Review: Designing and Using Effective Learning Environments

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Felder, R. & Brent, R. (2016). *Teaching and Learning STEM: A Practical Guide*. Jossey-Bass, San Francisco, CA.

Felder and Brent's *Teaching and Learning STEM: A Practical Guide* (Jossey-Bass: San Francsico, CA), is a new entry in a market that has been flooded with similar offerings – those targeted towards improving teaching and instruction – recently. This volume though is slightly different as it focuses specifically on STEM educators and is one of the more comprehensive of such volumes. Both authors are recognized leaders in the area of STEM education and have decades of experience in STEM education as well as in faculty development. The engineering education community in particular knows their work well. It utilizes research on learning as a basis for the advice provided in the book.

Before I talk more about this book, I have to start with a caveat. The authors explicitly state in the introduction that the book is not meant to be consumed in a single reading; readers should dip into the volume as needed. As a reviewer, I did not have this luxury. Although I did put test their advice on a new course I recently designed, for the most part I read the book in one sitting.

For STEM instructors looking to improve their teaching, the book provides a significant amount of practical advice for designing and teaching courses. The advice is provided in small doses and can be implemented in a similar manner, making it practically relevant. Another useful component is advice regarding assessing students' learning that accompanies guidance about course design and curricula. Specifically the book provides targeted advice for:

- Planning and conducting class sessions in which students are actively engaged
- Using technology for face-to-face, online, and hybrid courses
- Assessing student learning by looking holistically at knowledge, skills, and conceptual understanding
- Assisting students with developing skills across domains including communication, creative thinking, critical thinking, and teamwork
- Creating curricula and courses that support student learning for a diverse student body

The book is divided into three main sections: Designing Courses; Teaching Courses; and, Facilitating Skill Development. The first section, as the name suggests, goes into the nitty-gritty of how to design a

course, including guidelines for preparing course syllabus, planning class sessions, and creating teaching material. The second section focuses explicitly on how to teach including using active learning, use of technology, and promoting conceptual understanding. Finally, the authors provide guidance on how to develop problem-solving, professional, and teamwork skills among students. Throughout the book, authors provide examples of specific things that the instructor can do in class to implement an idea they have discussed. The authors also use cases and examples from their own experience to demonstrate ideas they advance. Throughout, they preempt objections that an instructor might have to a given approach, e.g. Table 6.6-1. Five Common Concerns about Active Learning, and address the issues. The book also includes numerous samples of usable items, including grading rubrics e.g. "Exhibit 8.4-2. Grading Rubric for Lab Reports." There are many research-based strategies, primarily those popular in the engineering education community, prescribed in the book such as cooperative learning, active learning, and project-based learning. These ideas are what make the volume STEM specific.

Overall, the book is extremely comprehensive and therefore the best, and probably the only, way to actually use it is to dip into it as needed, as the authors suggest. There are some pieces of valuable advice in the book that both novice and experienced instructors would do well to heed. First, don't try to do too much. I think this is something that we all forget. There is limited time, students have limited attention, and therefore, the best step is to keep things manageable. Keep it small. Second, keep iterating. This advice is in some sense a corollary of the first. If you keep things manageable and actually pay attention to what works and what doesn't, you have a better chance of making changes that work. Finally, if one reads carefully, and in some ways between the lines, the book is asking of its readers to be mindful of what they do and how they do it. Based on their vast experience the authors recognize that most instructors work under some kind of time or resource limitation and as a result are prone to taking on more than what can be actually accomplished. Their advice is to avoid this and think things through, make conscious choices about what goes in, or in their words – *curb your perfectionism*.

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