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Teaching Statement

As technology and industry in the world continues to advance exponentially, the engineers of the future will be tasked to solve more complex and challenging problems than ever before. As an educator, it will be my job to impart the skills and knowledge the next generation of engineering students will need to solve the problems of the future. To best prepare students for these problems, I will focus on developing critical thinking skills, bridging conceptual barriers between classes, and incorporating the social responsibilities of engineering through my instruction. All the while, I will strive to make sure students feel safe and welcome in both my classroom and the program as a whole.

One of the most crucial skills to relay to STEM students is the ability to take basic knowledge and apply it in a critical way. To me, this means making informed hypotheses using their conceptual background and interpreting external data to make their own conclusions. This is ultimately to prepare students for their lives after college, both in industry and academia, where they will be looked to as experts in their field. To accomplish this, I will take different approaches for students of different levels. For lower division students, who often still see problems as black and white, I would establish that most problems they will face won't have a singular answer. During lectures I will present multiple explanations, models and derivations for course content, as well as bring in real world scientific examples to establish this idea. One lower division class where there is a lot of opportunity for this is Thermodynamics. In this class the commonly used formulas are highly interconnected and can easily be derived in multiple ways and without disrupting from the overall course content. There is also a wealth of interesting literature I could introduce students to at the start of every class. I will also strive to have students formulate their own hypotheses about the course material, which is something I had practice doing as a teaching assistant for a lab section of Introductory Mechanics. I would take this further by incorporating the hypothesis formation in small stakes assignments such as homework and quizzes. This will allow me to assess how students are developing these skills in a more consistent and less stressful way than through examinations alone.

For the upper division students I will take a different approach. These students have completed more instruction and therefore have a larger knowledge pool to draw from, and probably recognize some gray areas exist in science and engineer. To develop these critical thinking skills, I would have instruction days where the class discusses a relevant scientific publication to understand the actual methods used to collect data and to give students an opportunity to try to assess the validity of the results and draw their own conclusions. For instance, in a Transport Phenomenon class this could include a discussion of a novel drug delivery technique where students are given the paper ahead of time and class discussion focuses on understanding and evaluating the results. This could be a fun and engaging way to end the class discussion on a topic after an exam. I would also develop this through the use of semester long student projects for upper division students to get an opportunity to synthesize their previous knowledge and make design choices to solve a realistic problem. Finally, I will evaluate the progress in this mainly through conceptual problems on quizzes as well as free response problems on exams that ask students to make predictions about problems before solving them.

Another learning goal I have for students is to foster deeper connection between the materials they are learning throughout the program. By separating topics into different classes, we often prevent students from connecting the knowledge and principles they learn in different

courses. For many students, the first time they make these connections in their knowledge is in a senior design class. In contrast I will strive to provide more connections much earlier on. By developing close relationships with colleagues to better understand what students are learning in the program, I can bring concrete examples that relate course material to past or concurrent courses. Through this I will help build the connections between materials that is needed for students to become experts. I would also like to explore bringing in smaller scale "mini-capstone" projects to provide students opportunities to synthesize their knowledge much earlier on in the curriculum. This would include second or third year classes designed to bring previous class concepts together to ensure that foundational engineering knowledge is reinforced and interconnected moving into tougher, more specialized classes. A fun an engaging way to test student connections with prior classes would be to have an in class activity where students are given a scientific problem and asked to propose potential experiments to develop a solution to the problem. For example, determining the mechanism of action of a drug molecule which might bring in concepts from biochemistry, cell biology, human physiology, and mass transfer.

The final learning goal I have for students is to breakdown the conceptual barrier between social and technical issues. As an engineering instructor, I will work to incorporate more engagement with social issues into the class room. Often times students mistakenly believe that social issues are irrelevant when working in STEM, when in fact it is one of the most crucial aspects of it. In the classroom I would connect students to these issues by bringing in case studies that demonstrate times when technical solutions failed because the social needs of the consumer weren't adequately considered. I will have students dissect the designs and suggest potential improvements, while driving them to consider how different social identities can be impacted by these products. While this best fits into project focused classes, it can be still be brought into typical classes. To really drive this home, I will make social considerations and reflections a key part of a larger project given to have students critically analyze their own designs to make them more inclusive and to make sure they are adequately addressing the needs of the stakeholders.

Ultimately, as a faculty member, I will strive to give student these skills throughout their education. However, these classroom goals rely on students feeling welcome and comfortable in the learning environment. This is something I will accomplish by setting ground rules for classroom discussion on the first day and in the syllabus. I will emphasize that students are people first and should take care of their physical and emotional health above all. To this extent I will provide students a certain number of flexible hours to spend to get more time for some assignments. I will also ensure that the outside literature and examples I bring in highlight the examples of scientists and engineers of varied backgrounds. Finally I will give my students my full support both in my classroom and around campus by being present at student organization events, particularly those supporting the advancement of marginalized students. Above all, I want to give my students the crucial skills needed to be successful scientists and engineers by guiding them through the process of critically evaluating evidence, connect the material they have been learning, and understand the larger social implications of their work. This is to help produce the next generation of rigorous scientists and engineers needed to solve the complex problems the world faces. As a faculty member I believe it is my duty to provide the best possible education to my students, and to show them that they can succeed in STEM no matter their background or identities.