Community Building as Teaching: Reforming an Introductory Biology Course

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Until 1992, Principles of Biology I at Hope College was a typical introductory course for majors, described by some as "boot camp biology." Students referred to the course as a "weed-out class" and acted accordingly: 10% or more of the 200 students dropped out before the end of the semester, and only about 50% of the students continued on to the second semester. We taught the course like that for many years and had found ways to justify it, but in 1990 and 1991 I was learning about movements to reform introductory biology, and I had to face the unpleasant fact that my own sons, about to enter college, would not thrive in my course, nor would I want them in there! I could see that it didn't have to be that way, so I applied what I was learning to transform our boot camp into an inclusive and cooperative learning community.

Tobias' (1990) study of a "second tier" of students who are very capable of learning science but not inclined to tolerate the standard way of teaching introductory courses was one important starting point for changing Principles of Biology, as was Project Kaleidoscope's (1991) call for the construction of "natural science learning communities." But the central experience behind the change was the opportunity to be academic director of the first Woodrow Wilson National Fellowship Foundation Leadership Institute for high school biology teachers. (See Howard Hughes Medical Institute 1994 for a description.) Those institutes are among the most intense experiences of learning communities that I have ever encountered. Just as the Woodrow Wilson teachers modeled for me what a learning community could be, I decided to set up a model community of faculty and students engaged in Principles of Biology.

The common life of the learning community
The construction of an atmosphere for community is our single most important act as teachers. A successful community strikes a balance between the vision and goals of the group and the differences among its individuals, so the job of teachers who build communities is to make possible the development of a common vision and to identify and respect the individual differences among our students. We work hard on the common life of our community.

Our first step simply involved changing the order in which we presented material. Instead of starting with molecular and cell biology, we put plant and animal diversity and physiology in the first semester. We wanted to begin with the students' own experience since that was a common possession that we could build on. Molecules, cells, genes and ecosystems are abstractions for most of our students, but they experience a diversity of middle-sized plants and animals, and they experience their own physiological control mechanisms every day. We now teach molecular and cell biology and genetics as well as population and ecosystem ecology in the second semester course and consider the five kingdoms and their physiology in Principles of Biology I. We call it "Homeostasis In All Its Living Diversity." That change alone raised the percentage going on to the second semester from 50% to 70%.

Most communities have common symbols like flags or company trademarks, so we developed a logo for the course which appears on the syllabus and on much of the other material we hand out during the semester. We used a bison for our logo the first year and an egret the last three because those animals were on the cover of our text book. The syllabus contains short essays about the philosophy of the course which call for personal responsibility but also give numerous indications that we are all in this together and are ready and willing to help each other out. There is a discussion of how to form study groups and an indication of the resources of the college Academic Support Center. We also appeal to an ethic of hard work and high standards, which we think is appropriate for any learning community.

Throughout the semester we create events which become the property of the group, things the class can talk about and incorporate as part of
a community identity. For example, we hold our second class period at a movie theater rather than in the class room in order to show Anima Mundi, a 35 minute movie of fantastically beautiful wildlife photography set to the music of Philip Glass. It revels in the great diversity of living things and does so in a way that excites and inspires the students. Its images hover over the rest of the course. About three times during the semester we play a game that resembles Bingo which is designed as a review of some of the material we have been covering. We play the games in teams of two and give the winners prizes of sufficient nuttiness to make them memorable, such as yeast rolls when reviewing fungal life cycles.

Functioning communities have media for communication that build an identity. Radio stations certainly do that for groups of teens, and newspapers function for cities or regions. For our community, we established an advice column called Ask the Bison or “Ask the Egret,” which was built upon questions students sent in about how the course was conducted, about the subject matter of the course, about broader questions on biology or about college life in general. Students deposit their questions in an “Egret Box” brought to class each day or send them via Hope College e-mail to the address EGRET.

The advice column has become an exciting aspect of the course. At first it seemed a bit frivolous, but it has knit the community together in wonderfully gratifying ways. Students can ask questions about things that bother them — the difficulty of a recent test, a sudden upsurge in the number of terms they have to learn, how to cope with ideas that seem to contradict long held values. We answer every question, so they know they will get a hearing, but we do not identify the writers, which reduces anxiety about asking. There are many other kinds of questions being asked. Last year a continuing series on squirrel behavior was launched by a question from a student about squirrel vocalizations. Others wrote in to challenge the conclusions of the first student and of the Egret by making their own observations and reporting on those. Other questions are decidedly frivolous and just for fun, and the Egret (and the Bison before it) tries to maintain a humorous and light-hearted tone in replying. Thus the serious questions lose some of their sting. Students feel more comfortable about speaking up. The weekly appearance of Ask the Egret is eagerly anticipated by the students, but we equally eagerly anticipate the questions to keep us posted on potential problem areas and to give us the chance to continue encouraging and building the community.

Finally, we have a single faculty member in any one section. This was a change from a common practice in introductory biology of having a series of faculty each teach part of a semester — a practice which many students dislike intensely. Having a consistent leader helps develop a sense of community, and it is less confusing to the students. The faculty of Principles of Biology form their own cooperative learning group. We coordinate the sections closely so that all of us do the same things each day, and that allows us to share the efforts of developing learning materials, lectures and tests. Cooperative learning groups work for the faculty too! Respecting individuals in the learning community.

Healthy communities respect and value the differences among their members. In a learning community, that means both recognizing the differences in learning styles among the students (3), and including different ways of learning during class periods and corresponding evaluation. We are learning how to teach in new ways. In the first year we agreed that at least one out of every three class periods would be conducted in some manner other than lecture, and we agreed that there should be lots of different approaches. We wanted as many students as possible to find activities that allowed them to thrive as well as the “first tier students” seemed to thrive on lectures and multiple choice tests.

There is no one teaching method in Principles of Biology I. Sometimes we form cooperative learning groups during class, and early in the semester we include an exercise on how to manage learning groups. We sometimes give out data from experiments and work them through together. Occasionally we have formed groups to work on a set of data outside of class and produce a
written assignment to hand in. I write "dialogues" (1) which the whole class performs simultaneously (aloud!) in pairs. The goal of the dialogues is to provide a safe way for the silent people in the class to talk about the material and to introduce ideas that can be packaged in an engaging manner in a dialogue but are tedious to present as a lecture. We present dramatic demonstrations of concepts such as "Blend-A-Plant" in which we illustrate levels of organization by considering the properties of a flowering plant before and after putting it in a blender and "Fizz Facts" in which we study the solubility properties of gasses using soft drinks. There are debates based upon the information on nutrition labels, and an exercise to consider what part of the human life cycle is affected by various methods of birth control.

We had to find more ways than multiple choice tests for evaluation too. Put simply, if it isn't evaluated, students won't consider it important. Many features of learning can be evaluated with good multiple choice questions, so we still use those. But we have expanded the range of ways students can show what they have learned. Student performance on all of these class and group activities is monitored and evaluated through a system of "cards" which we collect from time to time and which are a significant contribution to the students' overall grade. The Egret Card is a 5X7 card with the Egret logo and a space on one side for a name and other identification. The other side is for information to be evaluated — the conclusions of a cooperative learning group, what a student learned by attending a research seminar, reactions (sometimes even feelings) regarding a movie or other event. The cards are each worth a relatively small number of points but collectively all the cards carry significant weight in the final evaluation. Students do not know ahead of time when a card will be collected in class, and there are no make-up cards, so even class attendance has a positive value. We also have occasional written assignments, and our exams have always included essay questions which ask about the experimental basis of ideas presented in the class.

A significant number of students do not do as well as they or we would like on the first exam. On the day when the exam is returned we announce that performance below a certain level is intolerable to us as those responsible for the community, and we provide weekly review sessions which are mandatory for those who got below a certain score. These sessions result in considerable improvement in the overall performance of the class on subsequent tests, and they are one way we have of making good on our commitment to community success.

How is it working?

Since 1992, in some sections we have had no students withdraw from the class, and we seldom have more than three withdraw out of sixty or seventy even though the grade distribution is only slightly higher than before the changes. This is a decided decrease compared to 10% or more prior to 1992 and is an encouraging sign that students feel included at whatever level of achievement. The increasing reputation of Principles of Biology I has encouraged other faculty to teach some sections using the same approach. Some have reported that when using the new approach they have received the highest student evaluations they have ever had for this course. In my own case, I have received very high evaluations, but also some wonderfully backhanded complements. For example, one student wrote, Dr. Cronkite didn't teach me a thing in this course. I had to learn it all myself. For a professor who had just launched himself from the safe, controlled world of authoritative lectures into group learning and multiple teaching strategies, this couldn't have been a better evaluation.

At least one of the faculty has begun introducing the methods we use in the introductory course into his upper level physiology course, so the course is functioning as an agent of change for the entire departmental learning community.

The movement for change in science education includes a number of programs for reform from the top down through the creation of national standards or curricula. These efforts have their place, but I am convinced of the need for change from the bottom up, one teacher and even one lab exercise at a time. I was drawn to the Institutes of the Woodrow Wilson National Fellowship Foundation because of their central conviction that given the tools and the inspiration, teachers can be trusted to create the reform we all seek. I see that work with the Woodrow Wilson teachers, and my hope is for Principles of Biology to continue to function in a similar way as an agent of change. Gradually, but in ways that make a difference for our students, my colleagues and I are using the strength of community to change ourselves into better teachers.
Acknowledgments

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Literature Cited


AMCBT Seeks Logo

Interested individuals are invited to design a logo for AMCBT, the Association of Midwest College Biology Teachers, founded in 1957. The designer of the logo selected will be awarded $100 following the meeting and a short article featuring the logo will be published in the Bioscene. AMCBT logo designs should be submitted to the program chair by September 6, 1996 in order to be posted for members to view at the 40th annual meeting at Loras College on September 19-21, 1996. Logos will remain on display from Friday morning following breakfast through the Saturday morning break in the foyer of St. Joseph Science Hall. Color versions of the logo are encouraged for incorporation into electronic media, but the logo should be easily reproducible in black and white for printed materials.

The objectives of this organization described in its constitution are:

- to further the teaching of the biological sciences at the college and other levels of the educational experience

- to bring to light common problems involving biological curricula at the college level and by the free exchange of ideas; endeavor to resolve these problems

- to encourage active participation in biological research by teachers and students in the belief that such participation is an invaluable adjunct to effective teaching

- to create a voice which will be effective in bringing the collective views of the teachers of the biological sciences to the attention of college and civil government administrations

The organization maintains a web site that includes extensive archives of its journal, the Bioscene, newsletters, and past meeting proceedings as well as current information. This excellent source of information about the organization is found at the URL : http://papa.indstate.edu/amcbt

For more information, please contact the current program chair: Ethel Stanley, Beloit College (608) 363-2284 or (217) 428-2373 or be email: stanleye@beloit.edu