Teaching Philosophy **Michael J. Janik**

As an undergraduate student, my approach to engineering courses differed substantially from non-technical courses. In my engineering courses, I would sit towards the back and often read a magazine to stay awake. I could count on not being called on for any active participation. If the professor was so daring as to ask the class a question, I could count on someone else to raise their hand. I could cram for each test as necessary and get a good grade, so I waited until the night before an exam to engage in the material. This contrasted substantially with my other courses. In English class, we would discuss the week's reading or provide group critique on a student's essay. In my poetry seminar, every week was a discussion of our poetry, and occasionally we would sit with only candlelight and try to be creative. My U.S. Congress class had constant debate over historical or philosophical issues in the construction of our government. Not surprisingly, I chose to write for a weekly political magazine, participate in poetry readings, and join debates at the political union over joining an engineering research laboratory or participating in undergraduate engineering honors or student groups.

I graduated and took a job in industry as I could not imagine sitting in a full-slate of Chemical Engineering classes in graduate school. It took my experience as a Process Engineer and graduate courses at night to get me engaged and excited about my Chemical Engineering profession, and motivate me to return to graduate school and pursue an academic career.

As a teacher, I aim for an interactive classroom that engages and excites students to meet the course objectives. In the core Chemical Engineering courses I have taught, daily interactive exercises help assure students come to class prepared and stay involved with the material throughout the class period. Interactive exercises are sometimes simply stopping a derivation and asking students to work with their neighbor to determine the next step. More involved exercises break students into groups to complete a table of process relationships (if x goes up, what will happen to y) or to brainstorm on applications of a concept. More intricate group activities, such as a climate change regulation exercise in which students negotiated "non-binding regulations" on the number of quiz bonus points they could request, can help students internalize difficult concepts. In this exercise, students could request quiz bonus points, but whether they were granted depended on whether the class as a whole came under a total bonus point limit. This simulated the difficulty in managing global and individual national motivations in greenhouse gas emissions. Though it is challenging to manage a large class through these exercises (I have had as many as 140 students in a "Thermodynamics" class), I find students are generally eager to participate as long as expectations are clearly shared at the beginning of the semester and reinforced throughout.

Student projects and presentations, along with weekly reading and/or homework sets, keep students actively engaged in the material. I include a semester project in each course, and projects are constructed such that groups progressively work towards the final result throughout the semester. I have designed and taught a senior-level elective course in "Chemical Energy Technology" that illustrates how project work and classroom activities are integrated to meet course objectives. The main objective of this course is for students to be able to evaluate energy technologies for their potential future impact. In the final project, students construct future energy scenarios for the period 25-50 years in the future. During each class period, we analyze a potential energy source and technology. Students complete reading on the topic before class, and the class period is used to provide a brief overview presentation motivating a directed class discussion and review of the data available on the topic. At the end of each class period, we generate a "1 page summary" with the data necessary for students to assess the potential of the technology in their final project. Each pair of students leads one of these discussion periods.

I have been thrilled to see students eager to come to class and participate in interactive exercises and discussions, and more generally, to express an excitement for the course material beyond what I realized in my undergraduate engineering courses. Through a course and class period structure that maximizes interaction among students and engagement with the material, students meet the learning objectives of the course and leave enthusiastic about further learning and involvement in extra-curricular activities available in the department.