

## Preface

Why another “How to Teach” book, and why us as the authors? Our answers are in our stories.

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**(Rich’s story)** When I started my academic career in chemical engineering at N.C. State back in prehistoric times, I had the same training in teaching that most college professors get: none. Not knowing that there were alternatives, I fell back on the only teaching model I had, which was how my professors had taught me. Unfortunately, no one ever taught them how to teach either, and so for the first 15 years of my career I did what all my colleagues did—gave nonstop lectures and tests that were always too long, and drastically curved course grades so I wouldn’t end up failing most of the class.

You could take my lecture notes to the bank. The derivations were complete and correct, my delivery was clear and occasionally entertaining, and the students left the lectures thinking they understood everything. The result was that I got high ratings and won some awards. There was just one minor hitch. After the lectures the students struggled for hours to complete assignments that involved problems like the ones I worked in class, and many of their exam grades were pitiful. Most who failed blamed themselves, figuring that if they couldn’t do well with a teacher as clear as I was, they obviously lacked what it takes to be an engineer.

Most of them were wrong—a lot of the blame for their failure was mine. When I was developing and polishing those lecture notes—finding clear ways to express difficult concepts, coming up with good examples of every method I was teaching—I was really learning that stuff! The problem was that I was then feeding my students predigested food. They didn’t have to go through the intellectual labor of working some of it out for themselves, which meant that they never really understood it, no matter how clear it may have seemed in the lectures.

Most STEM professors never read education literature, and I was no exception. It was years before I learned that excellent research has been done on alternative teaching methods, some of which have been found to promote learning much better than traditional methods do. I started trying some of those alternatives and found that they worked beautifully in my courses. I subsequently met some pedagogical experts who helped me sharpen my understanding, one of whom became my professional colleague and the coauthor of this book—my wife, Rebecca Brent. (Who says educational research doesn’t pay off?)

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**(Rebecca’s Story)** I’ve been a teacher since my earliest preschool days spent “teaching” a neighbor child her letters, and early on I made education the focus of my career. I loved learning about how people learn and creative ways to facilitate learning. I began my professional life as an elementary school teacher, and then got my doctorate and became a teacher educator at East Carolina University. It was fascinating for me to watch my students as they first began to teach and put all the educational theory I had taught them into practice on a daily basis. I also worked on a faculty team to develop training programs for people in non-academic professions who wanted to change careers and become teachers, and it was then that I realized that passing along a few well-chosen techniques could go a long way toward helping people to become effective instructors. When Rich and I began to give workshops to university STEM faculty, I found that

the approach held up. We could help people understand something about how their students learn, get them to think carefully about what they wanted their students to be able to do and how they could evaluate the students' ability to do it, and offer some simple ways to get students engaged in class, no matter how many of them were in the room. Some workshop attendees tried a few of our suggestions and started to see effects on their students' learning; some made major transformative changes in their courses and saw correspondingly significant impacts; and a few now give excellent teaching workshops themselves, which delights us.

In our workshops, we review teaching methods that have been proven effective by solid replicated research, most of which are relatively easy to implement. Our goal in this book is to share those methods and some of the supporting research with you.

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The first chapter of the book contains a short introduction to some of what educational research has revealed about effective teaching and learning, a preview of the book's contents, and some suggestions for how to use the book. The chapter is a quick read and introduces ideas we will return to periodically in the rest of the book. Following that are chapters that deal with methods for designing and implementing effective courses and helping students acquire and improve their skills at problem-solving, communications, creative and critical thinking, high-performance teamwork, and self-directed learning.

There are several things we don't intend the book to be. One is a compendium of everything anyone knows about teaching. Writing something like that would take more time than we have and reading it would take more time than you have. It's also not a scholarly treatise on the theories behind the methods we have chosen to cover. Plenty of books out there review the theories and we will point you to some of them, but our emphasis will be on nuts and bolts of the practice—what the methods are, how to implement them, and pitfalls to avoid when doing so. We'll also share findings from modern cognitive science that provide good clues about why the methods consistently work as well as they do.

The book draws extensively on journal articles we have authored or coauthored. Most notably, the Interludes between chapters are almost all based on several of the "Random Thoughts" columns that have appeared in the quarterly journal *Chemical Engineering Education* since 1988. We are grateful to Managing Editor Lynn Heasley for granting us permission to modify and reprint the columns.

We have not been shy about asking for help, and so we have a long list of colleagues who reviewed chapter drafts, shared course materials, and provided invaluable encouragement and constructive criticism. Rather than elaborating on what most of them did and making this preface longer than some of the chapters, we will simply express our deep thanks to Lisa Bullard, Jo-Ann Cohen, Jackie Dietz, John Falconer, Elena Felder, Gary Felder, Kenny Felder, Mary Felder, Stephanie Farrell, Cindy Furse, Jeff Joines, Milo Koretsky, Susan Lord, Misty Loughry, Nikki Monahan, Michael Moys, Mike Prince, Julie Sharp, Kimberly Tanner, John Tolle, and Carl Zorowski.

We will, however, single out two individuals, without whom this book would not exist. From the moment she learned that we were planning a book more years ago than we care to contemplate, the superb author and educator Barbara Oakley functioned as our principal

cheerleader, critic, and nudge, repeatedly assuring us that the world desperately needed this book when we doubted ourselves, red-inking our occasionally pedantic or hyperbolic prose, and gently prodding us back into action when not much work was showing up in her inbox. Eventually things reached a point where we had to keep pushing on—we couldn't have lived with the guilt we would have felt over disappointing Barb. Words can't begin to convey our gratitude.

And words are equally inadequate to thank our editor, Maryellen Weimer, the long-time guru of *The Teaching Professor* newsletter and author of *Learner-Centered Teaching*. Having a professional icon like Maryellen working with us was somewhat intimidating—it was as if we had set out to compose a symphony and learned that Mozart would be advising us. Fortunately, besides being one of the top authorities on higher education in the world, Maryellen is also one of the finest editors and nicest human beings. She gave us a steady stream of impeccably good advice without ever trying to impose her views or her voice on our writing, and Rich has even forgiven her for siding with Rebecca every single time the coauthors disagreed about something.

And finally, we want to thank Kenny, Joyce, Elena, Leonicia, Gary, Rosemary, Mary, Ben, Jack, Shannon, Johnny, James, and Cecelia for putting up with our frequent disappearances in the final stages of writing this book. At the top of our very long list headed by “*When we finish this &#^\*%& book, we will...*” is “*be more reliable parents and grandparents.*” We hope that by the time the 13 of you are reading this, we will have started to keep that resolution.

Richard Felder

Rebecca Brent