

Summary

My goal is always to maximize learning and motivation in every student interaction, while balancing instructor guidance with student autonomy. Over the past 15 years, I have redesigned three different lecture-plus-lab courses. In my role, I created new content for those courses. I developed hundreds of test problems with a professional appearance. I produced lecture and lab videos. I added new features to improve retention of under-represented students and to increase motivation for all students. I published free online textbooks and labs to the internet. I have had collaborations with outside educational institutions as well as commercial industry. My guidance and support has provided extracurricular research opportunities to hundreds of undergraduate students.

Course Design 1

Digital Communications Laboratory (ECE 463): Failing custom analog hardware needed to be brought up to date. Using National Instrument products, I redesigned and built upon Prof. Steve Franke's original lab.

New Content

- I created lectures on digitally-implemented phase-locked loops (PLLs) and channel-coding.
- I created lab procedures in LabVIEW/PXI/USRP platform around Software-Defined Radio (SDR).

Best Practices

- I started using Problem-Based Learning (PBL) and open-ended design in a final project.
- I researched over-the-air signals to allow student autonomy in their final project choice.

Course Design 2

Exploring Digital Information Technology (ECE 101): After originally being offered to James Scholars, I was asked to teach a STEM course to non-engineers. The material required significant redesign for the general student population.

New Content

- I introduced the study of flow charts to provide a lead-in to the basics of programming.
- I added additional logic and finite state machines so that the course would satisfy the General Elective requirement of Quantitative Reasoning.
- I developed a line-following car lab and an open-ended final project.
- I added a Discovery Course class section for first-year students exploring new topics.
- I created a free online text and published materials to CNX.org for use by other universities.

Best Practices

- I provided resources to enable open-ended design and student autonomy in project choice.
- I implemented personal innovation, Content Personalization (see Research Statement).

Course Design 3 (accomplished with many colleagues, a full Community of Practice!)

Introduction to Electronics (ECE 110): With ECE 120 added to the curriculum, topical content for ECE 110 needed to be revisited. In ECE 110, the course lab and lecture had become independent of each other. Except where stated, the bullets apply to ECE 110. When noted, resources available from ECE 110 were extended to ECE 120.

New Content

- I co-designed lectures in many topics and a common-core set of lecture slides for all sections.
- I designed lab procedures and organized the lab and lecture to operate synchronously.
- I developed a low-cost, student-owned hardware kit for at-home exercises.
- I co-designed a free online textbook also available through Stipes Publishing.
- I designed free online modular lab procedures also available through Stipes Publishing.
- I designed and prototyped a coin-sorter platform for use in ECE 120.
- I created an open-ended final project procedure to replace the TA-mandated project.
- I created over 500 questions in PrairieLearn using Visio template for professional appearance.

- I co-created a hardware-based open-ended James Scholar program serving 60-80 ECE 110 and ECE 120 students each semester.
- I co-created two Merit sections serving about 50 ECE 110 and ECE 120 students each semester.

Best Practices

- I co-developed a syllabus as a scholarly document, informative and complete.
- I co-created learning objectives for every lecture, lab procedure, and module.
- I created mini-project modules to allow for student autonomy.
- I utilized Think, Pair, Share (TPS), group exercises, and iClicker engagement in the lectures.
- I adopted *CATME* for team assignments and peer review, reducing the “hitchhiker” issue.
- I created breakout sessions for peer-learning and community development in labs.
- I adopted *Gradescope* for better and faster feedback on formative assessments.
- I developed lecture recordings for asynchronous review.
- I created photos and videos to improve student comprehension of the laboratory tasks.
- I perpetuated Peer-led Team Learning sessions created by Michael Loui.
- I continued the use of *SafeAssign* to maintain academic integrity.
- I co-created a best practices document as advisory for the course.
- I adopted self-scheduled testing at the Computer-Based Testing Facility.
- I co-created a second-chance testing plan to improve students’ content mastery.

Extracurricular

I support undergraduate research for several students through Individual Study each semester. With few faculty entertaining research for first- and second-year students, I am regularly sought out by these students as an advisor. One such project led into a large research group that is now gaining University and industry attention, called *WaggleNet*.

WaggleNet is an undergraduate research group formed under my guidance to create a hardware system to allow beekeepers to monitor data from inside a working honeybee colony without physical interruption. This extension of the Internet of Things (IoT) to a physically-challenging environment created a fluid research group that varies between 20 and 60 active members at any time solving not only hardware issues, but also developing servers to collect, store, and distribute data to both beekeepers and researchers. Teams have formed to also provide an ad-hoc self-healing network, generic sensor support, sensor development, security, data-driven classifiers, and even marketing. The group is developing an app to advise beginning beekeepers on best practices as well as connect them to experts when in need. *WaggleNet* has received the Leung Student Venture Fund Award and a Student-Sustainability Committee grant. The founding student received the Siddharth “Sid” Muthal ECE Undergraduate Student Memorial Entrepreneur of the Year Award. *WaggleNet*’s engineered, time-saving approach to video production (marketing team) was used by the ECE ILLINOIS Communications Coordinator this spring to produce a departmental highlight video.

Students involved in both the Honors Project and *WaggleNet* adopted features of these groups to create a new RSO called *Zero2One* for which I also serve as mentor. *Zero2One* brings entrepreneurially-minded faculty and undergraduates across campus together to create business ideas and solutions. In addition to advising projects under these research groups, I also act as the mentor for the Midwest Robotics Design Competition (MRDC) which brings hundreds of students together from across the globe to compete in challenges at Engineering Open House (EOH) each year.

Excellence in Teaching

I actively enjoy teaching and mentoring students and am also passionate about the topics I teach. I believe this enthusiasm along with my teaching abilities have influenced my students and given them every opportunity to grow within our field and within the University. I have received feedback over the years to this effect from both students and peers, but most recently, students recognized this by placing me on the List of Teachers Ranked as Excellent by their Students 6 times in the last 4 years. This has been quite an honor.

I enjoy spending time with students in office hours, weekly workshops, post-exam evaluations, and dropping into the labs. This interaction enables me to keep a finger on the pulse of the coursework and to continually improve materials and pedagogy. I am grateful to have a role as a Chief Undergraduate Advisor which allows me to follow up with specific individuals who indicate they require additional guidance through the curriculum.

My flexibility in teaching modes is also highly valued. Following an injury in October 2018, I was unable to stand and deliver a lecture. I quickly moved to online lecture delivery to a full lecture hall. At the end of the semester, despite my extended physical absence, the students rated me as excellent. Fast forward to 2020 and the COVID-19 pandemic, a transition to online teaching was natural. This allowed me to focus on the lab portion of the course. In the middle of spring break, I rallied my TAs to brainstorm ideas. We divided the team into subgroups responsible for different aspects of moving the labs to a virtual setting. As classes resumed, we continued to offer the labs without any interruption.

I continually look to improve my teaching abilities as well as expand the science of teaching within the University. I regularly attend workshops both locally and nationally and serve as a panelist for groups like TPro2 and Collins Scholars. New faculty in Collins Scholars visit my classroom each semester as an example of excellent teaching. Supported by grants from NSF and the Grainger College of Engineering, as well as support from the ECE department, I develop and implement best practices in teaching and learning. As a senior member of the specialized faculty, I also serve as a mentor to our Community of Practice in teaching and learning both in the department and in the college. My broad use and development of best practices plus my recognition for teaching excellence led to my role with the Academy of Excellence in Engineering Education (AE3). As an Education Innovation Fellow (EIF), I now share my knowledge and experiences throughout the college. I am currently serving on the Instructional Contingency Planning Task Force as one of two members from the Grainger College of Engineering as we make plans for teaching in fall 2020 under the “new normal.”

Concluding Statements

I continue to take a scholarly approach to teaching and learning. I constantly seek best practices, first adopting those which work best with my style of teaching. Next, I assess and adopt those practices whose value in learning outweigh the costs. Finally, I continually develop, assess, and disseminate new teaching techniques.

As you will see from the above information, I have been actively involved in developing and expanding classes and labs at the University of Illinois. However, I have gone far beyond the minimum expectations of my role in my extracurricular activities in the department. I enjoy assisting the research groups. I believe in learning more about the science of teaching and finding ways to share this information. As a result, I have become a resource to others within the Department and the University as demonstrated by being asked to join many committees and fill additional roles.

I now look back on close to three decades of college teaching and eight years of advising experiences with humility, pride, and awe knowing that I have touched and influenced tens of thousands of lives. Knowing that I have been an integral part of educating so many young minds has been incredibly rewarding.