Ciências & Cognição, Vol 21(2), 198-201, 2016 <http://www.cienciasecognicao.org/revista> © Ciências & Cognição
Submit 02/05/2016 | Accepted 13/05/2016 ISSN 1806-5821 - Published 30/12/2016

In the age of evidence-based education, "Make it Stick: The science of successful learning": book review

Na era da educação baseada em evidências, resenha do livro "Make it Stick: The science of successful learning"

Roberta Ekuni [a], Sabine Pompeia [b]

a) Center of Biological Sciences, Universidade Estadual do Norte do Paraná, Bandeirantes, Paraná, Brazil; b) Department of Psychobiology, Universidade Federal de São Paulo, São Paulo, São Paulo, Brazil.

Abstract
Book review: "Make it Stick: The Science of successful learning", by Peter C. Brown, Henry L. Roediger, Mark A. McDaniel. London: The Belknap Press of Harvard University Press, 2014.
***Keywords**: learning; memory; cognition; testing-effect; education.*

Resumo
Resenha do livro: "Make it Stick: The science of successful learning" de Peter C. Brown, Henry L. Roediger, Mark A. McDaniel. Londres: The Belknap Press of Harvard University Press, 2014.
Palavras-chave: aprendizagem; memória; cognição; efeito da testagem; educação.

There is today a global trend towards making education an evidence-based practice (Ansari, Coch & Smedt, 2011). There is a sector that takes advantage of this trend and launches products and strategies to promote learning that are supposedly based on scientific data (Goswami, 2006). However, most of these products are actually based on Neuromyths, that is, misinformation about how the brain works (Pasquinelli, 2012). In this scenario, the book "Make it stick: The science of successful Learning" by Brown, Roediger, and McDaniel (2014) clarifies, with scientific explanations, evidence-based study strategies that improve memory and learning.

The book, authored by two renowned researchers in the area of memory and learning who teamed up with a professional writer (Brown) is easy to read and accessible to the non-academic milieu. Together, these factors are essential to disseminate science applicable to education.

With 8 chapters, the book is based mainly on the discoveries of Psychology and Cognitive Neurosciences and describes techniques that can be used in a more efficient and lasting way when teaching or learning.

The first chapter, "Learning is misunderstood", discusses the lack of knowledge about evidence-based learning techniques and the fact that many students use time-consuming and inefficient practices. Data supporting this can be found in a survey by Karpicke, Butler and Roediger (2009), in which students were asked which study methods they use. The most frequently reported

method was rereading notes or textbooks which, according to literature, is inefficient compared to other studies techniques such as solving or practicing exercises, or self-testing, the central theme of the chapter 2.

The second chapter, "To learn, retrieve", explains that memory is improved when we try to retrieve information, such as through quizzes, tests, and exercises. This phenomenon, known as “retrieval practice” or the "testing effect" (Roediger & Karpicke, 2006), is robust and evidenced both in the laboratory and in real classrooms environments . If the goal is to promote long lasting learning, information must be retrieved several times because this makes memory traces stronger and less labile (Karpicke & Roediger, 2008; Rowland, 2014). Each time one tries to remember a piece of information it is reconsolidated, its memory trace becomes stronger and it is potentially better integrated with previous and new knowledge, all of which can be potentiated with each recall attempt. Thus, repeated access to information can also improve semantic memory (McKenzie & Eichenbaum, 2011), allowing a more precise delimitation of the meaning of each content and reducing the likelihood that concepts will be confused with similar information.

The third chapter, "Mix up your practice", defines ways of studying regarding timing and the importance of the use of a variety of learning strategies. Examples are: massive practice (studying all the content at once), distributed practice (studying spaced over time), mixed practice (interleaving content), and varied practice (using different learning strategies). The authors points out that, from a scientific perspective, studying all content at once is an inefficient technique in terms of promoting lasting learning, whereas studying a little each day, preferably diversifying both content and strategies, has a greater potential to do so.

The fourth chapter, "Embrace difficulties", shows that learning is not always easy and that some difficulties are desirable to make learning more durable, essentially because they make people think about the studied content. The authors question the method of errorless learning, which argues that mistakes during the learning process should be avoided to obtain better results. For instance, highlighting text and re-reading content involve little in the way of difficulties and cognitive effort (Clark and Bjork, 2014). However, when some desirable difficulties are present, such as when trying to remember content without consulting notes or the textbook, interleaving study practices or spacing learning moments, despite there being a greater chance of making mistakes because the process becomes more difficult, the cognitive effort involved leads to longer lasting memories. To illustrate to readers how desirable difficulties work the authors explain how memories are formed by describing the processes of encoding, consolidation, retrieval and reconsolidation of information. Additionally, the importance of prior knowledge to serve as a basis for new learning is emphasized. The authors point out that new information is more easily learned if it has a more solid foundation, that is, if connections are made with other known content (see Ambrose & Lovett, 2014).

The fifth chapter, "Avoid illusions of knowing", argues that we lack adequate abilities to monitor our knowledge, or to know what we know (metacognition). People tend to overestimate their own memory, which has negative consequences to learning. For example, some study methods such as reading the content repeatedly leads to familiarity with the read information so student feels confident that they will be able to remember it later. However, believing that something is known does not necessarily translate into acquisition of knowledge, or success in subsequently remembering information. The authors finish the chapter by listing some strategies to improve our judgment of our own memory abilities. A way to do this is to test oneself repeatedly to determine whether the content was really learned.

A well-known phenomenon in the area of education is the existence of "learning styles", that is, the idea that acquisition of knowledge is optimized if the content is presented in a congruent way with each student's learning style (visual, kinaesthetic or auditory). This is a neuromyth which is

widely disputed (for a review, see Pashler, McDaniel, Rohrer & Bjork, 2009). In this context, the sixth chapter, "Get beyond learning styles", shows that other individual characteristics, such as prior knowledge, intelligence, aptitudes and interests, are far more important. Another essential factor is students' opinions of their own abilities: if they believe that they are capable of learning something, they probably will do so because they will strive and engage in the learning process.

In the seventh chapter, "Increase your abilities", the authors clarify what is neuroplasticity, intelligence quotient (IQ), and other terms related to learning. They discuss that two pupils with similar intelligence may learn differently depending on their level of curiosity and the cognitive stimulation available in their environment. In other words, they point out that it is possible to increase cognitive skills as long as active work is devoted towards doing so. This is relevant because many studies show that the role of socioeconomic status in learning must be considered and that environmental stimulation is relevant to cognitive development (see Noble, McCandliss & Farah, 2007). This chapter also discusses the low efficacy and lack of evidence that commercially available brain-training games result in long-lasting learning. The chapter ends with the presentation of efficient techniques such as mnemonic clues and rhymes, some of which are used by World Memory Championships competitors.

The last chapter, "Make It Stick", is a type of manual that describes how to learn based on evidence presented in the previous chapters. Tips for teachers to help their students become better learners are provided. This can be done by explaining how the learning process works, which techniques should be used to study, and by creating desirable difficulties in the classroom. Examples of the latter are making content less accessible or the information more difficult to retrieve, both of which strengthen memory traces as explained above.

At the end of the book there is a list of scientific papers and comments explaining the techniques presented throughout the text. Undoubtedly, this book is useful for students, a must for educators, and indispensable for those who have the power to formulate and execute public policies, as they may insert knowledge of these techniques into educational practices. We thus recommended that this excellent book be translated into Portuguese so that it can become accessible to those who only read this language.

References

Ambrose, S.A. & Lovett, M.C. (2014). Prior knowledge is more than content: skills and beliefs also impact learning. In V.A. Benassi, C.E. Overson, C.M. Hakala, (Eds.), Applying the Science of Learning in Education: Infusing psychological science into the curriculum (pp. 7-19). American Psychological Association.

Ansari, D., Coch, D. & Smedt, B.D. (2011). Connecting education and cognitive neuroscience: Where will the journey take us? Educational Philosophy and Theory, 43 (1) 37-42.

Brown, P.C., Roediger, H.L. & McDaniel, M.A. (2014). Make it Stick: The science of successful learning. London: The Belknap Press of Harvard University Press.

Clark, C. M. & Bjork, R. A. (2014). When and why introducing difficulties and errors can enhance instruction In V.A. Benassi, C.E. Overson, C.M. Hakala, (Eds.), Applying the Science of Learning in Education: Infusing psychological science into the curriculum (pp. 20-30). American Psychological Association.

Goswami, U. (2006). Neuroscience and education: From research to practice. Nature Reviews Neuroscience, 7, 406-413.

Karpicke, J.D., Butler, A.C. & Roediger, H.L. (2009). Metacognitive strategies in human learning: Do students practise retrieval when they study on their own? Memory, 17 (4) 471-479.

Karpicke, J.D. & Roediger, H.L. (2008). The critical importance of retrieval for learning. Science. 319, 966-968.

Mckenzie, S. & Eichenbaum, H. (2011). Consolidation and reconsolidation: Two lives of memories? Neuron, 71 (2) 224–233.

Noble, K.G., McCandliss, B.D. & Farah, M.J. (2007). Socioeconomic gradients predict individual differences in neurocognitive abilities. Developmental Science, 10 (4) 464-480.

Pashler, H., McDaniel, M., Rohrer, D. & Bjork, R. (2009). Learning styles: concepts and evidence. Psychological Science in the public interest, 9 (3) 105-119.

Pasquinelli, E. (2012). Neuromyths: Why do they exist and persist? Mind, Brain and Education, 6, 89-96.

Roediger, H.L. & Karpicke, J.D. (2006). The power of testing memory: Basic research and implications for educational practice. Perspectives on Psychological Science, 1, 181-210.

Rowland, C.A. (2014). The effect of testing versus restudy on retention: A meta-analytic review of the testing effect. Psychological Bulletin. Advance online publication, 1-32.

Web of Knowledge (n.d.). Recuperado em 25 Setembro, 2015, do https://webofknowledge.com/

Corresponding Author:

R. Ekuni - Universidade Estadual do Norte do Paraná, Centro de Ciências Biológicas, Rod. BR369, Km 54. Vila Maria. CP 261, CEP 86360-000, Bandeirantes, PR. E-mail: robertaekuni@uenp.edu.br **S. Pompeia** - Universidade Federal de São Paulo, Departamento de Psicobiologia, Rua Napoleão de Barros, 925, CEP: 04024-002, São Paulo, SP. E-mail: spompeia@gmail.com