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Book Review

Title: Teaching and Learning STEM: A Practical Guide (second edition)
Authors: Richard Felder and Rebecca Brent
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Having A Teaching Mentor on Your Bookshelf: A Review of *Teaching and Learning STEM: A Practical Guide*

Overview

There has been copious literature addressing the effectiveness of learner-centered teaching practices, and, correspondingly, many resources are available for instructors who are interested in improving their teaching. But, there is another important consideration for busy teachers who want to improve their practice: how do I adapt learner-centered practices in ways that are not overwhelming and daunting? Richard Felder and Rebecca Brent masterfully attend to both facets of improving teaching practice in their book *Teaching and Learning STEM: A Practical Guide*. This guide, drawing from the authors' extensive experience, offers practical, evidence-based strategies aimed at improving student outcomes in STEM fields. However, the book not only provides a vast compilation of resources, but also its encouraging tone and "bite-size" structure make it accessible and amenable to translating those resources into practice in manageable ways.

Through clever structural features, Felder and Brent have rendered critical aspects of a human teaching mentor into words and figures in a book that resides on our shelf (or on our computer). The tone is informal and encouraging, providing access to content as it is needed in real time. Rather than being erudite or sterile, they use a conversational tone to provide practical advice on course design and teaching methods, presented in easily digestible segments. Throughout, they remind us to change our teaching slowly, not try to do everything all at once, and structure the book to be a "just in time" mentoring resource. For example, the section "the critical first week" can be revisited near the start of classes. The content addresses a spectrum of issues for masterful teaching, including: guidance on assessing student learning holistically, covering knowledge, skills, and conceptual understanding; strategies for incorporating active learning, technology, and cooperative learning into the classroom; and tips for fostering essential skills such as communication, critical thinking, and teamwork. Each chapter ends with two sections: "Ideas to take away" and "Try this in your course." Importantly, drawing from their experience, they anticipate common concerns and challenges that faculty often express (e.g., "I barely have enough time to cover my syllabus without activities. I'll never cover it if I add them"), and respond in thoughtful ways, leaving the reader feeling more like part of a dialog than the recipient of a treatise. Refreshingly, chapters are interspersed with short interludes that keep us connected to the lived experiences of the students that we will be teaching.

Interlude: A conversation between Milo and Lorena

Lorena is a post-doc in engineering education research, and her mentor, Milo, stops by her office. She is getting ready to transition to a teaching-focused faculty role.

Milo: How are you doing?

Lorena: I'm nervous for the class I have to design and teach this fall. I love the topic and interacting with students, but I don't feel prepared for the bigger picture building a new course. I don't know where to start.

Milo: You should read the Felder and Brent book I'm working on reviewing – that's exactly what it's for.

Lorena: That would be really useful!

Milo: Actually, would you like to review the book together? You could provide insight on how it's helpful to you as a new instructor.

Two weeks later. . .

Milo: Have you had a chance to read the book yet?

Lorena: Yes, I finished it last night! Designing my course doesn't feel so scary anymore. They read my mind on what I've been worried about and gave me some manageable places to start. It's comforting to know that no one expects me to teach it perfectly the first time (or ever), and I also have this book to come back to as a resource later in the course when issues come up.

What Content is in the Book?

The book is organized into three main sections, each of which is prefaced by a concise summary of what the reader will find in each section, and when

in their course design and delivery process they might want to visit it.

Part One: Planning Courses

This section provides detailed instructions on creating learner-centered courses, spanning from the big picture of deciding which learning objectives to include in a course, to the process of turning an idea for a course into a more detailed syllabus, to the details of planning individual class sessions with effective teaching materials. Practical, easy-to-implement ideas are grounded in the science of how learning works, which is explained in an accessible way, to help readers understand how the tools presented will help their students get the course content into their long-term memory and retrieve it when they need it.

Chapter 2 includes over 50 examples of learning objectives, spanning different scales, types of knowledge, and course subjects, and exercises to help the reader practice writing and improving learning objectives. Chapter 3 highlights strategies to use – and not to use – when designing or redesigning a course, and preempts and addresses a wide range of teacher questions or challenges, from ''what's a reasonable time to devote to course preparation?'' to ''how much should test and quiz grades count towards the course grade?'' Among other resources for planning individual class sessions, Chapter 4 includes a section on types of tasks students can be given in class to promote learning, with diverse examples of each. Any instructor hoping to improve the effectiveness of their teaching should leave this section with at least a few, and likely many more, ideas that fit their context, and, perhaps more importantly, the confidence that those plans are achievable.

Part Two: Teaching Courses

If part one of the book helps the reader to discover the ''what'' of teaching, part two helps with the ''how.'' It includes chapters on effective instruction, including how to help students become more comfortable participating and what to do when sessions don't go as planned; active learning, from theory to practice; online teaching, in synchronous, asynchronous, and hybrid formats; and assessment of learning for a range of objectives. The interludes allow teachers a window into their students' experiences, providing potential impacts of different instructional choices. This section liberates teachers from the myth of ''perfect teaching,'' and instead shifts the focus to feasible ways to continuously improve teaching practice and respond when, inevitably, things don't go as planned.

Chapter 5 includes a list of events that commonly slow down instruction, resulting in teachers falling behind their plans, and what can be done about them. Chapter 6 includes over 20 active learning example prompts and seven in-class activity structures, aimed at seven different types of skills teachers might want to help their students to develop, so that teachers can choose and adapt ideas to best fit their context, and responses to eleven common active learning mistakes and concerns to help with implementation. Chapter 7 includes strategies to make active learning work well online, with multiple tables of activity ideas and when and how to use them. Chapter 8 helps teachers to assess their students' learning formatively and summatively, and includes many example question types and rubrics for different purposes, along with a nine-step process to guide the teacher from test design to grading to handling grade appeals from students. This section is a toolkit with limitless applications; its strength lies in its flexibility and adaptability to the needs of the teacher putting it into practice.

Part Three: Facilitating Skill Development

This section considers the professional world for which teachers are preparing students, and the skills they will need to succeed. It addresses how to better prepare students to solve complicated problems, to engage in critical thinking, and to develop professional skills like communication and working productively in teams. Throughout the section, teachers are introduced to different student archetypes and prompted to understand their perspectives, bring them on-board with active learning, and think through how to meet their different needs.

Chapter 9 describes the differences between novice and expert problem solvers, and details a range of inductive teaching methods that both help students to develop towards being expert problem solvers and cultivate the self-efficacy that allows them to thrive. Chapter 10 provides over forty low- and high-stakes tasks, and illustrates how they can be used to give students practice in seven types of professional skills, from communication to metacognitive thinking. Chapter 11 gives practices for forming teams, assigning team-appropriate tasks, and handling the challenges of teamwork to maximize its positive impact. Chapter 12 brings returns to learner-centered teaching to address diversity, equity, and inclusion, setting teachers on a path of continually-improving teaching practice.

Ideas to Take Away

From decades of delivering workshops to countless interactions with individuals, Felder and Brent have distinguished themselves with significant contributions to helping teachers develop their instructional practice. In their book, *Teaching and Learning STEM: A Practical Guide*, they have

distilled these experiences into an accessible resource which teachers can utilize. Like they do in each of their chapters, we end this review with important ideas to take away:

- The book provides instructors with useful content across the spectrum of issues that arise in teaching a course, including planning the course, its delivery, and students' skill development.
- Rather than a one-shot read to somehow magically change your teaching, the book is truly a "guide" designed to be a "just in time" resource to regularly use and consult for improved teaching and learning.
- The copious examples, the thought questions sprinkled throughout, and the interludes describing student experiences provide a rich way to contextualize and operationalize the content.
- Most importantly, the tone of the book and the responses to anticipated teacher concerns makes it feel more like a dialogue with a mentor than a monodirectional text. With this book on your shelf, you can always share your office with Richard Felder and Rebecca Brent!

Milo D. Koretsky & Lorena S. Grundy

Institute for Research on Learning and Instruction
Department of Chemical & Biological Engineering
Department of Education, Tufts University
Medford, MA 02155, USA.