Teaching Philosophy, Objectives, and Innovation

Note: Underlined text is a link to a Web resource, site or page.

Coffee Hours, 2018, UT Austin EER O's Café [2]

I seek to create safe, diverse, equitable, inclusive, and supportive environments for growth and learning, inside and outside class.

Listening during weekly coffee hours has been transformative [1]. I started the coffee hours 18 years ago so that I could give my full attention during coffee hours to mentoring questions and during office hours to homework and test questions. By being in neutral space during coffee hours, students have felt comfortable talking about a wide array of topics. They discuss career paths, hobbies, clubs, internships, and graduate study, and express self-doubt, imposter syndrome, stress, anxiety, and loneliness. Students help each other and form friendships. Due to the pandemic, Spring coffee hours shifted to Zoom; in fall, I added an in-person outdoor option on campus with social distancing and face coverings.

For many years, I have been redesigning my courses based on coffee hour discussions and survey comments. Since joining the Well-Being in Learning Environments project [2] in spring 2018, I have been systematically evaluating ways to achieve educational outcomes and choosing the way with the least student stress. Reducing student stress improves the learning environment. The pictures above are from the project's pamphlet and video.

Another profound impact on my teaching comes from 14 years of university service. I have learned so much from working with students, staff, faculty, and administrators from all 18 colleges/schools to make UT Austin a better place for all. That learning ramped up in 2019-20 when I was elected Faculty Council Chair. In fall 2019, my first action was to seek an increase in mental health professionals to meet student demand, which led to 18 new staff positions. Since Oct. 2019, we have been in dialogue with students to address employment issues and faculty misconduct. On March 13th, campus closed due to the pandemic. Over Spring Break, Prof. Kate Weaver (Graduate Assembly Chair) and I worked with constituents across campus to draft emergency university grading policies to mitigate disparities in how our student populations were being affected. In response to the murder of George Floyd and other acts of racism, we made sweeping recommendations, including addressing our own institutional racism. I expand on these efforts in the Biographical Sketch.

Since fall 1996, I have taught more than 2400 undergraduate and 300 graduate students in 49 undergraduate and 13 graduate courses. After discussing general teaching approaches below, I describe additional course-specific approaches in Sections A and B. For a description of the content in these courses, please see Course Descriptions.

Personal Connection. I arrive 30 minutes before lecture and stay afterwards to talk with students. During lecture, I let students know my challenges as a student and due to the pandemic. I talk about how and why I came to Austin. I invite them to coffee hours.

Self-Care. I promote healthy eating, sleep, exercise, and downtime. Course workload is uniform due to one major deliverable each week. I encourage students to benefit from academic peer coaching, and counseling and mental health, services. I let them know that 1 in 3 and 1 in 7 UT students, respectively, seek those services each year. Many psychiatric conditions have their onset in early adulthood (18-24 years of age).

Accommodations. Per Services for Students with Disabilities (SSD) guidelines, I do not require any students to have their cameras on and I take breaks during activities. I give synchronous lectures recorded for asynchronous access. A TA moderates the chat space. I enable automatic captioning in PowerPoint presentation mode and YouTube videos. I let students know about SSD accommodations due to temporary and permanent disabilities.

Review Pre-Requisite Material. For the first 3-4 weeks, I try to bring all students onto a common playing field by reviewing pre-requisite material in lecture and on assignments.

Encourage Discussion. I start lecture by asking students to give takeaways from the previous lecture. Students are welcome to ask questions at any time. [3].

- ***Motivate Material***. In lecture, I show how material fits into the course and electives. Discussing current events, industry trends, and research results helps students make connections to products, companies and research topics and plan their career paths. [3]
- ***Provide Multiple Viewpoints.*** I use text, formulas, graphs, images, audio, videos, and computer simulations to convey ideas. Students can run and modify the simulations on their own. [3]

Post Materials in Advance. Before the semester begins, I post all lecture slides, handouts, and 10+ most recent exams, package them into a single PDF file to encourage notetaking and populate the Canvas calendar with all class activities and assignment due dates.

Give Rapid Feedback. For each homework/exam, I release solutions within a few hours of the submission deadline and provide graded feedback by next lecture for discussion. [3]

Asynchronous Assignments. In response to the pandemic, students submit all assignments and exams asynchronously. Midterm exams are take-home. I write exams to be finished in 50 minutes, but students have 12 hours. Exams are open-book, open-note, open-laptop.

Flexibility. Students drop the lowest grade in each assignment category except midterm/ final exams to allow them to handle unexpected situations and fulfill other commitments.

In Their Own Lane. I use an absolute scale of A 90.00-100.00, A- 86.67-89.99, B+ 83.34-86.66, B 80.00-83.33, etc. It reduces stress two ways. A student knows the letter grade in the class and on assignments. It encourages collaboration because grading is not relative.

Low-Stakes Assignments. I schedule these throughout the semester to help students start early on assignments. This reduces stress, panic, and late-nighters before the deadline.

Train Awesome TAs. With the TAs, I discuss student learning and growth; accessible and inclusive learning environments; and student wellness. We review this document, and I provide [3] for follow-up discussions. We meet together each week. If they are first-time TAs, then I ask them to attend all lectures so they know where students are at.

A. Redesigning a Required Second-Year Undergraduate Course

After teaching a required second-year course, *Linear Systems and Systems,* seven times 1999-2010, I redesigned it in fall 2017 and fall 2018. I used the general approaches described above plus the following course-specific ones. Due to the fall 2017 redesign, I received a 2018 Excellence in Teaching Award based on surveys of second-year students.

Change Order of Topics. About 20-25% of students drop the course by mid-semester when topics were covered in a traditional order, regardless of instructor. In fall 2017, I moved the most overwhelming topic of convolution to be after midterm #1 and broke it into pieces of increasing difficulty. In the traditional approach, students confront the most difficult piece first. I used the time before midterm #1 to review pre-requisite material and build background for the previously overwhelming topic. I told students that the topic is the toughest for many students, including myself. I made other major changes as explained in the next two items. The drop rate reduced to 12.5% in fall 2017 and 4% in fall 2018.

Change the Textbook. To support the new topic order, I changed textbooks. The new book, *Signal Processing First*, also had half the number of pages, a more attractive layout, and a companion Web site with demos and hundreds of worked problems. The new book and Web site integrated text, formulas, graphs, images, audio and videos, and connected their meaning, to support a variety of learning styles. To accompany the new book, I created new lecture slides with animated content, and each slide referenced the relevant book sections.

Reduce the Panic. In previous offerings, many students panicked the night before homework was due. So, I created low-stakes "Tune-Up Tuesday" assignments. In Tuesday's lecture, students would solve a problem similar to one of the homework problems due on Friday by using mathematical derivations and computer simulations. For each part, I would first give them a few minutes, then field questions, and finally discuss solutions. They would submit their work at the end of lecture and I would give feedback on the same day.

Explore More Deeply. Each week brings a new topic and a homework assignment on it. In the past, students didn't have had the opportunity to connect topics together. I assigned two mini-projects in place of two homework assignments. Students could work alone or in teams of two. In fall 2017, students analyzed reliability in smart phone connections and created digital audio effects. In fall 2018, students synthesized a musical instrument and automatically detected musical notes being played. Students performed mathematical analysis, wrote computer simulations to hear the effects, and authored a narrative report. The completed work was significant enough to show during a job interview.

B. Creating and Teaching an Undergraduate Lecture Course with Lab Component

This section describes an elective with a weekly lecture and lab component for third- and fourth-year undergraduates, Real-Time Digital Signal Processing Laboratory. I created the course in fall 1997, and have taught the course in 42 of the 44 offerings. I use the general approaches described in the introduction plus the following course-specific ones.

Learn by Doing. In homework and laboratory assignments, students perform analysis and design by using many viewpoints of text, formulas, graphics, images, audio and videos [4]. They test designs by developing computer simulations that give immediate feedback in the form of sound or visualization. This sensory feedback helps students refine designs until they give the desired visible and/or audible responses. Lab, lecture and home are synced.

More Demos. On course surveys, students asked for more demos of communication concepts. I created audio demos for modulation. In cellular and Wi-Fi systems, modulation shifts data to higher frequencies for transmission, and a receiver to shifts the signal back to recover the data. To hear this, the demo plays a sound clip, shifts it up by a several octaves, and shifts it back to recover the original clip. Students can run and modify the demo.

Motivate the Material. Transmitting data through air, wire, or water channels causes distortion. A receiver will compensate distortions to recover the data with higher accuracy. When covering channel modeling, I visualize these distortions [4]. I then discuss the impact on cellular data rates and coverage, and expected improvements over the next 2-5 years.

Finish All Lab Work in Lab. To encourage students to be prepared for laboratory, I have created online low-stakes pre-lab quizzes based on assigned reading. In the lab section, the TA would review material and detail lab procedures and deliverables. Nearly all students finish lab experiments during the lab time. This allows time for their other commitments.

Provide Open Courseware. I created open courseware [5] to facilitate self-study. In spring 2014, I put slides, handouts, demos, homework solutions, and exams online, along with recordings of lecture, homework, and midterm discussions on YouTube (60,000+ views).

Course Alumni Network. Of the 1,957 course alumni, 678 undergraduate alumni have given permission to post names and employment info to be available to refer students for employment [4]. 278 of the 678 (41%) have attended or are attending graduate or professional school and are available to give advice about post-graduate studies [4].

References

[1] Brian L. Evans, "Student Mentoring: Coffee Hours", Department Retreat, UT Austin, Aug. 24, 2020.
[2] Well-Being in Learning Environments Project, UT Austin,. Video clip. Discussion of coffee hours starts at 1:30 mark.
[3] UT System Academy of Distinguished Teachers, *The Little Orange Book: Short Lessons in Excellent Teaching*, 2015.
[4] Brian L. Evans, "EE 445S Real-Time Digital Signal Processing Laboratory", Fall 2020, Alumni page.
[5] Brian L. Evans, "EE 445S Real-Time Digital Signal Processing Laboratory", Spring 2014, Open courseware. Videos.