

High School Physical Science Students' Attitudes and
Ability to Identify Biotechnology Careers via Student
Career Research and Sharing

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Chemistry I

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Abstract:

Due to a need for trained personnel in the biotechnology industry, it is imperative that students be given the opportunity to investigate career choices in biotechnology. Since today's student is technologically more adept than previous generations it makes sense to introduce careers in biotechnology by having students research biotechnology via the internet and create power point presentations. This study will monitor student attitudes toward career choices in biotechnology before and after students conduct research and create power point presentations pertaining to biotechnology careers. Students will use their presentations to "recruit" classmates to their biotechnology career. The Likert Survey will be used to collect pre and post survey data to investigate student attitudes toward biotechnology. In addition, a pre and post biotechnology career identification chart will be used to identify student familiarity with biotechnology career choices.

Rationale:

Florida is one of the fastest growing states for the life sciences industry and has biotech centers found in the top ten in the country. Ranging from research and development to clinical trials and business development, Florida's life sciences industry employs over 26,000 persons (Ray, 2010). "In 2008, the annual average wage for the biotechnology industry was \$63,768, exceeding the state's total annual average wage of \$40,569 by 57 percent" (State of Florida. Governor's Press Office, 2010). Since biotechnology is a leading industry cluster that plays a key role in the state's continued economic success, it makes sense to incorporate biotechnology career choices

into a physical science classroom. By doing so, students will learn about careers choices available to them in an ever changing job market. (Conroy, 2000)

A concern is which teaching practices will best serve this population of students? There is widespread agreement among educators and psychologists that student learn advanced skills of comprehension, reasoning and composition through interaction with content. “Technology applications can support higher-order thinking by engaging students in authentic, complex tasks within collaborative learning contexts” (Means, 1993, p. 26). Due to the ever changing need for technology integration in education, it makes sense to incorporate technology into a project that allows students to practice advanced skills when investigating biotechnology careers.

Action Research Intervention:

The students being studied are high school students taking a course in physical science. Students will be given an attitude assessment of biotechnology careers prior to and after participating in biotechnology education in the classroom which will be evaluated via the Likert Scale. In addition, students will complete a pre and post biotechnology career inventory chart to determine whether they can identify which career choices pertain to biotechnology careers. Students will be given mixed listing of careers to see if they can identify biotechnology career choices.

Prior to starting their projects, students will view an online video

(<http://player.discoveryeducation.com>) describing a variety of biotechnology career choices.

Subsequently, students will also view material

(<http://www.teachersdomain.org/resource/biot09.biotech.car.careers/>) that explains the different divisions available within biotech research and industry. After given instruction, groups of two students will then choose two career options within a division of the biotechnology sector, to

research given a specified protocol. Student groups will then choose one career choice from which to create a power point presentation. Groups will use their presentation to “recruit” or convince other students to make biotechnology career choices. Student projects will be graded on a rubric. (See unit plan) It is anticipated that after completing this lesson module that students will be able to more readily identify biotechnology career choices as well as have a more favorable attitude toward biotechnology careers. (See unit plan)

Connections to Bench to Bedside Summer Institute:

With the recent initiatives in the bioscience and agriscience industries the Bench to Bedside Institute material that lends itself best to this study was the Mission Biotech Lesson 6 - Careers.

Data Collection and Analysis:

Student pre and post project attitude surveys will be assessed by using the Likert Scale and analyzed for increasing trends. Data from the pre and post activity biotechnology career identification chart will be evaluated for increases in student ability to identify careers related to biotechnology.

Literature Cited:

Conroy, Carol A. "Reinventing Career Education and Recruitment in Agricultural Education for the 21st Century." *Journal of Agricultural Education*, Vol. 41, Issue, 2000.

Means, Barbara. "Using Technology To Support Education Reform." Sept. 1993. Web. 30 Aug. 2010. <<http://www.eric.ed.gov/ERICWebPortal/recordDetail?accno=ED364220>>.

Ray, John. "Growing the Nation's Bioscience Sector: State Bioscience Initiatives 2006." Florida: Florida Business Resource for Business Development and Relocation. Web. 01 Sept. 2010. <<http://www.eflorida.com/>>.

State of Florida. Governor's Press Office. 11743 Governor Crist Highlights Florida's Biotechnology. [Http://www.flgov.com/release](http://www.flgov.com/release). 05 Aug. 2010. Web. 29 Aug. 2010. <<http://www.flgov.com/release>>.

Budget and Budget Justification:

The following budget reflects needed materials for the classroom implementation of this research project:

Copied Materials	(1000) @ \$0.05 = \$50.00
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Removable Storage Devices	(5) @ \$9.88 = <u>\$49.40</u>
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Total	\$99.40
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Investigations in Biotechnology Careers Unit Plan

Bench to Bedside Action Research Proposal

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Lesson Plan

Biotechnology Careers

Objectives:

1. Students will be able to identify career options in biotechnology.
2. Students will be able to differentiate between the different divisions in a biotechnology company.
3. Students will be able to profile jobs for selected positions within a specific division of a biotechnology company.
4. Students will be able to engage potential recruits and enlighten them to biotechnology career options.
5. Students will be able to create power point presentations.

Standards:

- SC.912.B.23.01: Use several resources including the internet to gather information about job opportunities in the biotechnical field.
- SC.912.B.23.02: Outline the opportunities for careers in biotechnology in health, industry, medicine, genetics, agriculture, etc.
- SC.912.B.22.01: Define terms and demonstrate basic computer skills.
- SC.912.B.22.02: Use available computer programs to collect data and prepare reports.
- SC.912.L.16.10: Evaluate the impact of biotechnology on the individual, society, and the environment, including medical and ethical issues.
- LA.910.1.7.3: Determine the main idea or essential message in grade level or higher texts through inferring, paraphrasing, summarizing, and identifying relevant details.

Time: 5 class periods (48 minutes each)

Teaching Strategies: oral presentation, visual aids, video presentation, discussion, pairing, independent research, student presentations

Materials:

Class 1:

- Computer with attached projector.

Class 2:

- Computer with internet connection and attached projector.
- Document camera attached to projector.
- Copy of Biotechnology Industry Fact Sheet.

Class 3:

- Copies Career Profile sheets for student groups (two per group).
- Student computers with internet access.

Class 4:

- Copies of Biotech Career Fair instruction sheets with grading rubric.
- Student computers with PowerPoint program.
- Student flash drives to store presentations.
- Printer to print each presentation.

Class 5:

- Computer with attached projector.
- Teacher copies of grading rubric.

Advance Preparation: Arrange for time for students to research career choices and prepare power point presentations using computer with internet access and PowerPoint software (Class 3 and 4).

Procedure:

Class 1:

1. Introduce students to biotechnology careers by viewing “Emerging Careers: Biotechnology Occupations” online video. (<http://player.discoveryeducation.com>)

2. After viewing video whole class discussion:
3. What is biotechnology?
4. What experiences might help a student prefer a career as a biological scientist?
5. Why would genetic research technicians have to be good at record keeping?
6. What type of fields is a genetic technicians' work used for?
7. What is one of the main duties performed by biomedical engineers?
8. What is the main job of clinical research associates?
9. What job might biomedical equipment technicians perform?

Class 2:

1. Review Biotechnology Industry Facts from:
<http://bio.org/speeches/pubs/er/BiotechGuide2008.pdf>
2. Show students all four divisions commonly found in biotechnology from the website:
<http://www.teachersdomain.org/resource/biot09.biotech.car.careers/>
3. Whole class discussion:
4. What are your impressions of the people working in the video?
5. Which division interests you and why?
6. Would any of you consider a career in biotechnology?
7. Divide students into groups of two and review the requirements for the biotechnology career project and ask them to choose two careers from a division of their choosing to research.

Class 3:

1. Review requirements for students to research their biotechnology careers via the Career Fair Position Research worksheet.
2. Allow students to research two careers, from a division of their choosing, by using internet linked computers in the media center.
3. Hand out Career Fair Position Research for student use.

4. Assist student groups individually with their research and answer questions.

Class 4:

1. Review research progress with class and student research worksheet.
2. Hand out Biotech Career Fair Power Point Presentation sheet with grading rubric.
3. Instruct student how to use the PowerPoint program, store presentation to flash drive and print copy of presentation.
4. Allow groups to choose a position within the division to promote and prepare a power point presentation to present at the career fair.

Class 5:

1. Prepare teacher computer and projector for students to present power point presentations to class.
2. Collect presentation, print out, and student worksheets.
3. Grade projects as presented via rubric on the Biotech Career Fair Power Point Presentation worksheet.
4. Whole group discussion:
5. Would any of you consider a career in biotechnology?
6. Who of you would consider a career in a science related career?
7. What did you gain from completing this project?

Suggested Assessments:

- Student power point presentations can be assessed based on the grading rubric found on the Biotech Career Fair Power Point Presentation worksheet.
- Student worksheets used to research information to complete project, i.e. Career Fair Position Research worksheet.
- Student positions from Career Fair Position Research worksheet.
- **Option:** Award group from each class as the Career Fair Award Winners and offer extra credit for best presentation and persuasion.

References:

<http://www.teachersdomain.org/resource/biot09.biotech.car.careers/>

<http://bio.org/speeches/pubs/er/BiotechGuide2008.pdf>

<http://player.discoveryeducation.com>

Mission Biotech Supporting Curriculum Materials/Lesson 6

STUDENT WORKSHEET

Career Fair Position Research

Partner Names: _____

Division Name: _____

Instructions:

Use the following Career Profile Sheets to locate information about TWO careers in your division. You will then share your findings with pairs from other divisions.

CAREER #1 TITLE:

Summary of position (division, duties and responsibilities):

Minimum education required:

Minimum experience required (if any):

Average salary (or salary range):

CAREER #2 TITLE:

Summary of position (division, duties and responsibilities):

Minimum education required:

Minimum experience required (if any):

Average salary (or salary range):

Career Fair Position Research

(continued)

NOTES ON OTHER DIVISION CAREERS

(List division, title, brief description, and any other notes you feel are relevant)

Biotech Career Fair Power Point Presentation

You and your partner are charged with the task of selecting one career to promote at the Biotech Career Fair. You need to learn all you can about the position in order to recruit prospective employees to join your company.

Procedure:

1. Complete the student worksheet for each of the positions in your assigned division (career path).
2. Meet with your division and decide which position you and your partner will promote.
3. Design a power point presentation to be displayed at the career fair.
 - a. You will be given class time to complete your power point presentation. Please print copy, in handout form, to turn in.
 - b. Use the information collected on the worksheet as reference material.
4. Each group will present their power point to the class.
5. Present you chosen career and engage potential recruits. Remember, you are trying to convince them your position is the best.
6. While the judges are making final decisions.
7. Have fun!

What to turn in:

1. Student worksheet with each of the careers from your division (one set per pair)
2. Printed copy of your power point (hand out form).

Grading Rubric:

Criteria	Possible Points
Thoroughness of Student Careers Worksheet	10 points
General Appearance of Presentation	10 points
Group Members Recruiting Ability	10 points
Inclusion of Key Information on Power Point <ul style="list-style-type: none">✓ Position Name✓ Division Name✓ General Description✓ Education✓ School where program offered✓ Experience✓ Salary✓ Company Name✓ Company Location✓ Recruiters contact information	20 points
Extra Credit	Up to 5 points (if class winner)
Total	50 Points Possible (+5 extra credit)

Biotechnology Industry Facts

From: <http://bio.org/speeches/pubs/er/BiotechGuide2008.pdf>

- The biotechnology industry emerged in the 1970s, based largely on a new recombinant DNA technique whose details were published in 1973 by Stanley Cohen of Stanford University and Herbert Boyer of the University of California, San Francisco. Recombinant DNA is a method of making proteins— such as human insulin and other therapies—in cultured cells under controlled manufacturing conditions. Boyer went on to co-found Genentech, which today is biotechnology's largest company by market capitalization.
- Biotechnology has created more than 200 new therapies and vaccines, including products to treat cancer, diabetes, HIV/ AIDS and autoimmune disorders.
- There are more than 400 biotech drug products and vaccines currently in clinical trials targeting more than 200 diseases, including various cancers, Alzheimer's disease, heart disease, diabetes, multiple sclerosis, AIDS and arthritis.
- Biotechnology is responsible for hundreds of medical diagnostic tests that keep the blood supply safe from HIV and detect other conditions early enough to be successfully treated. Home pregnancy tests are also biotechnology diagnostic products.
- Agricultural biotechnology benefits farmers, consumers and the environment—by increasing yields and farm income, decreasing pesticide applications and improving soil and water quality, and providing healthful foods for consumers.
- Environmental biotech products make it possible to clean up hazardous waste more efficiently by harnessing pollution-eating microbes.
- Industrial biotech applications have led to cleaner processes that produce less waste and use less energy and water in such industrial sectors as chemicals, pulp and paper, textiles, food, energy, and metals and minerals. For example, most laundry detergents produced in the United States contain biotechnology-based enzymes.
- DNA fingerprinting, a biotech process, has dramatically improved criminal investigation and forensic medicine. It has also led to significant advances in anthropology and wildlife management.
- The biotech industry is regulated by the U.S. Food and Drug Administration (FDA), the Environmental Protection Agency (EPA) and the Department of Agriculture (USDA).

- As of Dec. 31, 2006, there were 1,452 biotechnology companies in the United States, of which 336 were publicly held.*
- Market capitalization, the total value of publicly traded biotech companies (U.S.) at market prices, was \$360 billion as of late April 2008 (based on stocks tracked by BioWorld).
- The biotechnology industry has mushroomed since 1992, with U.S. health care biotech revenues from publicly traded companies rising from \$8 billion in 1992 to \$58.8 billion in 2006.*
- Biotechnology is one of the most research-intensive industries in the world.
- There were 180,000 employed in U.S. biotech companies in 2006.*
- The top five biotech companies invested an average of \$170,000 per employee in R&D in 2007.
- In 1982, recombinant human insulin became the first biotech therapy to earn FDA approval. The product was developed by Genentech and Eli Lilly and Co.
- Corporate partnering has been critical to biotech success. According to BioWorld, in 2007 biotechnology companies struck 417 new partnerships with pharmaceutical companies and 473 deals with fellow biotech companies. The industry also saw 126 mergers and acquisitions.
- Most biotechnology companies are young companies developing their first products and depend on investor capital for survival. According to BioWorld, biotechnology attracted more than \$24.8 billion in financing in 2007 and raised more than \$100 billion in the five-year span of 2003–2007.
- The biosciences—including all life-sciences activities—employed 1.2 million people in the United States in 2004 and generated an additional 5.8 million related jobs.**
- The average annual wage of U.S. bioscience workers was \$65,775 in 2004, more than \$26,000 greater than the average private-sector annual wage.**

* New data are expected in mid-2008 from Ernst & Young, which publishes an annual global overview of the biotechnology industry.

** The data are from a BIO-sponsored Battelle Memorial Institute report, *Growing the Nation's Biotech Sector: State Bioscience Initiatives 2006*. A new, updated report is expected to be released in 2008.