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Brown, P., Roediger, H., & McDaniel, M. (2014). *Make it stick: The science of successful learning.* Cambridge, MA: Belknap Press of Harvard University Press.

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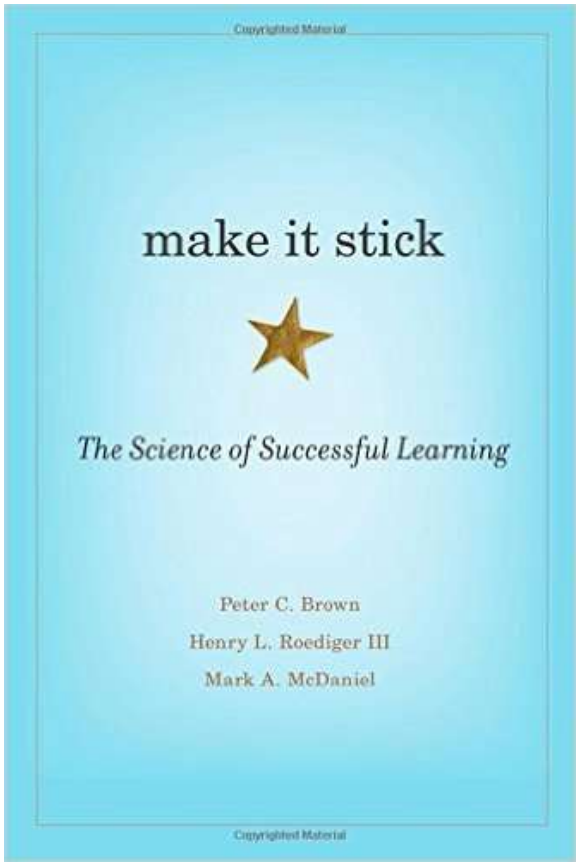

It is likely that when some readers see the title of the book: Make It Stick: The Science of Successful Learning, by Peter C. Brown, Henry L. Roediger III, and Mark A. McDaniel, they will mistakenly assume that the text is merely a basic review of lessons already learned. Most likely to harbor this assumption are practitioners who have been heavily immersed in workshops, in-service and college classes. However, these same readers will be pleasantly surprised. Not only is Make It Stick an easy read, with its mix of story-telling and scientific study, it is also filled with cutting edge science.

The mix of authorship works well throughout the book. Roediger and McDaniel describe themselves in the preface as cognitive scientists who have dedicated their careers to the study of learning and memory. Roediger, who has a PhD in psychology from Yale, has been a researcher in that field for the last 40 years, while McDaniel, with a PhD from the University of Colorado at Boulder, is a prolific author and researcher in the area of cognition

and learning. Brown joins the team as a storyteller, adding a personal touch and practical application to the science throughout the book.

According to the preface, the book was written largely as an off-shoot of evidence gained from research done over a 10-year period in collaboration with 11 psychologists. The James S. McDonnell Foundation of St. Louis, Missouri funded a research grant in 2002 for Applying Cognitive Psychology to Enhance Educational Practice to "translate cognitive science into educational science" (Preface). The information these researchers acquired makes up the lion's share of this book. Data was acquired from personal interviews, psychological and educational journal articles, and experiments and studies done since 2000, the majority prior to 2008. The experiments and studies done yielded some unexpected results in the area of retention, productive and non-productive study habits, feedback, the importance of embracing and overcoming challenges, and others. The entire book is basically a report of the research findings from this study.

The authors' stated audience for the book is teachers, students, trainers in business, industry, or military, coaches, or for lifelong learners who just want to keep their edge when learning new material. I found the material in the book to be applicable to my role as a special education teacher, as a student, and as a person over age 50 who is still in the business of learning something new every day. While many students might be able to learn subjects without the use of these strategies (although they would benefit any student), those with a learning disability benefit from new strategies such as those described herein. In special education, I am always on the lookout for such research based strategies to use to facilitate my students' learning.

The first chapter, "Learning is Misunderstood," whets the appetite for the rest of the book. The authors begin their argument by addressing some of the most common methods students use for "remembering": re-reading, highlighting, underlining, and concentration on a subject for hours, or "cramming" for a test. According to the authors, these strategies will not result in true learning, but will only give the illusion of knowing. Learning facts in a meaningful way by using the methods described in this book is the starting point, and concept development and creativity emerge from this basis.

The authors school the reader how to best study for true learning to occur. Each chapter is a mixture of personal example and scientific research, neither of which is dry. The methods championed are not easy, and they require a commitment of time to complete, but the examples of their success are convincing. As the authors say, although we have long thought that learning was best when it was easy, the opposite is true: learning "sticks" best when it is effortful. For example, the authors demonstrate that retrieval of a fact, having to pull it from memory, causes better learning than selecting from alternatives on a multiple choice test. Although, as a student, I've always preferred multiple choice/true-false tests over essay and short answer, I can vouch for the fact that the latter did elicit a better understanding of the concepts studied. Whether or not this is encouraging news for the learning community depends on our goals for learning. Students who are just trying to get through a test might find this approach frustrating, but as an educator who wants to see a different outcome from her students, I find these concepts fascinating.

The researchers develop the idea that "desirable difficulty" (p. 68), should be welcomed in our quest to learn. The idea is to constantly raise the bar on one's goals. The more difficulty there exists in retrieval of what has been learned, the more entrenched the learning will be, so the student should not shy away from difficulty, as long as it can be worked through. The entire book, is an encouragement not to take the easy route to

learning, and not to be discouraged when learning seems to be coming at a slow pace when following the authors' suggestions. Too much of the time, the emphasis in class seems to be to "cover the material," and to do so quickly. Teachers have come to expect students to chew it up immediately, and then to be able to regurgitate the learning on the test. The question is: how much real learning happens in such a situation?

Another strategy the authors espouse is to mix practice. Conventional wisdom is that to learn a topic, one should stick to that one thing, studying it repeatedly, having it stuck firmly before moving on, or massed practice. Research proves, though, that mixing it up, or "interleaving," as the researchers called it, produces longer-lasting, versatile learning. The example in the chapter was batters who focused on hitting only one type of ball at a time vs. those who practiced batting different types of balls, or mixed practice. Those who used mixed practice performed better when the true batting time came. The caveat to this type of learning, according to the authors, is the amount of time it takes. When practicing one skill over and over, a person may feel that they have learned more quickly, but the mixed practice, which is spaced out over time, will produce better results in the long run. In one first grade math curriculum, this was called spiraling. Students had various review problems on their math homework, rather than just what had been learned that day. The review always produced great retention of the prior learning.

The authors also introduce a fascinating concept called illusions of knowing (p. 102). They report numerous examples of ways we humans are either convinced or convince ourselves that we know things that actually never occurred, or facts which are not true. The authors also pointed out that incompetent people are not aware how little they know, even when they are able to compare themselves with others who obviously know more! The point was that we should be skeptical about how much we actually know of what we are supposed to have learned. The remedy: to use periodic self-testing to really check ourselves on what we have actually learned. The authors make a good case that periodic testing will not only show students where they are weak, but the retrieval required for these testing periods will solidify and strengthen what has been learned.

Although teachers today are told to differentiate for various learning styles in the classroom, these researchers cite the importance of going beyond the learning styles which are the student's strengths, and focusing on boosting the potential of the weaknesses we possess. One example that stood out for me was the way some people with dyslexia are able to overcome the disability and go on to become very successful in various fields because of their ability to be self-motivated and to see the big picture. Also of interest is the researchers' critical study of both learning style theories and IQ. The conclusion they reach is that, due to the lack of good research on learning styles, and the way that IQ can change over time, teachers would be better served by using the techniques outlined in Make It Stick. Their research results seem to support this conclusion.

Finally, the authors report on the amazing brain and its ability to change and grow until a person was in their 50s or 60s. Of particular interest to me, and supporting what early childhood experts have long asserted, the book cites studies that show IQ is improved when children are placed in early education programs. Young children whose mothers or caregivers read to them before age 4 and children who have access to learning tools such as puzzles and books also tend have higher IQ scores than those who do not. Early intervention strategies such as these could change the education experience for children and should be more of a priority.

While Make It Stick is similar to other books that offer scientific studies on the theory of learning, I found it to be full of applicable methods that can be easily applied to the classroom today. This applicability is

one of its greatest strengths, along with the fact that the book was engaging and easy to read. The final chapter is literally a step-by-step manual for students to use to improve their own learning. The authors demonstrate how to apply their techniques for lifelong learners, teachers, and business trainers. The only weakness I found was that the chapter on the brain seemed out of context to some degree. However, the information in that chapter was interesting, so it did not detract from the worth of this book.

I would recommend that anyone pick up Make It Stick who is serious about teaching or learning. I found it to be an accessible, inspiring book with enough research to convince the skeptical and well-told stories about people who use these strategies every day. Teachers looking for new strategies to help all their students, and students who are serious about truly learning the material at hand, rather than just cramming for a test, will find this work to be invaluable.

About the Reviewer

Sheri Lynn Warren is a PhD student in Curriculum and Instruction at Texas Tech University.

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