Abstract

The purpose of this study is to determine the effects of a two week unit focused on students’ ability to retain information and change their attitudes about learning when using selected bioscience activities in a high school classroom. I will use labs, lesson plans, and ideas from the Bench to Bedside Workshop from June of 2010.

Rationale

Schools are currently focused on school grades where most curriculums are based on improving FCAT scores and preparing students for end of course exams. Much of this is done by workbooks and simple constant repetition. This study will share the findings of how using hands-on biotechnology in the classroom increases students performance. I will use my Anatomy and Physiology classes to do the study.

I start my school year in Anatomy and Physiology teaching Introduction to the Human Body which teaches terminology. Over the years I have developed many hands-on activities for this unit which they enjoy and that help students retain the information throughout the year. I then move to the chemistry and cells unit. My students have had Biology and this should be a review but I find that they either never totally understood the information or have quickly forgotten it. I plan on using the information and hands-on labs that I learned at the Bench to Bedside workshop to teach this second unit and increase student understanding and retention. I learn by touching and doing and feel this is how most students learn. Students have heard about DNA and RNA but have no idea how important it is to overall health. I plan on using the pippetting lab to introduce my students to proper lab techniques. I plan on using the strawberry DNA extraction lab from Mission Biotech to show them DNA. I then plan on using the restriction digestion lab using the lab equipment from CPET at UF to show them about how DNA and RNA are being used to study genetic diseases. I plan on using the Mission Biotech video game to reinforce the concepts. I will continue to reinforce the concepts throughout the year using the BLAST website to teach information about diseases for each system throughout the year. My hope is that these hands-on labs will increase student grades, retention of material, and attitudes towards science.

Research shows that Biotechnology, definitely one of the most interesting and exciting topics for science classes, can be studied in sophomore biology as well as junior and senior level classes. Through classroom implementations, students gain a depth of understanding, giving them the ability to interpret recently published articles. Today’s students are attuned to contemporary research and seem anxious to understand what they read or witness on a news broadcast. The study of biotechnology can easily be inserted into the curriculum after the completion of a molecular genetics unit which included the structure of nucleic acids, replication, transcription and translation. (Paolella)
Bundy- Teaching Biotechnology in the Classroom

Research states that biotechnology can be translated as "life technology." It involves manipulating and using living organisms, especially at the molecular level, to benefit society in different ways. DNA fingerprinting, paternity testing, and diagnostic tests are some of the most well known practical applications of biotechnology. While biotechnology is increasingly in the news giving us continuing discoveries and breakthroughs awareness of the overall significance of this relatively new branch of science remains limited. This is especially true of students taking science courses at the high school level. A project to see the effects of teaching biotechnology was designed at Centennial Regional High School in Montreal Canada. The project brought hands-on labs to the students as well as pairing them with professor in their area. Students said the labs were challenging and gave them a feeling of what type of research is actually being conducted in the real world. The project went beyond current methods of teaching high school science and served to generate student interest in modern science and technology. (Ahmed)

In doing research one article gave reasons why biotechnology was beneficial to the high school classroom but went on to explain why it was not being used often. Benefits for teaching biotechnology were some of the same reasons that were expressed in Bench to Beside such as longer retention of material, students being more excited about learning, and they will be more prepared for real world science. The article explained that some of the reasons that biotechnology was not being taught were that teachers lacked the knowledge about biotechnology and that schools could not afford the equipment needed to teach biotechnology. The article went on to say that academic standards are raising and that biotechnology was going to have to be included in the curriculum and that states need to begin training teachers and getting equipment need to move forward in technology. (Zeller)

I learned through my research that biotechnology increases students learning, prepares them for college classes they may take, and shows them different carriers that are available for them after graduation. I learned that some of the things that need to change to be able to teach biotechnology are training for teachers and money for supplies in the classroom. Therefore the purpose of my classroom study is to determine the effect of a two week unit focused on students' ability to retain information and change their attitudes about learning when using selected bioscience activities in a high school classroom. I will be using equipment and knowledge from the Bench to Bedside workshop.

**Action Research intervention**

I plan on implementing biotechnology into my Anatomy and Physiology classroom in unit two chemistry and cells. I plan on teaching the background information through at home readings and lecture. I will use the hands-on lab for extraction of DNA form a strawberry and the gene cloning protocol lab showing PCR and Gel electrophoresis. I will reinforce the information with the Mission Biotech video game and the BLAST website to discuss specific diseases. I plan on doing this lesson around the middle of September and I expect it to last about three weeks.

**Bench to Bedside Connections**

I plan on taking several of the concepts we learned at Bench to Bedside and using them in my classroom. I will be using Julie’s explanation of how PCR works in my lectures. I am using the strawberry DNA extraction form the Mission Biotech teacher curriculum. I will be using the
equipment and the lab for the gel electrophoresis form CPET. I will be using the Mission Biotech Video game and their pre and post test. I will also be using the Identifying Disease Genes activity and the BLAST website.

**Data Collections and Analysis**

I plan on doing a pre and post test to determine the knowledge they have before and after the unit. I will collect data based on their lab book write ups. They will do projects based on the Identifying Disease Genes activates. I plan on doing a student survey to determine whether the hands-on labs affect their attitude about learning. I also would like to do career survey to see what careers my students plan on going into to learn determine what I can do in the classroom to prepare them for their career.

**Literature Cited**

**Ahmed, Maryann:** Biotechnology in the High School Classroom; *The American Biology Teacher*, volume 58, No. 3 March 1996; pg. 178-180


**Budget and Budget Justification**

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**Permissions**

I have already gotten permission from my school to have people in my classroom. I will have to get support from my technology person to run the Mission Biotech. I will have to get permission from my students and their parents to participate in Mission Biotech and just to notify them of the lab activities going on in my class room.
A study of the effects of a biotechnology unit on a students’ ability to retain information and change their attitudes about learning when using selected bioscience activities in a high school classroom.

Stephanie Bundy
Fort White High School
Fort White, FL 32038
Columbia County
Objective

- To Teach students the difference between ionic and covalent bonding
- To teach students how chemical bonds form and how they look
- To teach students to make Lewis structures
- To teach students about crystal structure
- To inform students about careers in biotechnology
- To explain to students how biotechnology is helping advance technology in science fields
- To give students hands-on learning using equipment used in research labs today
Methods

- I plan on implementing biotechnology into my Chemistry classroom in unit six chemical bonding. I plan on teaching the background information through at home readings, in class lectures, and class work/homework.

- I will use the lab Marshmallow molecules to teach students what bonds look like.

- I will use the hands-on lab for extraction of DNA from a strawberry, the food coloring pipetting lab, and the gene cloning protocol lab showing crystallization of DNA to give students hands-on learning using equipment used in research labs today.

- I will have the students do a presentation on careers to inform students about careers in available biotechnology.

- I will teach students about genetic diseases by having students make posters about different genetic diseases based on the Identifying Disease Genes activates from bench to bedside.
Outcomes

- I want students to learn the benchmarked material (chemical bonding) in a way that is fun and different and that can teach them about biotechnology using real world techniques and equipment.
Assessments

- I plan on doing a pre and post test to determine the knowledge they have before and after the unit. The pre and post test will have questions about biotechnology, proper lab procedures, and careers in biotechnology.
- I will collect data based on their lab book write ups such as did they understand what they were doing in the lab and can they interpret their results properly. I will take their lab book as a grade.
- I will use a rubric to grade the posters about different genetic diseases based of the Identifying Disease Genes activates from bench to bedside.
- I plan on doing a student survey to determine whether the hands-on labs affect their attitude about learning.
- I will use a rubric to grade their career presentations.
- I will take a final grade based on their final unit test.
Summary

- I hope this goes well and will be lessons and labs that I do year after year and that the students enjoy.
A study of the effects of a biotechnology unit on a students’ ability to retain information and change their attitudes about learning when using selected bioscience activities in a high school classroom.

Bench to Bedside Action Research Proposal

Stephanie Bundy

Science Teacher

Fort White High School

17828 SW SR 47

Fort White, Fl 32038

Advanced Placement Chemistry 2010-2011
Abstract

The purpose of this study was to determine the effects of a two week unit focused on students’ ability to retain information and change their attitudes about learning when using selected bioscience activities in a high school classroom.

I implemented biotechnology into my Chemistry classroom in unit six thru nine chemical bonding and Lewis Structure. I taught the background information through at home readings and lecture. I used the hands-on lab for extraction of DNA from a strawberry and the gene cloning protocol lab showing crystallization of DNA. I reinforced the information using a molecular structure lab where students make models out of marshmallows and gummies. I also used the BLAST website to discuss specific diseases. I also had my students do a career project where they researched careers they are interested including careers in biotechnology. I did the lesson around the middle of March to the end of March. I used the information and hands-on labs that I learned at the Bench to Bedside workshop to teach this unit and increase student understanding and retention.

Rationale

Schools are currently focused on school grades where most curriculums are based on improving FCAT scores and preparing students for end of course exams. Much of this is done by workbooks and simple constant repetition. This study will share the findings of how using hands-on biotechnology in the classroom increases students performance. I used my Advanced Placement Chemistry classes to do the study.

Research shows that Biotechnology, definitely one of the most interesting and exciting topics for science classes, can be studied in sophomore biology as well as junior and senior level classes. Through classroom implementations, students gain a depth of understanding, giving them the ability to interpret recently published articles. Today's students are attuned to contemporary research and seem anxious to understand what they read or witness on a news broadcast. The study of biotechnology can easily be inserted into the curriculum after the completion of a molecular genetics unit which included the structure of nucleic acids, replication, transcription and translation. (Paolella, 1991)

Research states that biotechnology can be translated as "life technology." It involves manipulating and using living organisms, especially at the molecular level, to benefit society in different ways. DNA fingerprinting, paternity testing, and diagnostic tests are some of the most well known practical applications of biotechnology. While biotechnology is increasingly in the news giving us continuing discoveries and breakthroughs awareness of the overall significance of this relatively new branch of science remains limited. This is especially true of students taking science courses at the high school level. A project to see the effects of teaching biotechnology was designed at Centennial Regional High School in Montreal Canada. The project brought hands-on labs to the students as well as pairing them with professor in their area. Students said the labs were challenging and gave them a feeling of what type of research is actually being
conducted in the real world. The project went beyond current methods of teaching high school science and served to generate student interest in modern science and technology. (Ahmed, 1996)

In doing research one article gave reasons why biotechnology was beneficial to the high school classroom but went on to explain why it was not being used often. Benefits for teaching biotechnology were some of the same reasons that were expressed in Bench to Beside such as longer retention of material, students being more excited about learning, and they will be more prepared for real world science. The article explained that some of the reasons that biotechnology was not being taught were that teachers lacked the knowledge about biotechnology and that schools could not afford the equipment needed to teach biotechnology. The article went on to say that academic standards are rising and that biotechnology needs to be included curriculum in science classrooms and that states need to begin training teachers and investing in the equipment needed to teach biotechnology. (Zeller, 1994)

I learned through my research that biotechnology increases students learning, prepares them for college classes they may take, and shows them different careers that are available for them after graduation. I learned that some of the things that need to change to be able to teach biotechnology are training for teachers and money for supplies in the classroom. Chemistry and biotechnology go hand in hand. You must have and understanding of chemistry to do many of the required test in biotechnology. I want to get my students excited about chemistry and biotechnology by using hand-on activities to show them careers that are available to them in their area which will give my students a chance at better job opportunities and increase the workforce in biotechnology. Therefore the purpose of my classroom study was to determine the effect of a two week unit focused on students’ ability to retain information and change their attitudes about learning when using selected bioscience activities in a high school classroom. I used equipment, staff, and knowledge from the Bench to Bedside workshop. I collected data by doing surveys, testing, projects, and in general monitored their overall attitude when they actually got to use biotechnology equipment in the classroom.

**Action Research intervention**

I implemented biotechnology into my Advanced Placement Chemistry classrooms which are juniors and seniors in high in unit six chemical bonding. I taught the background information through at home readings, homework, example problems, and lecture. I used my own notes in teaching the background material on crystals, Lewis structure, and ionic bonding. I used my own lab on Molecular molecules with marshmallows to teach about crystals and molecular molecules. I taught the material about biotechnology using the Power points from the Mission Biotech CD. I used the hands-on lab for extraction of DNA from a strawberry and the gene cloning protocol lab showing crystallization of DNA. The staff came from UF and did the crystallization lab. I reinforced the information using the BLAST website to discuss specific diseases. I had my students do a research project on careers to teach them about careers in
biotechnology and industry. I started the unit in mid March and finished at the end of March. My objective was to teach students lab techniques and how chemical bonding is relevant in health of the body. I feel my objective was met. My students learned about many careers doing the career project. They learned about crystals and DNA; and had fun using the biotechnology equipment in the classroom.

**Bench to Bedside Connections**

I used all of the lecture materials from bench to bedside when I taught the background information on biotechnology. I used the Mission Biotech CD for their power points and for their strawberry DNA extraction lab. I used the crystallization lab to teach crystals. The staff from bench to bedside came and did the lab with my students. They were wonderful and my students loved it. I used the information on the BLAST website for information on diseases and career information from Bench to Bedside.

**Data Collections and Analysis**

I did a pre test and post test. It had questions 10 questions asking what they knew about DNA, viruses, Gene cloning, PCR, and genetic engineering. The students were not able to answer many of the questions before but were able to completely answer the questions after. The students learned about bonds, Lewis structures, and crystal structure and were able to make an average grade of 80 or better. They did a lab on Molecular structure and were able to produce 20 proper Lewis structure. Students did the how to use biotechnology lab and were successful in making their assigned structure. Students did power points, posters, and papers on careers in biotechnology and industry. I graded the projects using a rubric. A 5 to a 1 was award for having creativity, correct information, and research. A 5 was awarded for being the best meeting all of the criteria and a 1 meeting the lowest amount of criteria. The ending learning activity was the crystallization lab. My students were so very excited. They were interested, curious, and involved. The staff from UF cam and did the lab. We then let them sit for a week and then evaluated who was the best solution and wrote an evaluation.

**Literature Cited**


Mission Biotech CD made by UF for the Bench to Bedside workshop and Lecture materials from Bench to Bedside.

**Budget and Budget Justification**

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**Permissions**

I have already gotten permission from my school to have people in my classroom. I had to get permission from my students and their parents to participate in Mission Biotech and just to notify them of the lab activities going on in my classroom. I sent home a parent letter to participate in classroom lab and food eating activities.

**Modifications**

I had to make major modifications to my original proposal. I had originally planned all of the activities for my Anatomy and Physiology Honors classes. When I got back to school I found out I had all Chemistry class. I had to go back to all of my notes and start again. I rewrote my paper in September. I tried to do the labs with my regulars’ class but time wise it did not work out. That is how I ended up with my AP students. I am glad lecture wise it ended up being my advanced students because they had a hard enough time understanding PCR and how viruses are used in biotechnology. I did actually do the introducing biotechnology equipment with my regulars and they loved using the pipettes and materials. I had several then inquire about jobs where these were used. My AP students loved the marshmallows molecules lab because of course they then got the roast and eat them. They loved doing the crystallization lab. It made it even more enjoyable having Houda from UF come and do the labs. They enjoyed the lab and equipment and interacting with someone from college. They were so excited and asked her a million questions. They were very excited and asked many times to get to look and see when they could check their crystals. I found that the lecture material information was much easier for my really bright students but that my regulars’ students had an easier time with the lab
equipment. I feel this is because they do not feel they have to get it one hundred percent correct and just try it. My advanced students had to make sure they knew what to do before trying it. I thought the experience was great and plan on using all of the labs again next year. Houda said they could come back again because I had already done Bench to Bedside and I plan on using her again. I will make all of these labs as a part of my curriculum as long as I have access to the materials and supplies.

I learned so much from attending Bench to Bedside. I have been able to incorporate it many times throughout the year in my classroom. I learned how important biotechnology is to many careers and how it can excite learning in students.