Essays on Teaching Excellence

Toward the Best in the Academy

Volume 4, Number 4, 1992-93

A publication of The Professional & Organizational Development Network in Higher Education (www.podnetwork.org).

Disciplinary Cultures and General Education

Sheila Tobias, The Research Corporation

For some years, I have been exploring the response of otherwise intelligent students to the prevailing discourse of disciplinary instruction. Note that I do not speak of the prevailing discourse of the disciplines. For while we claim to be introducing our beginning students to the disciplines we teach, the way we structure courses and measure performance often distorts or leaves unexplored the way our discipline is actually practiced. It is not surprising, therefore, that many intelligent and hard-working newcomers to our fields find them to be disciplines outside of what I call their "comfort zone," disciplines which do not "play" to their strengths. An underlying theme of any discussion of general education should be that there are a variety of "disciplinary cultures," and that it is a particularly harrowing challenge for students to cross from one to another.

As I discovered while studying "math anxiety," for anxious and avoidant students, mathematics is never just a subject but a relationship between themselves, the subject, and all who are better at it than they. Such relationships are as much influenced by teacher expectations, pace, exams, and style of presentation as by pedagogy and course content. In short, I believe students bring a "cognitive self-image" that bears on their approach to general education, their willingness to study and their capacity to succeed. For many students, a course in a discipline not their own is "hard" not because its content is too difficult for them, but because it is "packaged" and "purveyed" in unfamiliar ways.

To get a closer look at how subjects are "enculturated," and how that affects students, I placed three artificial populations of intelligent, accomplished outsiders in short and semester-long introductory courses in disciplines very different from their own.

The first were professors in fields other than science and mathematics, whose ability to think and to reason abstractly were indisputable, whose focus and concentration more than adequate. Placed in introductory science classes, they were to behave as undergraduate students, but also to keep a more sophisticated record of the teaching style and their response as learners. Second I invited a certain number of distinguished science and engineering professors to commit to studying Chaucer and Wordsworth in a junior-level five-day summer poetry seminar. The third group I called "second tier" students based on my hypothesis that a good many students are rejecting science even before it rejects them. These were nonscience graduate students who would devote semester-long study to introductory physics and chemistry and share with me both daily logs and a final essay about their experience.

The reactions to the disciplines of poetry and science from these "outsiders" suggest that it is the habits of learning, the new relationships that have to be constructed between learner and subject, and the packaging of courses that are highly problematic for these students. My conclusion at this point is: Students who may be fearful, avoidant, and even hostile to courses that we think are "good" for them to take, are not dumb; they are different. Theirs is not a failure of intellect, but a failure of fit.

A few examples of the problems they experienced help us think about what might serve to make the next generation of general education courses succeed.

The Missing Overview When non-science faculty were exposed to two days of "waves in elastic media," a number revealed they had trouble "following the lecture", both because there was no "overview" and because their traditional note-taking did not clarify the matters at hand. Active learners seek to translate new material into language they can understand, to hang topical detail on some overarching structure. But this is difficult when one is new to a field and not told where one is heading. One professor wrote:

Two things struck me about this mini-course. First, how interesting the material was and, second, how when I did not understand something immediately, my mind locked and I felt helpless. It seemed to me during these lectures that I lacked any framework of prior knowledge, experience or intuition that could have helped me order the information I was receiving. I had no way of telling what was important and what was not. I had difficulty distinguishing between what was being communicated to me merely for purpose of illustration or analogy. I could not tell whether I understood or not. Nothing cohered.

Scientists expect students to write down what they do not understand in order to grapple with it later. But students in other fields are not comfortable with this. From another professor, coping with the calculus, came the following insight:

I simply cannot write down what I do not understand.... I just can't put it into my notes if I cannot put it into my own words.

Problem Solving Our extremely intelligent learners in science grew, in time, to like problem solving, especially the setting up of the problem. They understood that "the physics is in the diagram." But in general, they found introductory physical science to be mired in a "tyranny of technique." And that teaching in science was little more than "doing problems."

Michele, a graduate student in philosophy, felt that the excessive focus on problems solving robbed her of the opportunity to "creatively interact with the material." She wanted something other than problem solving. She wrote:

My curiosity simply was not satisfied by the simple quantitative solution. I was more interested in "how" and "why" questions than in "how much." I wanted verbal explanations, with formulae and computations only as a secondary aid. Becoming capable at problem solving was not my major goal. But it was the major goal of this course.

"Simplify and Solve" Jacki was distracted by the deeper questions that the material suggested and found it limiting to merely "simplify and solve" her physics problems. Coming out of English and creative writing, she was used to putting a premium on finding complexity in issues that might seem simple. Studying physics required her to reverse her normal strategy. The deeper questions she was asking were important, and she wrote about these in her journal. She thought at first that the students sitting next to her were also engaged in these deeper questions, but, as she wrote:

Under time pressure and because the only feedback we get is on the homework assignments which are all problem-solving, I think the students around me are not pursuing these questions and eventually they will learn to disregard them as "extraneous" not just to this course, but to physics as well.

Examinations The problem of tyranny of technique is further exacerbated by narrow skills-testing on examinations. In some situations, although concepts were presented, even expanded upon, none of this material found its way onto homework assignments or examinations. As a result students learned to disregard these as "diversions." One of our visiting faculty made this observation:

The way an instructor operationalizes the goals for the course is not simply to speak them or to put them in a handout, but to incorporate them onto his exams. While the professor was talking concepts, his exams were testing numerical solutions. And he probably ever realized what the students discovered early, namely that the concepts and the history didn't really count.

More significantly, our outsiders did not find their exams in physics and chemistry to be "stretch experiences" for them. One wrote:

The problems on exams seldom required the use of more than one concept or physical principle. Only once were we asked to explain or comment on something rather than complete a calculation. The final asked the most primary, basic questions about only the most important laws of physics. I had woefully over prepared. We were not required at any time to interrelate concepts or to try and understand the "bigger picture."

Abstractions and demonstrations Many science professors believe that students who have trouble with their courses may be intelligent but not as capable of abstract thinking as they need to be to study science. None of the participants in these experiments had trouble with abstract concepts per se. They had, in fact, more trouble with the concrete than the abstract. A biologist wrote of the demonstrations:

There were times when Isaac's demonstration just didn't make the point, but when he put it into words, I understood. And then I wished he would do the demonstration one more time because I thought that then I would see what we were supposed to have seen.

A more profound criticism of demonstrations came from a professor of philosophy:

There were two types of demonstrations for us -- at least I think there were. The first is what I would call a "clarifying demonstration," such as the passing of a wave along a slinky, and the second, what I would call a "confirming demonstration," one that made a difference in the history of science but one that required us to follow something that was either moving too fast or that required a level of understanding we did not yet have.

Since it was sometimes not quite clear what one should be looking for, the demonstrations became for him "just one more subject to learn."

Here is a clear case of miscommunication. The professor of science relies on his demonstrations to clarify complex material, but to the uninitiated these were barriers to understanding.

Language The issue of language was for both our scientists studying poetry and for our nonscientists studying science a barrier. Our nonscientists were aware that science and mathematics use language sparely and very precisely, also that "ordinary" words have particular meanings in science and that these meanings may be quite different from what they are in other contexts. As a result, however, they wondered about all expressions. One commented that he found the language comprehensible except for some words that were used in several different ways at once. He gave some examples that made him realize he was in "unfamiliar territory."

The idea of zero or zero-ness. Unless a non-physicist deliberately thinks about it, zero is the absence of anything, the absolute bottom or "start." But to the physicist, zero is actually in the middle with plus and minus quantities on either side.

Scientists studying poetry Since I realized that my student stand-ins brought to courses in other fields, even brief ones, something of the cognitive self-image I spoke of earlier: non-rational expectations as to what would be "hard" and what would be "easy" and how they would do, I instructed the 14 science and engineering faculty to begin to keep a journal record of all their thoughts and feelings even before their poetry seminar began. One chemist offered the following description of his state of mind. Prior to the arrival of the books, he had fully expected to have a very hard time with Chaucer -- after all a very distant poet and one whose works would be dealt with in part in Middle English. He was sure that Chaucer would be more difficult than Wordsworth, 19th century poet who shared the chemist's fascination with Nature. But when the books arrived, the chemist changed his mind.

The Chaucer looked like, weighed in like and was organized like a chemistry text. There was a table of contents, notes and help items, and the first assignment was on page 1. But the Wordsworth was just two bare volumes of poetry with no annotations in no particular order and the first assignment was on p. 127.

How was he going to deal with a subject that was not vertical?

Talk, talk, talk Not just the material, but the "features of the delivery system" were a problem. As another engineer wrote after the first day:

The mode of presentation -- start talking and keep talking -- was certainly "different" (I almost said "disconcerting"). Engineers tend to think graphically and to seek structural models for everything, and so my notes have lots of graphic doodles in the margins: a time line for Chaucer with the Great Vowel Shift marked in color. (He *brought his colored pencils to the seminar.) and abortive directed-graph taxonomy for Wordsworth, trying to connect his odes, sonnets, elegies and preludes, with arrow. (vectors)*

The science and engineering professors were distressed that there was:

Nothing on the blackboard, no diagrams, no key words, no outline, no nothing. I found it very hard to follow a lecture that was just words and more words. What was most important? What was not? And the furious writing going on around me. What the hell did they find to write down that was so interesting?

When, well into the late morning of the first day, the Wordsworth instructor finally did write something on the blackboard, everyone cheered.

Meander and Grope The scientists had trouble particularly with the lack of "linearity" of the seminar. The problem to them seemed to be one of sequence.

In science and engineering, we claim to build multi-story edifices starting from strong but simple foundations, with the elegance and subtlety of the principles and relations growing as one ascends. By contrast, the making and assessment of literature seems akin to building and visiting suburban subdivisions: just drop in anywhere and chat with the neighbors; no neckties needed. Some of the neighbors may talk in code, but if that gets heavy, just move on down the block.

They found it difficult to write papers when the assignments were elliptical, such as "How seriously does Chaucer take the Prioress (a character in the Prologue) and how does he take her seriously?

One engineering professor, struggling with that assignment, said he'd fully expected to have trouble finding the answer to questions in the humanities, but not that he would not be able to understand the question. Another wrote what he thought dealt with the question and when he showed it to his wife, a graduate in English, for her approval, she told him it was "too short." "Too short?" he wailed. "I wrote enough to answer the question." Yet, when he got his paper returned, the instructor's comment was that it was "too short." Which means there are conventions in literary analysis for how much is enough to answer a question that outsiders to literature aren't explicitly told.

Interpretation The scientists and engineers were skeptical about interpretation more generally. Most of all they were put off by the "ambiguities" both in poetry and in its interpretation. One said, at the end:

I am used to reading for what is on the surface, not for what is hidden. Poetry seems to favor the expression of ideas in purposefully complex and equivocal language.

Conclusions What conclusions for General Education can we draw from these experiments? One conclusion, not mine, might be that disciplinary cultures are so different that it is likely scientists and literary critics are born and not made. Best for students to find the subjects that are intellectually and temperamentally suited to them, and leave other disciplines to those who find them more to their taste. Another conclusion for general education courses to explore, however, might be this one: I think we college educators owe our students an education that leads them not just out of their ignorance but very intentionally enlarges their comfort zones as well. And those who teach in college owe ourselves the experience of being on the boundaries of other disciplines, too.