Teaching and Learning STEM: A Practical Guide FREE

Teaching and Learning STEM: A Practical Guide. , Richard M.Felder and RebeccaBrent, Jossey-Bass, 2016, 336 p, $45.00, ISBN 978-1-118-92581-2

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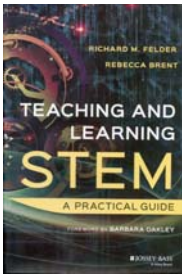

Teaching and Learning STEM

A Practical Guide

Richard M. Felder and Rebecca Brent

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I read *Teaching and Learning STEM: A Practical Guide* by Richard Felder and Rebecca Brent with attention and pleasure. This well-written book combines the wisdom of experienced teachers with expertise in education research to provide an informative yet practical guide to teaching courses in the STEM fields—science, technology, engineering, and math. It belongs on the desk of new and experienced faculty alike.

Felder and Brent are spouses and colleagues with decades of experience and collaboration in education research, teaching, and faculty development. In *Teaching and Learning STEM*, they draw heavily on their previously published journal articles and the Random Thoughts columns they have coauthored for almost 30 years in *Chemical Engineering Education*.

The book's high-quality content is strategically organized. It follows the way a teacher thinks about instruction, beginning with course planning and then discussing various elements of instructional strategy and goals. A sensible layout features clear bold headers, succinct chapter summaries, and effective reiteration of key points. The authors also provide illuminating philosophical asides. In one, Felder and Brent discuss the tension faculty face between their simultaneous roles as gatekeepers who enforce the rules and as coaches whose primary goal is to help students learn, and they suggest how to reconcile those roles. This is a thoughtful book designed for busy instructors.

Relevant literature from cognitive-science and education research is summarized concisely and feels surprisingly comprehensive for such an accessible volume. The coverage of the research literature and the practical advice on research-based instructional techniques are presented in a way that would make sense to a practicing teacher—as opposed to an education researcher—which is one of the great strengths of the book. I particularly appreciated the authors' careful treatment of learning styles. They accurately acknowledge the debates among researchers in the field and still provide well-founded, accessible information for teachers. Despite its discussion of the research literature, the book avoids feeling like a literature review, which is refreshing. That said, some of the instructional recommendations could have included additional citations.

While well-grounded in the education literature, *Teaching and Learning STEM* is a lively and readable teaching manual. The authors' compassion for new faculty in particular and their understanding of the challenges of the academic life are especially apparent. They educate their readers but move quickly to offer clear suggestions for applying education research to classroom practice. For example, they provide a wonderful list of questions to ask students instead of the traditional nonstarter, "Any questions?"—such as, "What can I clarify?"

The book gives useful guidance on various pedagogical goals, including supporting effective teamwork and helping students to solve problems and self-check their solutions. A table in chapter 6 includes one of the most useful lists of generalized active learning tasks I can remember; for example, instructors might ask students to "sketch the form of a complex mathematical function, the solution of a differential equation, without doing any calculations."

Rather than printing tedious laundry lists of pedagogical strategies, the authors introduce specific techniques, such as Peer Instruction or Just in Time Teaching, at relevant moments throughout the book. That strategy helps keep the volume readable. I appreciated the many references to current technology and Web tools, though they may result in the book's feeling dated in a few years, and I found myself wishing for an online supplement. However, I was surprised that the PhET Interactive Simulations products were not mentioned; as a former member of the project, I know they have an extensive research base and are broadly used in STEM fields. I was also somewhat disappointed not to find a discussion of preparing courses for majors versus nonmajors.

The authors discuss effective implementation of their techniques and offer tips on getting students to do pre-lecture assignments, dealing with student resistance, and avoiding common mistakes when using active learning. However, they carefully avoid getting bogged down in too much detail. Thus, while comprehensive, the book is not exhaustive or exhausting. Its relatively broad topic—STEM teaching—enables the authors to build a foundation of good teaching that draws from expertise in many disciplines and lends the book an authority and breadth missing from physics-focused teaching books. The cross-STEM approach will be particularly useful to those teaching interdisciplinary courses.

Teaching and Learning STEM is probably the first book that I will recommend to new and experienced physics faculty. This practical guide will serve faculty members well for many years. It's probably not the only text that should be on the shelf; it would be well-accompanied by an overview of research-based instructional principles, such as *How Learning Works: Seven Research-Based Principles for Smart Teaching* by Susan Ambrose and coauthors (Jossey-Bass, 2010), and a physics-specific volume such as *Teaching Physics with the Physics Suite* by Edward Redish (Wiley, 2003) or *Five Easy Lessons: Strategies for Successful Physics Teaching* by Randall Knight (Pearson, 2002). But my bet is that *Teaching and Learning STEM* will be the one faculty members find themselves picking up many times, as if turning to an old friend.

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