My interest in mechanical engineering began in my childhood where I spent many hours making, tinkering, and discovering how the built environment worked. These hands-on experiences allowed me to develop a desire to discover the connection to mathematics and physics in order to improve my projects. Once that realization occurred, any barriers I had towards learning the engineering fundamentals were lifted. I hope to bring these kinds of experiences to the students I teach.

Teaching Philosophy

Traditional engineering pedagogy typically focuses heavily on lecture based theoretical courses paired with hands-on laboratory courses. The aspects of creativity, team collaboration, and an infinite possibility of problem solutions are all too often absent. As a result, undergraduate students are often left to their own devices outside of the lecture and lab to discover the skill development and practical side of engineering that they will require in their future careers. Cookbook instructions for lab experiments or canned problems with a single solution are virtually never present in the real world. Often, only the students who participate in extracurricular projects, internships, or research positions make the connection from theory to practice early on in the curriculum. Thus, the traditional structure may not be the best way to maximize student understanding of core engineering principles and instill the agile problem solving methods students will need in the future.

Although there are variety of motivational reasons students pursue engineering, I believe introducing the actual practices of engineering early in education will build passion and interest. Once this door is open, it is much easier to thread in the skills the students need to become stronger engineers in their future careers. I would like to see engineering curriculum that mimics the practice of engineering through an iterative pattern of posing realistic problems followed by a search for the necessary fundamentals and finally culminating in the application of the new knowledge to arrive at a solution to the problem. Not unlike my childhood experience, this model allows interesting realistic problems to lead students to the engineering fundamentals as opposed to trying to present all of the fundamentals before the interesting problems arrive.

Engineering students are capable of creating and solving problems when they enter college. We should enrich their entire experience (especially the first year!) with challenges from real-world problems that leave them begging for the knowledge and tools that they typically have to slog through during their first years of school. Richard Miller, President of Olin College, often draws an analogy between engineering students and violin students: "Can you imagine not playing the violin until your fourth year of study? Violinists start making sounds with their instrument the first day of lessons." Our curriculum could allow our students to draw the engineering bow across the strings the minute they step into the classroom. For these early project-based courses to be effective, however, the latest pedagogical developments must be utilized to maximize learning potential.

Practical Classroom Examples

In my courses, I provide students with small-scale projects either based on portions of the projects and problems I have had to solve in practice or from Resources like the Directory of Projects for First-Year Engineering Students[1]. I typically focus on team success and ensure the problems are open-ended to more closely mimic the practice of engineering. I choose classroom teaching methods that have evidence-based research backing their tenets. For example, research shows that peer learning is highly likely to improve both understanding and retention when intertwined with short lectures. There are already prominent examples on the UCD campus where these methods are making a big difference. A recent New York Times article[2] highlights the UCD Chemistry department's success with peer learning. Teachers that are excited about new teaching methods can increase students' understanding and retention of material more than those that stick with tired curriculum. Another method that I make use of is rapid in-class assessment; at every break, each student writes a positive or negative feedback/comment about the last lecture portion on sticky note, passes it in, and I adjust my teaching after the break based on the feedback. I tie this in with electronically collected feedback before, during, and after the course to have data to back my teaching decisions. To keep up-to-date on topics like these, I follow the education research literature, especially the summary literature

aimed at practicing educators and plan to attend more "teach the teachers" style workshops in the future.

Prior Experience and Future Interests

A good teacher is also best when they know their material well. I was fortunate to have spent most of my graduate school years in the UCD MAE department and am intimately familiar with the undergraduate and graduate curriculum. I have taught a number of the available courses as both a teaching assistant and a lecturer. At the undergraduate level I have strong experience with mechanics and machine design courses along with the dynamics and controls curriculum. For example, in the Fall of 2012, I was the lecturer for ENG-4 with four TAs under my supervision and approximately 120 students. I introduced additional updated components to the curriculum, developed a full suite of openly available teaching material[3], and went well beyond what was expected of me to ensure my students received the best education I could provide. The TAs and I worked as a team to execute the course and I had each TA co-instruct the labs. As aligned with my teaching philosophy, I broke up lectures into 10 minute segments where 10 minutes of oratory teaching were followed by 10 minutes of quick team collaborative exercises like in-class sketching. This led to positive feedback from the students and strong success in their assessments.

I am also well prepared to teach at the graduate level in machine design, solid mechanics, dynamics, control theory, biomechanics, vehicle dynamics, and aircraft control. I am interested in developing more modern courses in biomechanics, optimal control, and the latest in multibody dynamics (e.g. O(N) methods).This puts me in a good position to maintain and grow many of the department's core courses. However, my course topic strengths are not entirely based on current UCD MAE offerings. I have spent time at Delft University of Technology, Old Dominion University, Cleveland State University, Stanford University, and with the Software Carpentry non-profit where I have gleaned both new course ideas and methodologies to provide stronger connections to industry. For example, I have experience in teaching computational methods for data science. I have given numerous workshops and tutorials to scientists and engineers on simulation, optimization, data analysis, etc. I have been trained by the Software Carpentry organization in pedagogical methods and teach two-day workshops around the world to introduce scientists and engineers to the best practices and methods in scientific computing. The mechanical engineer of the future will be additionally tasked with data driven engineering. The engineering curriculum will need to adapt to bring data science into many of the core courses for our students to stay competitive in the job market.

Finally, I would like to offer teaching workshops in collaboration with the engineering college and education schools for teaching assistants (TAs) in our department to improve TA instruction. Some of the topics I want to work on are co-instruction, collaborative teaching material development, technology in the classroom, and distilling the latest findings in engineering education to the faculty, lecturers, and teaching assistants. Furthermore, I hope to serve on college and campus wide committees that have education improvement topics and participate in pedagogy trainings at other institutions so that I can bring back new ideas to our department. For example, UC Davis has created the "I am STEM" program dedicated to improving our university's STEM education efforts. As a lecturer I will be working closely with this program and others to enhance our offerings in the MAE department. The people that I meet at these campus groups will be ideal collaborators for pursuing educational grant proposals such as those under the NSF's Undergraduate Education (DUE) program. This houses directorates like "Improving Undergraduate STEM Education" and more interdisciplinary ones such as "Transforming Undergraduate Education in Science, Technology, Engineering and Mathematics" that could help empower the work done in the MAE department.

Diversity Statement

In terms of understanding how diversity plays an important role in the growth of our societies and the lives of the people in them, I have grown a great deal from my pre-adult years where I grew up in the still very racially segregated and homophobic small town southern United States. There I was born into a place of

---

[1] http://www.discovery-press.com/discovery-press/studyengr/projects.asp

[2] http://www.nytimes.com/2014/12/27/us/college-science-classes-failure-rates-soar-go-back-to-drawing-board.html

[3] http://www.moorepants.info/jkm/courses/eng4

privilege due to my skin color, gender, and socioeconomic status. I recognize now how much those factors have played into my upward movement throughout my life and how my hard work is not the only thing that got me where I am today. My view of how the world works and what diversity means has had many positive transformational changes over the years but I would like to highlight one of the more powerful experiences I have had that has affected how I behave and make decisions when I am in a teaching role.

The mechanical engineering field unfortunately needs much improvement in attracting women and having a racially diverse student population, not to mention other diversification needs. Engineering has a long history of bias towards the status quo that educational leaders today are trying to unravel and set straight. Oddities like the dominance of women in early computer science and the rapid decline of their participation are both functions of our intentional and unintentional decisions and behavior. Many of these ingrained societal influences are beyond our control as teachers, but I will be dedicated to improving this situation with the power that I have. I have been very fortunate to be involved with several radical communities in terms of diversification over the years and believe those experiences will help improve diversity at UCD if I am hired.

I spent eight years running and volunteer teaching at a do-it-yourself bicycle repair shop which also traditionally suffers from gender and race imbalance. Using techniques I gleaned from numerous trainings on creating inclusive "safe space" environments for people of all backgrounds, I was involved with implementing the latest advice from cultural studies to make the shop as inclusive as possible. I plan to extend the practices and knowledge from that experience to the teaching atmosphere at the UCD MAE department to help us create the most welcoming and inclusive engineering department in the country.

My tenure as an instructor at the bicycle shop taught me many things but the most significant takeaways were not to take diversity, inclusion, and marginalization lightly and definitely not to dismiss things that I have not experienced or do not understand. I also learned to listen to people who think about these things a lot and let their guidance influence my behavior and decisions. I now have a strong support group to turn to for advice in difficult situations. Overall, I have a better awareness and now recognize much more quickly when situations are not "right" and am willing to stand up for diverse students needs and know where the best avenues for help are.

There are also more specific examples of practices that I have picked up and utilize when teaching. I set ground rules in classroom interaction early on that helps ensure equitable time for students to speak so that traditional dominators cannot control classroom time. I am generally able to recognize these patterns and facilitate classroom discussions so that they are inclusive. I have also been involved with and observed developing specific times and spaces for marginalized communities, like women, LGBT, etc. This lets similar groups of learners learn on their own terms instead of those of the dominant majority. I also work to develop classroom and lab ground rules, such as codes of conduct and safe space agreements, that are in place for all students to see and be aware of, whether posted on a sign in the lab or on the classroom website. I explicitly discuss these ground rules in class and even let the students collaboratively develop these agreements so they are invested in abiding by them. I have also learned how a classroom or lab atmosphere can be exclusive to many groups simply because of things like decor, lighting, politically incorrect jokes, and general attitudes and behaviors of superiors. I will be working with various groups to reduce and eliminate these factors in my courses and labs. Furthermore, I work to ensure that there are anonymous feedback avenues for students and work to place students in need with the appropriate campus groups for support, letting them and the support groups help inform what I need to do to make the classroom accommodating.

Finally, I will be an ally for minority groups in the engineering college and give what support I can to help them strengthen and grow and will be a strong proponent of diversification of our selected students, staff, and faculty. My ethnicity, gender, and socioeconomic status puts me in the "typical engineer" bucket in terms of diversification but my experiences in life working with and for marginalized people, from disabled wheelchair fabricators in Zambia to disenfranchised homeless at the DIY bicycle shop, has instilled the empathy and understanding deep inside that will play an important role in changing engineering stereotypes for the next generation.