TEACHER QUEST TAMPA BAY PROGRAM

ACTION PLAN

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Lesson Title: **Mother Nature Doesn't Use a Brita Water Filter**
Grade Level: **8th**
Subject Area(s): **Science**
Date: **7/12/2010**

Summer Work Experience

The job responsibilities took place in an all encompassing research and treatment driven environment that included full-service lab research and analyses in which:
*bacteria cultures were grown
*human lymphoma suspension cells were cultured
*plasmid DNA was extracted from the bacteria
*optical density determined for plasmid utilizing optical density
*restriction digested DNA, gel electrophoresis
*prepared human embryonic kidney adhered cells
*transfected human embryonic kidney cells with green fluorescent protein (GFP)
*microscopy analysis of GFP transfected cell culture utilizing lab analytic microscopy techniques
*microscopy analysis of a gene targeted MDA-MB-231 human breast cancer in vivo utilizing a mouse with attached "window"

Certainly, the experience of working with and meeting people that support the prevention, education, and treatment of cancer has been humbling, at the very least. Truly impressive and inspiring is the desire and drive to advance, innovate, and reflect on the greater cause is the rule, rather than the exception.

My teaching style is dynamic, so it will add to my proverbial bag of tricks-primarily which are experiential. The knowledge acquired during my tenure at Moffitt and with TRDA will have had and will continue to have major positive implications in my personal and professional lives.

The potential long-term relationships that have been established were far broader that I imagined possible in such a short period of time. We met with various aspects of the greater Moffitt group that provided insight, observations, and advice-all with great candor. We plan to arrange school

and Moffitt cooperative community functions such as developing health screenings and mammography bus visits to the school for the community through the Tampa Bay Community Cancer Network (TBCCN), we have had preliminary talks with student organizations for tutoring and mentoring, such as RISE (Rise Inspire Strengthen Encourage) a USF-based minority pre-medical student organization, and CBSO, a Moffitt-based graduate student organization composed of pre- and post-doctorate fellows that also would like to develop a positive relationship with our students and communities, and many, many, contacts that have expressed a sincere interest in visiting our schools to help inspire our students and to demonstrate the availability and importance of STEM related careers.

Lesson Plan

Objectives

To continue to foster and grow the relationships with Moffitt-the organization, the people within the organization, and the organizations within the organization with the students, the school, and finally, with the district. To directly convey STEM-related opportunities to my students and to provide for them the tools that they will need to maintain a long-term educational and developmental importance and continued focus of STEM in both specific to their futures and in the "big picture" for the world markets.

Sunshine State Standards

SC.D.1.3.4 The student knows the ways in which plants and animals reshape the landscape (e.g., bacteria, fungi, worms, rodents, and other organisms add organic matter to the soil, increasing soil fertility, encouraging plant growth, and strengthening resistance to erosion).
SC.D.2.3.2 The student knows the positive and negative consequences of human action on the Earth's systems.
SC.F.2.3.1 The student knows the patterns and advantages of sexual and asexual reproduction in plants and animals.
SC.F.2.3.3 The student knows that generally organisms in a population live long enough to reproduce because they have survival characteristics.
SC.G.1.3.3 The student understands that the classification of living things is based on a given set of criteria and is a tool for understanding biodiversity and interrelationships.
SC.G.1.3.4 The student knows that the interactions of organisms with each other and with the nonliving parts of their environments result in the flow of energy and the cycling of matter throughout the system.
SC.G.1.3.5 The student knows that life is maintained by a continuous input of energy from the sun and by the recycling of the atoms that make up the molecules of living organisms.

SC.G.2.3.2 The student knows that all biotic and abiotic factors are interrelated and that if one factor is changed or removed, it impacts the availability of other resources within the system.
SC.G.2.3.3 The student knows that a brief change in the limited resources of an ecosystem may alter the size of a population or the average size of individual organisms and that long-term change may result in the elimination of animal and plant populations inhabiting the Earth.
SC.H.1.3.1 The student knows that scientific knowledge is subject to modification as new information challenges prevailing theories and as a new theory leads to looking at old observations in a new way.
SC.H.1.3.2 The student knows that the study of the events that led scientists to discoveries can provide information about the inquiry process and its effects.
SC.H.1.3.3 The student knows that science disciplines differ from one another in topic, techniques, and outcomes, but that they share a common purpose, philosophy, and enterprise.
SC.H.1.3.4 The student knows that accurate record keeping, openness, and replication are essential to maintaining an investigator's credibility with other scientists and society.
SC.H.1.3.5 The student knows that a change in one or more variables may alter the outcome of an investigation.
SC.H.1.3.7 The student knows that when similar investigations give different results, the scientific challenge is to verify whether the differences are significant by further study.
SC.H.2.3.1 The student recognizes that patterns exist within and across systems.
SC.H.3.3.2 The student knows that special care must be taken in using animals in scientific research.
SC.H.3.3.4 The student knows that technological design should require taking into account constraints such as natural laws, the properties of the materials used, and economic, political, social, ethical, and aesthetic values.
SC.H.3.3.5 The student understands that contributions to the advancement of science, mathematics, and technology have been made by different kinds of people, in different cultures, at different times, and are an intrinsic part of the development of human culture.
SC.H.3.3.6 The student knows that no matter who does science and mathematics or invents things, or when or where they do it, the knowledge and technology that result can eventually become available to everyone.
SC.H.3.3.7 The student knows that computers speed up and extend people's ability to collect, sort, and analyze data; prepare research reports; and share data and ideas with others.

Materials

(Currently available to the project)

2 30 gallon glass tanks to be used as the basis for the Biological filter (no media has yet been purchased for the biological filter)

1 150 gallon primary tank (the primary tank currently houses two Tesselata Moray Eels and supporting livestock, i.e. feeder shrimp, detritus consuming snails, 2 fan-style water pumps to facilitate additional water movement throughout the main tank, sand media)
1 50 gallon return sump containing up to four 200 micron filter "socks"
1 3500 gph primary water return pump and associated hoses, shutoff valves, etc.
1 Protein Skimmer rated for a 350 gallon system. The protein skimmer creates micro bubbles onto which dissolved organic proteins, algae, and waste adhere. The waste is collected into a receiving cup, the contents of which are disposed on a semi-weekly basis.

(Materials required in order to comprehensively address project as it is designed and intended)
1 Electronic pH monitor
1 Electronic nitrate monitor
1 75 gph return pump (refugium tank #2)
1 Mangrove plant (refugium tank #1)
4 pounds of "live" rock

*Various biological filtering media: sand-sifting snails, macro algae, clams, shrimp, copepods and amphipods

Although the completion and sustainability of the project will not depend on additional outside sources, the remaining startup equipment that may be required as well as additional ongoing typical needs consumables, i.e. food for the livestock, reverse osmosis filters (for the purification of the water), replacement bulbs for the lighting systems, marine salt, additional livestock when needed will be replaced by a combination of the following funding sources: the principal teachers supervising the project, as well as science department funds directly.

Instructional Procedures

Weeks 1 and 2: Data will be collected by each class period for the main tank only. The data will be collected from the single source, as the biological filters are often "cycled" for two weeks as similar systems are thought not yet to be mature enough to adequately address the targeted contaminant and to sustain level pH for the system. The refugium and the associated biological filtration will be part of the whole system. The students will be asked to ascertain a correlation of nitrate levels with system pH and if such a correlation exists. The students will also begin to collect qualitative data analyses of the appearance of the system to become more familiar with the system and to recognize when apparent visual changes occur. Qualitative analysis will be discussed weekly and recorded for each period as a consensus measure.

Week 3: The refugium will be isolated from the main tank for the week. Data collected each period will be from both the refugium biological filter system and from the main tank. Students will

hypothesize what they think will occur to the levels of the targeted measures for each separate system.

Week 4: The refugium will return to the main tank system as a biological filter for one week. Monitoring will progress as usual, but readings will now be taken from both systems to ascertain differences in target reading levels, if any.

Weeks 5 through 10: Data collection and rotation will follow routine as was established in weeks 3 and 4.

Weeks 11-16: Data collection will continue on the established track. Students will hypothesize what will occur with the rotation now following a semi-monthly schedule.

Week 17: Data will be shared among students and the department. Student created PowerPoint presentations will follow.

Week 18: Students will solicit electronic publications to post their findings.

Integration of Summer Work Experience/Follow-up Activities

Biological system effects and interdependency of environmental factors

The purpose of the inquiry-based experiment is to verify and quantify if the addition of a comprehensive diverse biological filter either reduces or stabilizes two critical components of a closed marine ecosystem. We will collect water samples at regular intervals to test the purity of water samples of a closed aquaria system for a specified naturally occurring contaminant (nitrates) and pH level-both critical primary components of a micro marine ecosystem.

During my varied experiences in working with the superb organization and associates of Moffitt Cancer center, I employed hands-on research that included: full-service lab research, environmental impacts on living organisms, growing bacterial cultures and targeting mutagenic cells, plating human lymphocytes, transfecting the cells using green fluorescent protein markers, analyzing the systems and identification of contaminants, purifying desired cellular components, and utilizing lab analytic microscopy techniques.

Although the class project itself does not specifically address cancer research, we will implement many of the research, observational, and analytical techniques practiced during my field experience at Moffitt, as well Moffitt's holistic comprehensive approach to total cancer care (prevention, testing, research, genetic predispositions, biologic and chemical compatibilities, and public and patient education).

The project will implement laboratory and data collection techniques utilized during my field experience with Moffitt Cancer Research Center. I will communicate with my students on the possible extensions of the aquaria project, and how the bases of the research conducted afford

them a foundation for critical and essential skill sets that will be applicable to them well beyond the conclusion of the project.

All of the approximately 300 8th grade students in the school (2 participating teachers-Marcantoni and Baskett) will partake in following student-driven research and system design involving existing components, as well as typically available and compatible biological filtration media including:

- Biological, interdependent organism systems (Science-Biology)
- Design for the interactive biological media (Science-Bioengineering)
- Electronic substance monitors and recording of observed data (Technology)
- Research and subsequent electronic publishing of data results (Technology)
- Design and observation for the system (Engineering)
- Data and conversions for system targeted chemical compounds (Mathematics-calculating concentration; Science-Chemical components)
- Budgetary constraints (Mathematics)

Assessment Instrument

Inquiry and critical thinking-based continuous assessments, including the following methodologies:

*Discussions as needed, with no time greater than 4 school days to discuss issues and qualitative and quantitative observations;

*Socratic Seminar including discussions of the interdependence of biological organisms and systems;

*Formal testing including the principals addresses according to the aforementioned sunshine state standards and;

Peer evaluations of presentations-guided by a teacher created rubric. Student responses will be 40% of the group/individual grade by weight.

Comments

Urban middle school students often have very little to no first-person experience with the interdependence of biotic and abiotic factors in fully functioning ecosystems. This experiment provides students direct observational and practical skills and accountability of the interactions between living organisms and the physical environment in a complex micro closed ecosystem.

Students will experience ownership, data gathering, critical thinking, and decision-making processes that are required in caring for the biological needs of marine flora and fauna in a closed system and then use the knowledge acquired to project what is required for a more complex natural macro system.

The experimental study introduces the students to potential career choices in:
biology, marine biology, biotechnology-agriculture, food, and medicine; bioengineering and genetics; research science; veterinary science; politics and policy-biomedical research and environmental protection; business and industry-research, sales, marketing, company policy, safety; ecology and economic impacts-work with government and private institutions addressing ecological and economic impact of biological issues, such as wildlife management and sustainability, species extinction, exotic species impact, environmental pollution, water quality testing and engineering; mathematics- data collection and mining, biostatistics, bioinformatics computational biology; epidemiology and public health; scientific project management; electronic engineering, technology, and monitoring; science writing and communication-grant proposals, the publication of experimental results; art; forensic science, et al.

Source: http://www.aibs.org/careers/