

Project Summary: How do we provide students with the tools needed to conduct research? How do we teach the “art” as well as the “science”? Within Engineering, we have many courses, tools, and approaches for teaching the science. Teaching the “art” of research is more challenging. Much of this art comes from experience and intuition. Therefore, we expect students to learn how to identify and solve relevant research problems primarily through their own trial-and-error. But while this method of learning is indispensable, we should also be able to provide students with insights based on our own mistakes and setbacks. And yet this is rarely done, at least in my community of operations researchers. We invest enormous time and effort in research projects but publish only a small fraction of what we’ve done – specifically, the successes. However, the obstacles that we have encountered in our research provide us with valuable insights that shape how we address subsequent research problems. *Our objective in this project is to examine ways in which we might better help students develop successful research skills by allowing them to learn from our failures as well as our successes.*

In particular, we plan to develop a collection of materials (classroom and distance learning course materials, a detailed case study, and a tutorial lecture) that focus on teaching large-scale optimization techniques by having students extensively study a single research project that relies heavily on these techniques. The students will work through the process of solving this research problem, following a path similar to that taken in the original research, attempting to address the same difficulties that the original researchers encountered. They will also have the opportunity to try their own ideas and to receive guidance in learning from their own mistakes. They will learn about large-scale optimization tools by *using* them – and, in the process, develop a far better understanding of the subtleties and challenges that accompany them.

Although these teaching materials will primarily be used to teach a graduate-level course in large-scale discrete optimization within the Industrial and Operations Engineering department, these materials will also be made available to a much broader audience, disseminated through academic conferences, the Web, and sharing with other universities and departments. Furthermore, it is our hope that these materials will serve as a template for chronicling other research projects. Ultimately, we would like to compile a book comprised of many “research histories,” allowing students to observe and learn from the experience and insights gained by more experienced researchers as they tackle new problems. Finally, we hope that our experience in this process will also provide us with new ideas as to how to convey the “art” of optimization in the undergraduate classroom.