Transforming a "Hard-core" Science Class into a Diversity Course

I must admit that, at first, this task seemed very daunting. "Hard-core" science classes tend to be content heavy and that content was written, for the most part, long ago from a white, privileged, male perspective. This doesn't mean that a science class can't be transformed…it just requires a willingness to be creative in both your teaching strategy and in the assignments that are given to the students.

First off, using an inclusive approach to delivering the material is important. According to Joy Wallace, physical environment speaks volumes. Wall displays, both inside the classroom and throughout the science building, should be multicultural. These displays should show both sexes, different races, cultures, and physical abilities performing scientific activities. Wall displays should be interesting and inviting. This may not be possible in all situations, for example teaching in a wide variety of rooms around campus, but there should be some visible area where this can occur (Wallace, 1).

Other areas of classroom comfort should be considered. The arrangement of desks and proximity of the teacher to the students will give a more open and interactive feeling for the students. Standing behind or at a podium or desk may establish a barrier between the student and the instructor that may not be easily or comfortably crossed (Wallace, 1-2).

Second, teaching manner may need to be rethought. Varied types of presentations of material will have the best chance of reaching the varied learning styles of the students. Science classes tend toward the lecture format, due to the large amount of factual knowledge that is imparted. I approach this problem in several different ways. I use PowerPoint presentations, video, overhead transparencies, writing on the chalkboard, and handouts with varied examples to stimulate different types of students. I also add discussion of the current topic from varying points of view. Of course, my course has a laboratory component where the students also get hands-on experience with the concepts from the lecture.

Third, the language that you use needs to be inclusive. Be aware of the common pitfall when asking students for their opinion that you don't single out a particular student to speak for their whole race, gender, culture, etc. Be conscious of your examples and the way that you present them so as not to offend any one person in the classroom. You certainly don't want to discourage, by your attitude or actions, anyone in their pursuit of a science degree.

Now…let me show you how I have been approaching teaching a "hard-core" science course as a diversity course. The course I teach is Biology 211: Microbiology.

Biology 211 – Microbiology
Spring 2003

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Office Hours: Monday & Wednesday 11:00 – 12:00
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Course:
Lecture: MWF 10:00 – 11:00
Laboratory: Monday 2:00 – 4:00
Tuesday 9:00 – 11:00
Thursday 2:00 – 3:00
Credits: 4.0
Prerequisites: Biology 113, one semester of college Chemistry

Texts:
Lecture: Microbiology: An Introduction, Tortora, Funke, & Case, 7th edition, Addison Wesley Longman, 2001.
Encounters in Microbiology, I. Edward Alcamo, Jones and Bartlett Publishing, 2001.

Laboratory: Microbiology, Vicki Stanavitch
Photographic Atlas for the Microbiology Laboratory, Leboffe & Pierce, Morton Publishing, 2000.

Course Description:
A study of microbiological morphology, taxonomy and physiology, characteristics of pathogenic and nonpathogenic microorganisms and viruses; chemotherapy, methodology of determinative bacteriology, and investigative procedures.

Course Objectives:
At the completion of this course, the student:
1. Will have a better understanding of the nature of the microbes in the world around us and how those organisms play a vital role in that world.
2. Will develop useful skills in culturing and identification techniques that can be used in the job market.
3. Will understand the implications of current treatment methods on future outbreaks of infectious diseases.
4. Will explore the concept of privilege and how it affects the control of microorganisms in the world around us.
5. Will explore responses to infectious diseases from many different perspectives.

Requirements:

Examinations: Three lecture exams will be given on the dates supplied in the syllabus. These exams will include all lecture material, articles, and discussion material for each chapter assigned. **Make up exams will only be given in extenuating circumstances and with PRIOR notification and approval.** Please make every effort to be present on exam days.

Assignments: The student should review each chapter prior to coming to class. Additional reading assignments will be given throughout the course of the semester at the discretion of the instructor. Homework questions may be assigned and will be due on the dates assigned. The student should be able to discuss the answers to these questions with the rest of the class. Written responses to many discussion topics will be required.

Paper: A 5-7 page research paper on a current microbiological topic is required. You should be prepared to discuss your topic from many different cultural perspectives. The paper should follow MLA or APA format for set up and citations. Five sources are required, of which no more than two can be from the internet. Specifics will be detailed when the paper is assigned.

Presentation: The student will be required to give a 10 minute presentation on the topic of their paper. The presentation must include some type of visual aid. A PowerPoint presentation is an acceptable visual aid. Other visual aids may be used with the consent of the instructor. Other than PowerPoint, the visual aid may not take up more than half of the allotted time for the presentation.

A group poster presentation will be required that will deal with one of the following diversity topics: Tetanus, HIV, Malaria, Chagas Disease. Other topics may be explored with prior instructor approval. The presentation will be given to the class during the week that the topic is covered in the lecture.

Attendance: The students are responsible for their own learning, but this learning will be enhanced by class attendance. No more than 3 absences (excused or unexcused) will be allowed. For every absence beyond three, the student's grade will be lowered one full letter grade. Students should plan to be on time and ready to work when the period begins. Tardiness is unacceptable and will be penalized. Three late arrivals will be counted as an unexcused absence and will be penalized as above.

Academic Honesty: As with any college course, academic honesty is expected. Plagiarism is unacceptable and will not be tolerated. Suspected academic dishonesty will be reported to your division chair and to the academic dean and may result in your removal from the college.

Grading: Your grade will consist of the following:

1. Three Examinations	300 points
2. Final Examination	200 points
3. Paper	100 points
4. Presentations	150 points
5. Attendance / Participation	50 points
6. Homework / Quizzes	100 points
Total:	900 points

*The lecture portion of your grade will make up 75% of your final grade and the lab portion of your grade will make up 25% of your final grade.

Syllabus

Week of:	Topic:	Readings/Assignment:
January 13th	Introduction to the Course	Self Disclosure Inventory
	Fever Without a Cause	Encounter #1
	The Microbial World and You	Chap. 1

- **During this unit, I have the students fill out a Self-Disclosure Inventory that allows them to examine their "Cultural Lenses" through which they will study science. This can affect how a student looks at a particular topic and will be important for the discussion of the many microbial caused diseases that we will study. We discuss the inventories after the student has completed them, although the student can disclose only the information that they feel comfortable with. I do not collect them, but I do ask the students to refer back to them periodically to re-examine their perspective.**
- **The reading "Fever without a Cause" is about a young man who traveled to Thailand and Mexico and contracted an *Entamoeba histolytica* infection. This reading can be used to discuss the disease Amoebiasis and the cultural and environmental factors that lead to this disease. Treatment methods can be discussed and factors leading to access to medical care or lack of accesss. Questions at the end of the reading are handed in after the discussion, with a brief description of the student's opinion of our discussion or some aspect of the discussion.**

January 20th	The Microbial World and You	Chap. 1 / Researcher Paper
	Observing Microorganism Through a Microscope	Chap. 3
	Blackwater Fever	Encounter #7

- **During this unit, I examine the history of Microbiology and how organisms are viewed with a microscope. I assign the students a small research project. They need to look up a Microbiologist / Immunologist who is not a white, male member of the science community. They will write a one page biography of their chosen scientist and present that person briefly to the class. This will enhance the students understanding of the science institution in general. We discuss why all the textbooks contain mainly information by white, male, privileged scientists and what societal factors lead to this occurance.**
- **The reading "Blackwater Fever" has to do with Malaria, so the first poster presentation will be due. This presentation will explore Malaria from the point of view of the "at risk" population for the disease. Prevention techniques are explored and how some of the techniques, although simple, are strongly resisted by the population. A short reaction to the presentation must be handed in by every student.**

January 27th	Functional Anatomy of Prokaryotic and Eukaryotic Cells	Chap. 4
	Firestorm	Encounter #2
February 3rd	Microbial Metabolism	Chap. 5
	Distant Echoes	Encounter #9

- **The last two chapters are pure factual information. I am still trying to decide how to add a diversity activity that would fit well with this information, but as of yet, I have none.**

February 10th	Microbial Growth	Chap. 6
	Mysterious Fevers	Encounter #12

- **During this chapter, we not only look at the conditions that are favorable to microbial growth, but we also explore the conditions that can be avoided to prevent microbial growth and why some cultural traditions may actually lead to the spread of microbes. I have the students explore one of their own cultural traditions that may promote microbial growth. After exploring one of their own traditions, I have them explore a tradition from another culture and describe how that tradition may promote microbial growth. Refusal of medical care based on religious convictions is the example that I give in class. This also leads well into the next chapter that looks at different methods for controlling microbial growth. A brief description of the traditions explored is handed in and the student's opinion is included.**

February 17th	Physical and Chemical Controls	Chap. 7
	Blindsided by Tetanus	Encounter #3

- **This is the second topic for a poster presentation on Tetanus and why vaccinations have not completely wiped out this disease worldwide. A brief opinion of the presentation topic is handed in by every student.**

February 24th	Antimicrobial Drugs	Chap. 20
	A Lethal Scratch	Encounter #11

- **During this unit, we look at the access to antimicrobial drugs by all people and the problems with their use and overuse in developing countries, as well as the same problems here in our own country. We also explore the concept of resistant organisms. A brief opinion of the discussion topic is handed in by every student.**

March 3rd	Microbial Genetics	Chap. 8
	Biotechnology and Recombinant DNA	Chap. 9
	Triumph by Treachery	Encounter #13

- **During this unit, we explore access to medical testing for all people and why these Biotechnology techniques should be available for all people.**
- **The reading "Triumph by Treachery" is the third topic for a poster presentation. It explores *Strongyloides stercoralis*, a disease predominant in tropical Third World countries and Puerto Rico.**

March 10th	No Classes – Spring Break	
March 17th	Domain Bacteria / Archaea	Chap. 11
	Coccus**	
	A String of Pearls	Encounter #4
March 24th	Bacillus**	
	Other Bacterial Types**	
	An Independent Diagnosis	Encounter #16

- **These groupings of topics are descriptions of the different families of organisms that are Gram positive and Gram negative. Numerous disease and disorders are explored, examining the cultural and social groups that may be affected. Treatment and prevention methods are discussed and lack of access to medical care is also re-explored.**

March 31st	Virology	Chap. 13
	A Deadly Specter	Encounter # 6

- **During the virology unit, we explore many of the viral diseases that affect humans. We include how these viruses are transmitted, treated, and prevention methods. Since a large number of STD's are viral, we explore the sexual contact aspect of contracting this viruses and how different attitudes about sex and sexuality may lead to the spread of these diseases.**
- **The reading "A Deadly Specter" is the fourth topic for a poster presentation. This presentation may take one of two forms…a look at the topic from the African perspective or the homosexual perspective. Both groups have a different stake in the game and different risk factors to avoid. A very ambitious presentation may actually look at HIV from both perspectives. A brief opinion of the presentation will be handed in by every student.**

April 7th	Environmental Microbiology	Chap. 27
April 14th	Food Microbiology	Chap. 28
	The Baby Who Stopped Eating	Encounter #8

April 21st	Fungi	Chap. 12
April 28th	Protists and Parasites Medical Parasites Intruder in the Heart	Chap. 12 Encounter #14

*Lecture topics are tentative and subject to change.
**This information will be found scattered throughout chapters 21-26.

Test Dates: **Friday, February 14th**
Friday, March 7th
Friday, April 25th
Final Exam Week – 5/5 thru 5/9
Paper / Presentation due dates to be announced.

- **The last three chapters that are covered are special topic areas. Environmental microbiology deals with the cycling of elements and nutrients in nature (definitely a factual topic), waste water management (different techniques are explored and the cost element is emphasized in choice of technique), and water testing techniques. Food Microbiology looks at the processing of food by the food industry for canning and prepackage products. The benefits of these processes are explored and why food poisoning can be a real hazard in areas where food handling procedures are less than sanitary. The last chapter is more medical in content…but we do explore the risks of parasites where sanitation and water treatment are not cost effective and little used.**
- **Most of the discussions lead to talk of how we could help improve or change the conditions in areas where disease is rampant and how those conditions can be changed in our own backyard. With the discussion, I hope to have the students consider that with any scientific approach, some cultural perspectives must be honored and what works for one culture may not work for another.**
- **The Joy Wallace article that I used can be found at:**
  http://www.col-ed.org/smcnws/equity/profile.html
- **The Self-Disclosure Inventory that I am including comes mostly from Arthur Breese of College Misericordia. I only made a few changes to some of the questions to relate them more to a science class and less to a teaching class.**

SELF-DISCLOSURE INVENTORY

INTRODUCTION:

In this class our discussions will revolve around the subject of science and its relationship to social background and teaching practice. Your self-disclosure via this inventory will help you to determine what colors your view on many scientific topics. When you introduce yourself to the class, you will only have to disclose those elements of the self-disclosure that you feel comfortable sharing with the class. Please use additional paper to complete your response when necessary.

1. Name:_____

2. Specialization:_____

3a. Sex: Male / Female

b. Age:_____

c. Race and/or Ethnicity:_____

d. Religious Affiliation, if any:_____

4a. Are you fluent in any language other than English? YES / NO
If yes, please specify:_____

b. What languages were or are spoken in your childhood home?_____
_____

5. How long has your family/ancestors (both sides) been in the United States?_____
_____

6. Where did your family/ancestors (both sides) come from before arriving in the United States?
_____

7. What is the name of your hometown/city and state? _____

8. Indicate the distance of your hometown/city from Keystone College.

_____less than 50 miles

_____between 50 and 100 miles

_____between 100 and 200 miles

_____more than 200 miles

9a. Check all of the adjectives that describe the type of community in which you spent most of your time growing up:

_____rural

_____suburban

_____urban

_____low-income

_____working class

_____middle class

_____upper middle class

b. Was this community either racially/ethnically segregated or predominantly of one racial/ethnic group? YES NO

If NO: Skip to 9c

If YES: What was the predominant racial/ethnic group?

c. Was this community racially/ethnically integrated? YES NO

If NO: Skip to question 9d

If YES: What racial/ethnic groups were present and in what q proportions/percentages?

d. Provide other descriptors of the community in which you spent most of your time growing up:

10. Indicate the highest level of education completed by your parents or guardians.

11. Indicate the occupations of your parents/guardians.

12. Please check the option that best describes the social class background of your household.

_____low income _____middle class

_____working class _____upper middles class

13. How many siblings do you have?_____

14. Have you traveled outside of your home state? YES NO

If YES, please indicate where:

15a. Please identify an author, book, film that you have especially enjoyed or was significant to your life. Why?

b.If any religious texts such as the Bible, Koran, or Torah particularly significant in your life, please discuss how and why they were significant.

16. Please describe a ritual or significant event that you value or has been especially important in your life. Explain why this is the case.

17. Have you ever experienced interpersonal conflict because of your race, ethnicity, gender, cultural group, or an organization you were active in? If so, please describe one or more of these conflicts. Was this conflict resolved in any way and, if so, how?

18. Do you feel that your racial, ethnic, and/or cultural group membership (and the latter includes gender) has been a positive feature in your life? If so, briefly explain why.

19a. How many CLOSE friends do you have? _____

b. How many of these close friends are of a different racial/ethnic background than you?

If more than zero, to what racial/ethnic groups do they belong?

c. How many of these close friends are of a different social class background than you?

20a. Why do you think students fail in science?

b. Why do you think students succeed in science?

21a. In what ways (if any) do you think you were advantaged studying science in school?

b. In what ways (if any) do you think you were disadvantaged studying science in school?

22. Briefly discuss your most memorable high school teacher. Please explain why this was the case.

23. Briefly describe the reason that you chose to study science.

24. Briefly describe the person who most motivated you to study science.

25. What do you most want to accomplish with in your career in science?

26. Have you had any other college courses that dealt with issues of culture or diversity? If so, please list.