tr>
<td>Email address</td>
<td><a href="mailto:burnette@duvalschools.org">burnette@duvalschools.org</a></td>
</tr>
<tr>
<td>Phone number</td>
<td>904-508-5263</td>
</tr>
</tbody>
</table>

**Lesson Preparation**

**Learning goals:** What will students be able to do as the result of this lesson?

As a result of this lesson the students will become familiar with some biotechnology techniques such as the ELISA technique, DNA virus microarrays and the importance biotechnology plays on the potential to aiding in determining the causes of diseases. The students will also practice micropipetting techniques.

**Estimated time:** This lesson will take approximately two weeks A/B days for 90 minutes
Materials/Resources:
“Extraordinary Measures” DVD
PowerPoint on Diabetes from Summer 2011 Lectures
- Clip on Barry Byrne- Pompe Disease
- PowerPoint on Glycogen Storage Disease from Summer 2011 Lectures
- Mission Bio-tech video game simulation
- The Healing Power Within Reading Article
- Pipetting activities
- Prevalence of Self-Reported Diabetes and Exposure to Organochlorine Pesticide article

Teacher Preparation: What do you need to do to prepare for this lesson?
I will practice my ELISA and microarray techniques. I will also review the materials of Bench to Bedside PowerPoints. I will also review the Mission Bio-tech game on biotechnology.

Lesson Procedure and Evaluation
Introduction: Describe how you will make connections to prior knowledge and experiences and how you will uncover misconceptions.
I will show clips on various biotechnology videos acquired from the 2011 Summer Institute as to the impact biotechnology has on life so that students can relate to this topic. I will also ask questions about biotechnology. I will utilize reading articles on diabetes as well as parts of animals that can be used to regenerate muscle tissue to grasp the students attention. I will activate prior knowledge of students by asking them about hypoglycemia, hyperglycemia and probe any other questions about friends who inject themselves with insulin
**Exploration:** Describe in detail the activity or investigation the students will be engaged in and how you will facilitate the inquiry process to lead to student-developed conclusions. I will present the ELISA technique, microarray lab to the students, as well as the GATOR pipetting lab.

---

**Application:** Describe how students will be able to apply what they have learned to other situations.

I will use some of the techniques from these labs as experience on DNA electrophoresis by purchasing science take out kits.

---

**Assessment:** Describe how student knowledge is being assessed at the appropriate cognitive level for the targeted benchmarks.

The students will be given a sheet with instructions on pipetting various volumes.

I will make my own teacher generated questions throughout the lesson as exit quizzes. For example: Define the following terms: antibody, antigen, immunology..

1. What is the purpose of the ELISA technique?
2. What does the term ELISA represent? Etc........
**Teacher Self-Reflection:** Record your thoughts on the lesson and describe any modifications you would recommend based on the outcomes.

I will do this daily in my teacher journal.
Using Biotechnology to Motivate High School Students to Study Science

Elizabeth Searl, Biology/Biology Honors Teacher
Duncan U. Fletcher High School
700 Seagate Avenue
Neptune Beach, Florida 32233
burnette@duvalschools.org
Abstract: With the rise of technological advancement, it is important for teachers to stay informed on issues related to technology. As a result, there is a need to impart knowledge on biotechnological skills to students. It is the role of a school to impart knowledge and inform students about the technological advancements that are used in society and arm them with the right tools to be competent individuals. As a science teacher, the CPET program has definitely outlined a variety of techniques and lectures that will empower me as a teacher to impart knowledge and real world skills on motivating students to study science. Selected students at Duncan U. Fletcher High School were presented with a variety of biotechnology techniques to determine if these techniques motivated them to study science rather than another subject area. Questionnaires were developed for the students and a few biotechnology techniques and articles were introduced to the students. 80% of the students had an incredible change of attitude about science and technology. As a result of this short program, they are eager to learn more about science and aspire to view careers in the science field.

Rationale: With the rise of technology, I implemented some of the biotechnology techniques in my Honors Biology class to determine with these techniques assist students in understanding biological standards. Zeller(1994) discusses buzzwords such as gene cloning, recombinant DA that should be included in all biology courses. Cox (2007) presents an interesting article about self-reported diabetes and exposure to organochlorine pesticides among Mexican Americans. Barnett(2001) also discusses a model of pedagogical context knowledge. When using the scientific method, some of these biotechnology techniques will be implemented. I used reading articles related to DNA and gel electrophoresis, game simulation which we encountered great difficulty, the ELISA method as well as powerpoints to inform students about diabetes, wound healing, and a stem cells lab. This study provided
students with an opportunity to view real life applications between the scientific world and research. Oftentimes students are disconnected because they do not see the connection between theory and the real world. With the rise of new technological advancements, teachers are responsible for delivering and presenting standards mandated by the State of Florida. During the school year, I implemented some biotechnology applications to graph student interest as well as provide a sound and firm knowledge and technological approach.

**Action Research Intervention:** When I taught a two weeks unit on the scientific method, I interviewed my Biology Honors students using a questionnaire from the University of Florida to formulate their attitudes toward science. Using my state curriculum guide, I embedded biotechnology into the unit on the characteristics of life. I gave the students a questionnaire on their interest in biotechnology, learning, and ideas about science. I collected questionnaires and implemented various biotechnology techniques in the classroom when we worked on the scientific method. Although I made various attempts the Mission Biotech program did not work on the computer at Duval Schools. We read an article on rBGH and rBST from the website [www.sustainabletable.org](http://www.sustainabletable.org) to give students a reading assignment with questions about the controversy surrounding whether or not rBGH is safe for cows and humans. We also read *The Healing Power Within* which discusses how extracellular matrix allow for tissue regeneration. Next we completed an ELISA procedure activity from the University of Florida equipment locker. This activity truly sparked the student’s interest. They were very excited about this lab. For preparation, the students practiced micropipetting techniques from a lab activity generated from the University of Florida where they made a gator as well as UF. The students also completed a Diagnosing Diabetes Science Take Out kit on diabetes. I also utilized powerpoints, google scholar articles, video games and a variety of biotechnology techniques utilized during the Bench to Bedside institute. I provided snapshots of a variety of techniques and topics specifically, diabetes, microarray, and ELISA method so that students will understand how scientists really work. I will revisit some of these techniques again when I specifically work on genetics (DNA gel electrophoresis),
Connection to Bench to Bedside Summer Institute: When I first came to the Bench to Bedside institute I was unaware of how many more technological instruments could be used in the classroom. I used the movie Extraordinary Measures which I saw at the University of Florida this summer in addition to the ELISA Procedure, as well as Science to Go Kit on Diabetes. I also used the powerpoints by the various lecturers. I feel empowered to utilize some of these activities in the classroom so that students can see the connections between science standards and the real life applications.

Data Collection and Analysis: I conducted pretest and post test with my students. The pretest included interviews as well as a questionnaire from the University of Florida and my own teacher made questions. I also used exit quizzes, student journals, lab quizzes, chapter quizzes, tests and projects for evaluation.

Interview Questions: 
Prepared by Teacher, Elizabeth Searl
Q1. What do you do when a program that deals with a scientific issue is turned on after watching your favorite show?
Q2. What do you think a scientist does on a daily basis?
Q3. Do scientific interventions influence society?
Q4. How is science related to everyday life?
Q5. When you read a newspaper are you interested in scientific articles?
Q6. Are you interested in learning about the history of science?
Q7. What is your attitude about science?
Q8. How often have you done labs in your science classroom?

Of 100 students surveyed,
Q1. 75% stated that they change the channel when a program about a scientific issue is shown.
Q2. 90% of the students surveyed stated that scientists worked in a lab all day long and 10% believe that they work out on the field.
Q3. 80% of the students believe science does not influence society. 20% believe that science influence society.
Q4. Students stated that they use science everyday from using toothpaste which they stated was a chemical reaction, to chemical reactions in foods, to scientific experiments in the classroom.
Q5. 100% of the students surveyed stated that they are not interested in reading newspaper articles on science.
Q6. 100% of the students stated that they are not interested in the history of science.
Q7. 50% stated that they have a positive attitude towards science and 50% stated that they have a negative attitude towards science.
Q8. 80% of the students stated that they have completed science labs in middle school while 20% stated that they have not completed any science labs in middle school.

How familiar are you with the concept of:

<table>
<thead>
<tr>
<th></th>
<th>Willing to explain concept</th>
<th>Familiar with concept</th>
<th>Not Familiar with concept</th>
</tr>
</thead>
<tbody>
<tr>
<td>DNA extraction</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Biotechnology</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ELISA method</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Glucose/Wound Healing/Glucocorticoid dynamics</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pipetting</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diabetes</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Of 100 students surveyed 100% stated that they were not familiar with any of the concepts. 0% were willing to explain the concept and 0% were willing to explain any of the concept.
Prepared by Teacher, Elizabeth Searl
Pre Test
Q1. Have you heard about the use of genetically altered microbes?
40% Yes 60% No
Q2. Would you take a drug made from an animal?
37% agree 40% disagree 23% DK
Q3. What do you understand about the term genetically modified foods?
67% answered correctly while 33% answered incorrectly
Q4. If you had a need for regenerative tissue, would you use a new biotechnology technique?
3% agree 7% disagree 90% DK
Q5. Do you think a thumb can be regenerated?
30% agree 24% disagree 46% DK
Q6. Do you think that people can use animal parts for a cure?
34% agree 20% disagree 46% DK
Q7. Do you read scientific magazines?
31% agree 40% disagree 29% DK
Q8. Do you drink milk that is hormone free?
95% said no and 5% said yes
Q9. What is cloning?
90% of the students answered this question correctly and 10% did not answer the question correctly
Q10. Do you eat only organic foods?
2% answered yes and 98% answered no

I utilized this survey I acquired from the University of Florida when I attempted to use the Mission Biotech Program.

Section 1: Ideas About Learning
Q1. I enjoy learning science
50% SD 20% D 10% A 20% SA
Q2. School science has improved my decision-making
10% SD 30% D 5% A 55% SA
Q3. I enjoy using technology to solve science problems.
50% SD 50% SA
Q4. I plan to take more science classes in school.
60% SD 10% D 5% A 25% SA
Q5. Technology helps me learn science.
Q6. More time in school should be devoted to science.
10% SD  10% D  10% A  70% SA
Q7. Computers make learning science more interesting.
5% SD  2% D  13% A  80% SA
8. Learning science is interesting.
0% SD  0% D  46% A  54% SA
9. I enjoy using technology to learn science.
100% SA
10. More time in science classes should involve the use of technology.
100% SA

Section II Ideas about careers.
11. I would be more likely to take a job if I knew it involved working with technology.
10% SD  20% D  33% A  37% SA
12. Working in technology would be interesting.
37% SD  30% D  24% A  9% SA
13. I would like to become a scientist.
50% SD  10% D  20% A  20% SA
14. I would like to get a job in technology.
67% SD  23% D  4% A  6% SA
15. I would like to work in a field related to biotechnology.
56% SD  10% D  20% A  14% SA
16. I would like to work with people who make discoveries in biotechnology.
90% SD  2% D  3% A  5% SA
17. I would enjoy a job in biotechnology.
44% SD  7% D  2% A  47% SA
18. I will probably choose a job that involves using technology.
67% SD  23% D  5% A  5% SA
19. I would enjoy working in a biotechnology laboratory.
90% SD  2% D  3% A  5% SA
20. I would like to work in a science laboratory.
59% SD  6% D  12% A  23% SA

Section III: Ideas about biotechnology
21. Biotechnology helps create solutions to the world’s problems.
23% SD  24% D  33% A  20% SA
22. Biotechnology is important for a country’s development.
23. Biotechnology discoveries improve our ability to treat diseases.
24. Biotechnology is important in modern life.
25. Biotechnology is useful for the problems of everyday life

The students wrote an essay about the movie *Extraordinary Measures*. Then they answered the following questions:

1. Why was the movie titled *Extraordinary Measures*?
2. What is the disease in this movie?
3. What information do we know about Pompe Disease?
4. After viewing this movie, do you see the significance of becoming a researcher?
5. After viewing this movie, are you more interested in becoming a scientist? Why or Why not?

We also completed an ELISA lab. The students were not graded on this assignment. In this experiment, the students tested for the following allergens: Pollens: Oak Pollen, Timothy Grass, Ragweed, Mold Spores, Foods: Nuts, Seafood, as well as House Dust Mite and Cat Dander.

After the activities on biotechnology, the students’ attitudes changed completely.

**Post Test survey**

Q1. Have you heard about the use of genetically altered microbes?
60% Yes 40% No

Q2. Would you take a drug made from an animal?
67% agree 30% disagree 3% DK

Q3. What do you understand about the term genetically modified foods?
80% answered correctly while 20% answered incorrectly

Q4. If you had a need for regenerative tissue, would you use a new biotechnology technique?
90% agree 7% disagree 3% DK
Q5. Do you think a thumb can be regenerated?
97% agree 3% disagree 0% DK
Q6. Do you think that people can use animal parts for a cure?
100% agree 0% disagree 0% DK
Q7. Do you read scientific magazines?
78% agree 22% disagree 0% DK
Q8. Do you drink milk that is hormone free?
50% said no and 50% said yes
Q9. What is cloning?
90% of the students answered this question correctly and 10% did not answer the question correctly
Q10. Do you eat only organic foods?
87% answered yes and 13% answered no

I utilized this survey I acquired from the University of Florida when I attempted to use the Mission Biotech Program.

Section 1: Ideas About Learning
Q1. I enjoy learning science
80% SD 10% D 10% A 0% SA
Q2. School science has improved my decision-making
0% SD 5% D 25% A 70% SA
Q3. I enjoy using technology to solve science problems.
10% SD 90% SA
Q4. I plan to take more science classes in school.
0% SD 6% D 22% A 72% SA
Q5. Technology helps me learn science.
10% SD 90% SA
Q6. More time in school should be devoted to science.
0% SD 0% D 10% A 90% SA
Q7. Computers make learning science more interesting.
0% SD 0% D 0% A 100% SA
Q8. Learning science is interesting.
0% SD 5% D 5% A 90% SA
Q9. I enjoy using technology to learn science.
100% SA
Q10. More time in science classes should involve the use of technology.
100% SA

Section II Ideas about careers.
11. I would be more likely to take a job if I knew it involved working with technology.
0% SD 5% D 15% A 80% SA
12. Working in technology would be interesting.
0% SD 5% D 5% A 90% SA
13. I would like to become a scientist.
0% SD 5% D 10% A 85% SA
14. I would like to get a job in technology.
0% SD 5% D 5% A 90% SA
15. I would like to work in a field related to biotechnology.
8% SD 10% D 10% A 72% SA
16. I would like to work with people who make discoveries in biotechnology.
5% SD 2% D 13% A 80% SA
17. I would enjoy a job in biotechnology.
0% SD 5% D 3% A 92% SA
18. I will probably choose a job that involves using technology.
3% SD 10% D 15% A 72% SA
19. I would enjoy working in a biotechnology laboratory.
0% SD 0% D 17% A 83% SA
20. I would like to work in a science laboratory.
0% SD 0% D 3% A 97% SA

Section III: Ideas about biotechnology
21. Biotechnology helps create solutions to the world’s problems.
6% SD 10% D 10% A 74% SA
22. Biotechnology is important for a country’s development.
2% SD 10% D 7% A 81% SA
23. Biotechnology discoveries improve our ability to treat diseases.
3% SD 10% D 20% A 67% SA
24. Biotechnology is important in modern life.
0% SD 0% D 2% A 98% SA
25. Biotechnology is useful for the problems of everyday life.
9% 5% D 5% A 71% SA

The students wrote an essay about the movie Extraordinary Measures. Then
they answered the following questions:
1. Why was the movie titled Extraordinary Measures?
2. What is the name of the disease in this movie? What are the symptoms?
3. What information do we know about Pompe Disease?
4. After viewing this movie, do you see the significance of becoming a researcher?
5. After viewing this movie, are you more interested in becoming a scientist? Why or Why not?

We also completed an ELISA lab. The students were not graded on this assignment. In this experiment, the students tested for the following allergens: Pollens: Oak Pollen, Timothy Grass, Ragweed, Mold Spores, Foods: Nuts, Seafood, as well as House Dust Mite and Cat Dander.

After the activities on biotechnology, the students’ attitudes changed completely.

Post Test survey indicated that the students are extremely interested in Biotechnology. They were extremely pleased with all of the activities we performed in the classroom. Based on the survey, a significant amount of students changed their attitude from not being interested in science to becoming interested in science as a result of the biotechnology activities.
Questions from the article on rBGH and rBST

1. Define somatropin?
2. What is the purpose of bovine somatropin?
3. What does BST represent?
4. Why is rBGH used in cows?
5. When did the U.S. Food and Drug Administration approve rBGH?
6. Which countries have banned the use of rBGH? Why?
7. What report in 1991 caused concern?
8. How do dairy industries prevent and treat mastitis outbreaks?
9. How is the use of antibiotics negatively impacting the dairy industry?
10. How have rBGH injections cause severe mastitis?
11. How are cows who produce unnaturally high quantities of milk become malnourished?
Lesson Plan

School: Fletcher High School

Course: Biology/Biology(Honors) Unit: Characteristics of Life

Days/Date: September 12, 2011 – September 23, 2011

Instructor: Elizabeth Searl

Standard(s): SC.912.N.1.6 Describe how scientific inferences are drawn from scientific observations and provide examples from the content being studied.

Outcome: Students should be able to distinguish between observations and inferences, observe and classify objects as living or nonliving based on the characteristics of life.

Guiding Question: What inferences can we make about living things from our observations?

Enduring Understanding: Observations lead to inferences; inferences can be tested. All biological life is interconnected and dependent.

Continuous Improvement Focus: Reading and Writing Skills using a student journal. Students will be prompted when to write in their journals.

Materials: hand lens, sanitizer, beans, plant, nonliving items, fish, brine shrimp, Diabetes Kit, PowerPoint on Diabetes, ELISA kit for the University of Florida, Reading article on rBGH and rBST, Reading article on The Healing Power Within, Micropipettes and food coloring

New Vocabulary: observation, biosphere, inference
<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
<th>Teacher notes</th>
</tr>
</thead>
</table>
| Entering the class  | Anticipation Guide 1-3  
  What is Biotechnology? How does biotechnology influence our world? Is technology an important aspect of science? How do we use biotechnology in everyday life?  
  Survey on Attitudes about Science and Technology/Biotechnology | Don’t forget lab supplies and hand sanitizer |
| Focused Lesson      | Characteristics of Life/Observations and Inferences  
  What is biotechnology? What is the significance of biotechnology in the world today? What is diabetes? What is Pompe Disease? | Standard: S.C.912.N.1.6 |
| Workshop            | Mini-Lesson: PowerPoint on Characteristics of Life: Students will fill in the blanks  
  PowerPoint on Diabetes and Wound Healing from the University of Florida  
  Video on Tissue Regeneration of a Finger  
  Modeling/Guided Practice: Reading from text on Characteristics of Living Things  
  Reading of article on rBGH and rBST  
  Reading article on The Healing Power Within  
  Teacher: Show students video It’s Alive Part 1; It’s Alive Part 2 from Prentice Hall Website  
  Complete all checkpoints on the website | Extensions/Re-teach/Enrichment  
  Use of Prentice Hall website  
  Differentiation: Allow students to write in their journals about their opinions about Tissue regeneration  
  Blooms/Webbs Reference: |
| Independent Practice: Section 3-1; Worksheet 1-2 | Knowledge-list
Comprehension-Classify objects as living or nonliving |
|---------------------------------------------------|----------------------------------------------------------|
| Students: Students will observe and classify objects as living or nonliving based on the characteristics of life | Evaluation/Assessment:
Daily exit quiz |
| Engage: Anticipation Guide 1-3 | Reflections:
Allow students to work in groups of two rather than 4 |
| Explore: Quick Lab pg. 19 Diagnosing Diabetes Science Take-Out Kit | |
| Explain: Characteristics of Life PowerPoint | |
| What is Ecology PowerPoint | |
| Extend: Energy Pyramid Activity | |
| Evaluate: Short quiz on Thursday/Friday | |
| Section 3-1 and Section 1-3 worksheet | |
| Closing/ Wrap-up | Homework:
Section 1-3 Worksheet and Section 3-1 |
| Review of Vocabulary words; review of characteristics of life | |
| Students will answer questions from the Science Take Out Kit on Diagnosing Diabetes including the graph. | |
| Students are required to write in their journals about glucose levels in blood plasma samples | |

Cross-Curricular Connection: Writing in Science  Write about your thoughts on rBGH and rBST. Do you have a difference in opinion about eating organic foods and drinks?
Content Specific Techniques Learning Strategies (Including ESOL)

___Vocabulary Strategy: A-Z word sheet; word mapping ___XCornell Notes/ Two Column Notes

___Reading/Reading Strategy (KWL) ___Skilled Questioning, Socratic Seminars, Quick-

_X__Writing Daily/Lab Reports/Word Problems write/Discussion

___Free Response Writing ___SQ5R, KWL, Think Ahead

___Modeling ___Cooperative/Collaborative Learning: peer-tutoring

_X__Other (Anticipation Guides) small group work

__Modified Curriculum: Personalize Lesson

ESE Accommodations: ___ Language Experience Approach: draw examples

___Instructional Methods and materials: implements from the experience of the student

changes to teaching methods _X_Essential vocabulary: identify and teach essential

___Assignments and assessments: changes the way students vocabulary

practice and demonstrate learning in assignments like ___Oral Strategies: speak slowly with facial

projects, worksheets, homework and class tests expressions and gestures to add meaning

__Time demands & scheduling: assists students who need to work ___Visual Advance Organizers: use visual aids

at a different pace ___Whole language: simplify grammatical structure

___Learning Environment: maintains a barrier-free classroom and paraphrase, summarize sections and

_X__Use of special communications system: encourages students highlight or underline key words

to express themselves and understand others to participate ___Word
Pronunciation & Meaning: model key

fully in the classroom or difficult words in lesson

___Study habits Reinforced: teach study skills and
use of textbooks, skimming and scanning techniques

___Interventions: Allow groups of two to ensure hands-on experience

__X_Monitoring Student Progress: Use formal and
informal type of evaluation. Ask students to
perform simple tasks and observe their understanding

__X_Use manipulative materials, hands-on activities,
Problem-solving, learning centers, and multi-
media materials to support content (Quick Lab)
Literature Cited


**Budget and Budget Justification:**

Science to Go Kits on Diagnosing Diabetes from U.F. $0.00
2 Micropipettes from Fischer $240.00
ELISA Kit from University of Florida $0.00
Yogurt $10.00
Additional micropipettes borrowed from Ponte $0.00

Vedra High School

**Permission:** I spoke with my principal about my implementation of my action research project. I shared the information with the other teachers in my department. I also went to see my district science supervisor to talk with her about starting a program at Fletcher High School. I sent a letter out to my parents informing them about my action research proposal. My principal was really impressed with my biotechnology work so I was able to go to another DNA Workshop in Gainesville.

**Learning from you Action Research:** My students were extremely well behaved when I worked on the biotechnology activity in the classroom. I enjoyed using the micropipettes because it gave me an opportunity to practice too. I wrote a grant to get a greater push on implementing biotechnology at Fletcher High but I was not awarded the grant. Students love new activities and were extremely thrilled to do all of the activities. I learned that it is my role as a teacher to continually spark interest in students so they can look in the future at new possibilities in science. I wish I had the opportunity to revisit some of the labs when I worked on DNA but time did not permit since this is the first time the students are administered the Biology EOC.

**Dissemination:**

I spoke with members of my administration as well as teachers in the classroom. I tried to get a new course going at Fletcher High School on biotechnology. When we met in collaborative sessions on early release days, I shared it with the teachers about my implementation in the classroom. I am interested in doing more at a conference but if I don’t have grant money I can’t move forward and I was turned down when I applied for a recent grant.
Below is my grant application:

Elizabeth Searl  
Duncan U. Fletcher High School

2011 Excellence in Biotechnology Education Awards Application

A Meeting with Biotechnology

Proposal Summary

I believe students lack insight into a variety of careers in science. As a science teacher this summer had been my first experience learning about biotechnology. I would like to give students an opportunity to learn new techniques simply because there is new technology available and students should be given an opportunity to connect with these concepts. I do not believe that students are exposed to biotechnology at Fletcher High School in Duval County. I would like to implement an afternoon or weekend program on biotechnology. I would like students to learn about micropipetteing techniques, ELISA method, DNA extraction from plant tissue, viral immunoassay as well as DNA electrophoresis. I would also like students to view powerpoints on genetic diseases affecting the current populations and the significance of how biotechnology impacts their lives. I would also have a variety of field trips to view the local health clinics such as the Mayo clinic and the University of Florida. By purchasing micropipettes, ELISA Kits, viral microarray kits, as well as DNA kits, the students will learn about biotechnology techniques. I would send out a community flyer in the community to students interested in a biotechnology program. Once I have received the registration forms I will meet after school or on Saturdays to instruct the students on the various biotechnology
techniques. I will administer a number of quizzes and lab technique quizzes to the students.

**Instructional Objectives**
I would like students to have an understanding of biotechnology techniques such as ELISA, DNA extraction from plant tissue and viral microarray techniques. I would like students to learn about viruses affecting plants so my focus will also be on viral microarray techniques. I think that the population should grow plants organically so I would love students to learn about viruses that may affect their plants. This project will definitely interest students.

**Project Description**
This project is important because students should have an opportunity to practice these biotechnology techniques. They are the future leaders of tomorrow and they should be equipped with the best knowledge and hands on experience necessary to learn and build upon the present biotechnology techniques. They will learn about micropipetting, the ELISA method, viral microarray, and extraction of DNA from plant tissue. The students will not only learn about biotechnology techniques but will also identify crops with viral diseases and grow organic vegetable plants that are locally infected in Jacksonville. I believe exposing students to growing organic molecules is also important. All the students exposed to this project will soon become adults who will have a deeper understanding about organic foods as well as how to grow organic foods. I believe I could impact the entire community learning about biotechnology since there is no program presently at Fletcher High School.

**Evaluation Criteria**
I will give students a variety of teacher generated quizzes based on questions about the ELISA method, viral microarray, and the extraction of DNA from plant tissue. They will also grow organic vegetables as part of this project. I will give a pre biotechnology survey and a post
biotechnology survey. I will also give students a pre biotechnology content survey as well as a post biotechnology content survey based on the various methods used in the program.

**Implementation Plan**

I would like this project to take place for a period of two to three months. I will conduct labs on the ELISA method, viral microarray, an extraction of DNA from plant tissue for two months. I will also have then plant various local Floridian plants organically so that they can do DNA plant tissue extraction. I will present various powerpoints to the students.
## Budget

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Item</th>
<th>Cost (per kit)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>Real Time PCR Lab Activity</td>
<td>139.00</td>
<td>695</td>
</tr>
<tr>
<td>5</td>
<td>Bio Rad Elisa Kit</td>
<td>124.00</td>
<td>620</td>
</tr>
<tr>
<td>5</td>
<td>BioRad pGLO</td>
<td>89.00</td>
<td>445</td>
</tr>
<tr>
<td>5</td>
<td>Plant Tissue Culture Kit using Soybeans</td>
<td>110.00</td>
<td>550</td>
</tr>
<tr>
<td>5</td>
<td>WARDS Micropipette 0.5-10microliters</td>
<td>140</td>
<td>700</td>
</tr>
<tr>
<td>5</td>
<td>WARDS Micropipette 2-20 microliters</td>
<td>140</td>
<td>700</td>
</tr>
<tr>
<td>5</td>
<td>WARDS Micropipette 20-200 microliters</td>
<td>140</td>
<td>700</td>
</tr>
<tr>
<td>5</td>
<td>WARDS Micropipette 100-1000microliters</td>
<td>140</td>
<td>700</td>
</tr>
<tr>
<td>5</td>
<td>Agarose Gel</td>
<td>56.75</td>
<td>283.75</td>
</tr>
<tr>
<td>Item</td>
<td>Quantity</td>
<td>Price 1</td>
<td>Price 2</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>----------</td>
<td>---------</td>
<td>---------</td>
</tr>
<tr>
<td>Electrophoresis Kit</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 Agarose Dye Markers</td>
<td>1</td>
<td>12.50</td>
<td>25.00</td>
</tr>
<tr>
<td>1 Electrophoresis Power Supply</td>
<td></td>
<td>202</td>
<td>202.00</td>
</tr>
</tbody>
</table>

**Total Cost: $5620.75**

These items will allow me to perform the various labs on biotechnology. The students will be able to perform these labs using high tech equipments making them more ready to participate in other biotechnology classes or programs. I will seek additional help from the community for the $620.00

**Professional Profile**

My name is Elizabeth Searl and I have been a Biology/Biology Honors teacher for 21 years. I enjoy teaching Biology. This summer I attended a two week Biotechnology Workshop at the University of Florida and it has opened my eyes to a different perspective in science. I am also a 2000 Presidential Awardee recipient in Science. I believe that through my experience this summer at the University of Florida I will be equipped with the experience to provide this program to high school students.