Teaching Statement

I believe teaching is the most influential activity we partake in. Having learned from patient, empathetic, and talented teachers, I want to help the next generation of students learn engineering and optimization techniques similarly. The overarching theme of my teaching is helping students learn how to learn. I have five major goals for student learning: rational problem analysis and reasonable assumptions; appropriate resource location and usage; effective communication with peers, experts, and other folks; adaptive approaches and failure acceptance; and lastly, innate inquisitiveness and lifelong learning.

Engineering courses focus on mathematical formulations, solution methods, and design. However, little time is spent connecting the math to real-life scenarios. As a teaching assistant, I noticed that students knew math concepts but struggled with word-problems. My teaching pedagogy involves helping students analyze real-world situations and translate it to appropriate engineering concepts. For instance, "Calculate the probability of no arrivals for 5 min, given a Poisson process with rate λ/ hr" can be framed as "If a coffee shop has λ customers per hour, what is the probability that no customer shows up for 5 minutes?" I will assess this skill by designing assignments, exams, and projects as practical problems rather than abstract math problems, and evaluating student argumentation to ensure learning[1]. Additionally, I will use interactive activities and breakout rooms in class for individual and collaborative problem breakdown. For my probability/statistics course, I conducted a semester-long interactive game where students could win prizes for their practical understanding of the concepts. I also designed and provided interactive worksheets to aid this goal. Altogether, I expect my students to see the forest *and* the trees.

My second goal for student learning deals with knowledge of appropriate resources. As engineers, we have established easily accessible construction codes, legal practices, and manuals for ready reference. However, experience and training help identify appropriate resources and their availability. While mentoring GLUE[2] undergraduates, I guided them in accessing research papers, judging relevance and importance, and learning tools for simulation work. Post ramp-up, my students built on it rapidly, harnessing prior knowledge and creativity to generate results. One student contributed to a journal publication[3], and another in proposal-writing literature review. I will teach this using smart course project design and by requiring verified sources (such as flood plans, campus master plans, or capacity manuals). Reading responses are another way of assessing how students access information. This goal suits upper level courses such as Optimization in transportation engineering and Operations research models, building upon students' prior knowledge.

My third goal focuses on collaboration and knowledge exchange. Engineers communicate with peers, experts, and non-engineers to discuss projects and impact. From personal experience as a traffic consultant to Westlake Hills city[4], presenting ideas in town hall settings is very different from academic settings. Using differences as learning opportunities and allowing my students to remain open towards differing worldviews is crucial towards achieving this goal. I will inculcate this by including collaborative discussion activities in class as well as group work for projects.

[1] Andrews, M. E., & Patil, P.N. (2021). "A Systematic Review of Argument Assessment Frameworks in Engineering Education." In ASEE Annual Conference & Exposition Proceedings, 2021.

[2] Graduates Linked with Undergraduates in Engineering research program, one semester long

[3] Patil, P.N., Ross, K.C., and Boyles, S.D. (2021). "Convergence behavior for traffic assignment characterization metrics." Transportmetrica A: Transport Science 17 (4): 1244–1271.

[4] `https://www.statesman.com/NEWS/20160828/Cops-not-the-answer-to-problematic-intersection`

This goal lends itself well to inviting guest speakers and panelists. Specifically, I want to stress equal opportunity, service-based projects, language sensitivity, and inclusive curriculum. Working with various socio-economic stakeholders can be simulated in the classroom and built upon outside the classroom. My course design strives to minimize prerequisites and bring everyone to an equal starting point rapidly. This goal aims to help students convey the big picture effectively to non-engineers, just as one would to the public on infrastructure projects. I believe these methods would be most effective at the freshman and upper-class level courses, such as Introduction to Civil/Transportation engineering, cornerstone projects, and capstone projects.

My fourth goal looks at developing student confidence in the classroom and treating failure as a learning experience. I proactively solicit mid-semester and end-semester feedback from my students, and the most echoed reason for lack of participation is the fear of saying something dumb or appearing stupid in front of the instructors or their peers. It is a rational fear of failure, attributed to performance avoidance, feeling of shame, self-handicapping, or learned helplessness. I want to stress upon my students that stumbling is acceptable and important to the process of learning. I have incorporated techniques such as grab bag activity or digital name pickers to encourage student participation in my classes without targeting. Removal of grades as the primary incentive provides a space to normalize innovation, failure, and adaptability. Specifically, my courses will include assessments where two lowest scores are dropped, and assignments where student assessment of their performance is graded. Frequent progress reviews will help me provide targeted and timely feedback. Depending on the course, I will use a subset of reading responses, programming sessions, software and data-based assignments, or traditional assignments and exams to assess student learning. Sophomore/junior courses like Probability/statistics or engineering finance would suit these methods.

My final goal for student learning is developing and encouraging lifelong learners. This is an ambitious goal that does not have a straightforward one-size-fits-all solution. I have strived to teach this to my students as well as my mentees, and have noticed that different personalities needed different techniques. These can entail providing pieces of the larger picture and letting their inquisitiveness fill the rest, or by charting out a clear linear path and letting them progress by themselves, among others. This is something I would like to gain more experience with through additional student interaction and engineering education research. By enabling students to be innovators and lifelong learners, we can progress beyond set practices.

I have set these goals and my methods have been adapted to fulfill them. All goals aim beyond differences in student careers and help students succeed in any environment. The underlying philosophy focuses on the Pareto principle, where 20% of the efforts account for 80% of the effects. I prioritize 20% of transferable skills that help my students improve efficiently. In parallel, I actively review the latest advances in engineering education research and incorporate best practices (such as flipped classrooms, active learning approaches, etc.) for STEM education in my repertoire. I have learned curriculum design, assessment techniques, inclusive teaching methods, STEM education instruments, NSF and ABET directives, etc. as a part of coursework for the graduate certification in engineering education at UT Austin, and have implemented it in the three courses I have helped teach. With instruction in Civil engineering and optimization, I am comfortable teaching introductory civil and transportation engineering courses, introductory optimization courses, and graduate level transportation courses on network analysis and optimization techniques. In conclusion, not only do I aim to teach students engineering, I wish to teach my students skills that transfer to any discipline or career and help them keep learning.