

# Statement of Teaching Philosophy

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Engineering courses often teach well-known facts and established problem-solving strategies. As a teacher, I believe that it is crucial for my students to learn not only the “what” and the “how” of a given problem, but also the “why.” Why is a particular approach used? Why is the problem in question important, both in the context of the course and in the real world? By making students understand what they are doing and why, they become empowered to use that information in other situations. While a student will not remember all the details of every problem they solve during a semester, I believe that my purpose as a teacher is to give them a sense of awareness of what they can accomplish. In the future, when they are confronted with a problem in industry or in graduate school, they will know what resources and tools are available to them and will have confidence in their ability to find a solution.

As an teacher, I am first and foremost accountable to the students. They are the reason I am there. The success of the teaching-learning process is also critically dependent on the accountability of the individual student to me, to themselves, and to their classmates. When a student realizes that I depend on them to do homework, pay attention in lectures, and participate in discussions, a better classroom environment develops. One of my tasks is to bring the students to this realization. The process begins with showing the students respect. I need to understand where they are coming from, both academically and culturally, so that I can fit my teaching style to their learning needs. This understanding can be gained by having students fill out a survey in the first lecture and by soliciting feedback throughout the duration of the course. I must show genuine enthusiasm for the subject matter and be open to discussion beyond what I may have prepared for a given lecture. Sometimes it is more important to satisfy the curiosity of the class by following a tangent than to get through all the contents of a prepared lecture. When the students realize that the course is there for them and that they play an important role in its success, learning is no longer a job but an experience. One approach of bringing students to an understanding of their importance is to encourage them to interact individually with me. Students who talk with me one-on-one after class and in office hours tend to gain confidence for participation in lectures. These opportunities also give me the chance to talk to students about things outside of the course, such as graduate school, academia, and research. I enjoy forming these relationships and I think that the students appreciate them as well. I still greet many of my previous students when walking around the university. In a smaller class, this personal link can be fostered with all students by having individual meetings at the beginning of the semester.

As a teacher, it is not only my responsibility to make students aware of the details of the course they are taking, but also the big picture of where the course fits into their program curriculum and the world-at-large. As such, it is important to expose students to the research aspects of the university. Research is an important part of the academic world that students may have little contact with, even though they coexist with it for years. The undergraduate student in the classroom is a future graduate student, research scientist, or professor, and understanding what role they might play in the world of science and engineering can set them on the right track. I often describe to the class how what they have learned can be used to understand the basics of a Ph.D. thesis.

By incorporating research ideas into lectures, homework sets, and exam problems, students can begin to see outside of the sometimes narrow scope of a given course. Equally important is the ability for students to see how their knowledge applies to real-world problems and to be able to communicate their understanding with non-experts. As such, the students need to be versed in the language of words as well as that of equations. When confronted with a question such as “describe the difference between evaporation and boiling,” or “explain what the wind-chill factor means,” students become aware of what they may have previously taken for granted. Along these lines, I try to write exam problems based on my own experiences. Such problems develop the students’ ability to break down a real situation and they feel that they are accomplishing something. For example, while waiting to play hockey, I became curious as to how much time must pass before all the liquid water left in the cleaning process freezes. This became a heat transfer exam question, which was formulated by calling a local arena for details of their cooling system. These types of problems are also advantageous to students in that they can assess the physical relevance of the answers (i.e., would they expect a freezing time of five seconds, five minutes or five hours?).

My research is in the area of thermal transport at micron and nanometer length scales. This topic required me (and now requires my graduate students) to take courses outside of mechanical engineering (e.g., physics, materials science), as much of the needed knowledge is not covered in the standard mechanical engineering curriculum. In order to expand the frontiers of engineering, these concepts need to be incorporated into the existing culture. This incorporation will come through research and individual graduate student mentoring, but also by including specific examples into traditional courses and by developing new courses at both undergraduate and graduate levels. The latter step is a challenge, as educational materials are only starting to emerge, but it is a great opportunity to gather and disseminate the available knowledge. For students to be interested in a particular research area and realize that they could make a significant contribution to it, they first require awareness. I believe that concepts in quantum mechanics and solid state physics, which form the basis for much of my work, can be appreciated by students at all levels with the correct approach and draw students into wanting to learn the finer details. Engineers will play an important role in the development of future technologies, and to do so, they will need to be equipped with the right knowledge.

The university plays a unique role in society, in that it is a place where teaching, learning, and research co-exist. The full potential of any of these three aspects of the academic culture is only realized when taken into context with the other two. As an engineering professor, it is my responsibility to incorporate teaching and learning into all my endeavors, but also to bring research ideas to the classroom.

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