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The most important thing I've learned as a teacher is that it's not about me. It's not about *my* teaching. It's about *their* learning. Coming to this point of view was a process that developed over time and involved accepting gifts of insight from colleagues whose teaching I admire and from wonderful workshops and materials offered by the Center for Excellence in Undergraduate Teaching. In retrospect, I see that learning about teaching produced a transformation that included four sets of changes. With the privilege of learning comes the responsibility of sharing. I offer the story of those changes and the strategies that emerged in the spirit of the gift. If something here helps you, I ask you to pass it on to someone else, inflecting it with your own experiences.

Shifting My Focus

The first change in my approach to teaching was most crucial, involving a shift of focus. It slowly dawned on me that my main challenge in teaching was not to become a virtuoso who both demonstrated total mastery of his subject and successfully transferred that knowledge to his students through pedagogical performances that achieved crystal clarity through emotionally compelling and memorable experiences. Rather, my challenge was to figure out how what I had to offer might make a difference in the lives and careers of learners who arrive from different pathways into a classroom we briefly share.

Certainly my contributions to student learning experiences (i.e., my teaching performance) could not be successful if students found the interactions boring. Indeed, I am persuaded the whole process of making a difference in the lives and careers of students works best when the experience is emotionally compelling and memorable, that is, when it is fun, when it speaks to ongoing and expected struggles in students' lives and work, and when it helps students practice identifying and intelligently confronting difficult issues.

But learning to shift focus from *me* to *them* meant that delivering knowledge in class with perfect clarify was neither the ultimate goal nor even an especially useful measure of the quality of my teaching. Asking students "Is that clear?", and then watching them ritually, and often mindlessly, nod their heads was not a good method for determining whether or not significant teaching and learning had just taken place, no mater how thorough my preparation nor how much I had agonized over presentation.

Such a focus on presentation provided no evidence, for example, that students had generated intelligent responses to what they had just seen and heard, and had begun to locate those responses in relation to other responses they had generated to other learning activities prior to coming to that particular class or assignment. Rather, "being clear" was about me alone. It was about my efforts and desire to achieve, demonstrate, and perform senior standing in my intellectual arena.

But their learning is not about my virtuosity.

Critically Assessing My Own Trajectory

A second change in my approach to teaching was to develop a greater critical awareness of my own location as a teacher, including my own trajectory as a learner, what sorts of knowledge I gained in the process, and what my stakes were in teaching.

At the undergraduate level, my teaching lives primarily in the environment of the elective, and the bulk of the students I engage are pursuing majors in engineering. I view the elective course as the core, exemplary model of the entire academy because the elective course, in contrast with the course in the major, has to convince students of its value. I view the academy as a collection of cultural projects, each with a constituency both inside and outside of the academy. The competition among these projects is not to attain a total state of knowledge but to make a difference in the outside world. To that end, every project of knowledge production inside the academy, including all research, has to convince its outside constituency it has value. The elective course is a place to practice this activity in the protected space of the university.

I came to the elective course through an intellectual trajectory with two threads. One is about engineering. I was raised in Pittsburgh by a predominantly lower-middle class family. Almost all of the men worked in trades of various sorts and all of the women worked at home. My generation faced expectations pertaining to both social class and gender. I joined my brother and male cousins in aiming for engineering, and all of the women, including my sister, became either teachers or nurses. I really loved learning engineering at Lehigh University. I also worked in the summers as an apprentice engineer in steel mills, at Eastman Kodak, and at a small company that made glass bottles.

The other thread is the one that led me to interdisciplinary work. I studied Spanish continuously through high school, and in eleventh grade I had a dream entirely in Spanish that changed my life. I began to realize there were other ways of looking at the world besides the way I understood it. I got interested in studying different perspectives. While learning mechanical engineering, I found myself reading extensively about public debates over new technologies, such as nuclear power and radioactive waste disposal, and I found I could understand technical arguments on both sides of these debates. What I could not understand, however, was why people were fighting. How could people who were highly trained, knowledgeable, and with high degrees of personal integrity disagree with one another systematically, and even violently, about such things as nuclear power? I realized my engineering training, for all its strengths, was not preparing me to work in a world with people who defined problems and understood their work differently than I did.

Following these questions led me to spend an extra year as an undergraduate completing a degree in the social sciences. I then took a flying leap into graduate school in cultural anthropology at the University of Chicago. A deepening interest in controversies over technology shaped my master’s and Ph.D. research and then led me to postdoctoral research at the National Academy of Sciences and faculty positions in interdisciplinary Science and Technology Studies (STS) at Michigan Technological University and, finally, Virginia Tech.

STS is a relatively new interdisciplinary field built on two sources of legitimacy. One source comes from within the academy, as researchers from history, philosophy, and sociology of science and technology found themselves asking questions they couldn’t answer with tools from their own fields. Over time, a community was built around the core question: What is the relation between the knowledge dimensions and the social and cultural dimensions of problems involving science and technology? The other source of legitimacy comes from society at large. STS has a responsibility to help society address and solve problems that involve science and technology.

When I began teaching at Virginia Tech, I tried to bring insights from the liberal arts to engineering students. Basically, I was helping students recognize and even expect technical problems to have complex, non-technical dimensions. The students were genuinely engaged in the experience, and I received lots of high instructor evaluations in those courses.

But I always had this nagging doubt. What are they doing with these insights once they leave my classroom? Are the benefits of the class limited to this space--to only our interactions right now? I was training them to recognize complexity, to appreciate complexity, to expect complexity, but I gave them no tools for grappling with complexity. Nor did I give them any guidance on how to take this understanding of complexity and relate it to what they were learning in their engineering courses. As I came to the realization that successful teaching was about learning, I also realized I needed to develop a different type of course.

Researching the Trajectories of Students

Just as I needed to critically assess my own trajectory, I needed to develop a deeper understanding of the trajectories of students. This third change in my approach to teaching involved accepting the never-ending and always-changing responsibility of figuring out who my students are in relation to the course at the point of their arrival. To maximize the possibility students successfully integrated learning from the course into the knowledge and practices they were gaining in their majors, I had to better understand how students were predisposed to view the course and its material prior to encountering it. On what sorts of trajectories were they traveling?

With support from the National Science Foundation, I supervised an ethnographic study of undergraduate engineering education. I learned how the rigorous method of engineering problem-solving confronting students at the undergraduate level could have the unintended consequence of training them to divide the world into two parts: the right and the wrong, the rational and the irrational. Quite possibly, the very rigor of the engineering method might be inhibiting the professional competence of engineers to work in arenas where people define problems differently from one another. I began to see the need to train students to work in a world where people drew boundaries differently.

In addition, I learned the core emphasis on technical problem-solving trains engineering students to view courses in the humanities and social sciences as “opinion courses.” In order to succeed in an opinion course, the student has only to figure out the opinion of the instructor and then plot strategies to engage that opinion in ways that avoid rejection. The key criterion in selecting an opinion course is that it not lower the student’s grade point average.

In order to successfully engage and inflect the trajectories of engineering students, I had to develop a “knowledge course” that both resisted the opinion label and provided students with first-hand experiences confronting perspectives other than their own and engaging those perspectives as positions that had value. The course Engineering Cultures emerged, developed with a colleague who was then a graduate student.

Engineering Cultures takes students from country to country, helping them see that what it means to be an engineer has varied significantly, along with the types of knowledge engineers value most highly. It also follows the history of engineering in the United States in order to document the emergence of differences by disciplines and career trajectories that live right here in our classroom. Students also explore differences by gender and race. Who is here and how did you get here? Who is not here and why? The course also offers "Problem-Solving with People," a self-styled enhanced engineering method that begins with strategies for defining problems with other people.

Mapping Student Trajectories within the Course

The fourth change in my approach to teaching, which extends the other three, was to structure the course around student trajectories, including strategies that maximized the likelihood students would be convinced the experience had take-home value. Enacting this objective made the course significantly more complicated. The successful operation of the course became a story of student development. It was joining student trajectories and inflecting them in stages.

Engineering Cultures begins by using examples to illustrate what the dominant model of engineering problem-solving includes and what is left out. Indeed, a dramatic performance of this view in class is not about achieving virtuosity but about building credibility with students, as in "I too am an engineer and not simply a holder of questionable opinions."

While surveying national histories, course assignments insist students both learn about different perspectives on engineering but successfully perform those perspectives as well. For example, exams are structured to feel like exams in engineering in that they require students to demonstrate dedication in completing reading, attending class, and paying attention. While some exams do have short essays requiring 15-20 minutes of writing, a 50-minute exam usually consists of 7-8 questions calling for 4-5 sentences each.

Equally important are the many informal oral and writing assignments in which students must, for example, write a dialog in which they, as Japanese engineers, are engaged in negotiation with American engineers; mediate among French, German, and British engineers working at Airbus; draft poetry that captures the early dreams of socialist engineers in the Soviet Union; or enact the debate between design and manufacturing engineers at General Motors in the 1920s who disagree about the merits of a copper-cooled engine.

To insure building a course around student learning was not simply a delusional and narcissistic projection of the utopian fantasies of its founder, it became important to research how trajectories of student learning and identity were influenced by the course. In addition to the standard instructor evaluations, graduate student assistants, my co-founder, and I developed three instruments for measuring and assessing student learning in the course. A pre-post multiple choice test evaluates content knowledge, a pre-post essay test evaluates ability to engage differences, and a final survey traces changes in students' predispositions regarding those who define problems differently.

In sum, a seemingly small reversal in my thinking about what counts as teaching ultimately had a profound and continuing effect on my daily pedagogical practices and how I understand my interactions with students. On the one hand, it took the pressure off. It's not about me. On the other hand, it put the pressure on, adding a new and never-ending challenge. I need to learn about and engage *them*. In my judgment, so do you.

"The best thing I can say about Gary Downey is that his Engineering Cultures course changed my life. I walked into the first class wondering how, as an engineer, I could fulfill my dreams of serving society in a meaningful way. I walked out of the last class knowing exactly what I needed to do to be happy, satisfied, and successful as an engineer. No single course or professor at Virginia Tech had a greater impact on my life." Sam Stone (B.S., Computer Engineering, 2004; Ph.D. candidate, Computer Engineering, University of Illinois).