My teaching philosophy centers around two goals: creating a learning environment that encourages a diverse spectrum of students to become skillful scholars and providing students with meaningful educational experiences that train them to be high-impact engineers. All the methods that I incorporate into my classes are evidence-based strategies from educational literature or training I have received. Evidence-based strategies are built on established teaching and learning frameworks, allowing for rigorous implementation and assessment of their efficacy in a classroom. Incorporating evidence-based strategies is not only important for assuring the success of the methods, but also for my increasing work in engineering education research. I currently have two on-going engineering education research projects, funded by seed grants from the Leonhard Center and the Schreyer Institute, that have allowed me to formalize my two teaching goals through the application of research methods.

Being both an educator and an educational researcher has significantly improved my teaching outcomes. Using a Design-Based Research framework, which is a formal method for continual improvement of teaching during a research project, I have collaborated with Dr. Andrea Gregg, who has a background in educational research, to make significant improvements to several of my courses. The formalisms that are provided by engineering education research are a solid foundation upon which I can not only integrate evidence-based practices but also innovate and develop new practices for improving my teaching and student outcomes. While I am a teacher first, the research lens has taken my educational innovation to the next level and supported my two teaching goals.

The first goal – creating a learning environment that encourages a diverse spectrum of students to become skillful scholars – has two components. First, I teach the core technical material in a clear and engaging manner and develop in-class activities and take-home work that support student learning. I use a number of active-learning strategies to dynamically engage students in the material. These in-class activities are supported by readings, videos, homework, and quizzes that directly relate to the material and activities in class so that students have continuous and frequent engagement on the topics. This variety of sources also helps support students with a range of educational backgrounds and learning styles. Second, and possibly more importantly, I actively work to teach students the skills necessary to learn higher-level concepts and apply them to a variety of problems. My educational research partner, Dr. Andrea Gregg, and I have developed a model for improving student conceptual learning called ALM – Active Learning and Metacognition, which outlines a process by which students learn, use, and reflect on concepts in a cyclic manner to improve understanding. To implement ALM, I develop structured activities and scaffolded reflections on those activities to prompt students to reflect on not just their understanding but also how they approached a problem and the solution method they used. These reflections are then used as the basis for further activities, allowing students to use their reflective practices to improve their problem-solving skills and develop deeper understanding of the material. This methodology helps support learners from a wide variety of backgrounds to erase the “hidden curriculum” of college and provide them skills in an up-front and supportive manner that will help them throughout college and their career ahead. I have worked with Dr. Gregg to host workshops for my colleagues to share these methods with others.

The second goal – provide students meaningful educational experiences to become high-impact engineers – incorporates examples, case-studies, real-life data, and practicing engineers from relevant industries in each course to show students the connections between the fundamentals and their engineering career. This approach prepares students to be highly effective engineers after they graduate because they not only know the fundamentals but have seen those fundamentals applied in real-life contexts. We discuss contemporary issues and the broader context of engineering work. This context includes topics such as regulation, environmental impacts, ethics, and economics in concert with the fundamentals to understand the influence that these contexts have on the profession. I bring in a diversity of examples to show students a range of faces and backgrounds in engineering contexts. I have designed learning outcomes for courses that not only emphasize fundamental knowledge, but also skills and contextual issues. Putting together a solid understanding of the fundamentals, better metacognitive and problem-solving skills, and a broader appreciation of engineering contexts, students in my courses receive a high-impact engineering education.