

# Engineered for Learning

## The Spiral Curricular Design

Spiraling refers to distributed practice as opposed to massed practice. Findings about the learning boost from spiraling are among the most robust in the learning sciences, applying across a wide range of content and for all ages from infants to adults. In fact, “Space learning over time” is the first recommendation in the U.S. Department of Education’s Institute of Educational Sciences (Pashler et al., 2007) practice guide. And in a recent review of the literature, Lisa Son and Dominic Simon write, “Both in the laboratory and the classroom, both in adults and in children, and in the cognitive and motor learning domains, spacing leads to better performance than massing” (2012).

Over a century of research has consistently proven

- Higher achievement on assessments
- Better, long-term mastery of math facts, skills, and concepts
- Faster identification of intervention needs

### SELECTED ANNOTATED BIBLIOGRAPHY

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Bjork, R.A. (1999). *Assessing our competence: Huristincs and illusions*. In D. Gopher & A. Koriat (Eds.), *Attention and performance XVII: Cognitive regulation of performance: Interaction of theory and application* (pp. 435-459). Cambridge, MA: MIT Press.

Summarizes the types of illusions of comprehension and competence and outlines the implications for real-world instruction.

Dempster, F.N. (1988). *The spacing effect: A case study in the failure to apply the results of psychological research*. *American Psychologist*, 43, 627-634.

Demonstrates the high potential for spaced learning to improve classroom learning and supports the application of spaced learning in classroom settings.

Pashler, H., Bain, P., Bottge, B., Graesser, A., Koedinger, K., McDaniel, M., & Metcalfe, J. (2007). *Organizing instruction and study to improve student learning* (NCER 2007-2004). Washington, DC: National Center for Education Research, Institute of Education Sciences, U.S. Department of Education. Retrieved from <http://ncer.ed.gov>.

Recommends the spacing of key course content as an overarching principle that teachers should attend to as they plan out sequences of instruction.

Rohrer, D. (2009). *The effects of spacing and mixing practice problems*. *Journal for Research in Mathematics Education*, 40, 4-17.

Explores research that demonstrates how dramatically test scores can be improved through spaced practice.

Son, L.K., & Simon, D.A. *Distributed learning: Data, metacognition, and educational implications*. *Educational Psychology Review* (2012): 1-21.

Discusses recommendations regarding how and why spacing strategies might be encouraged in real-world learning.

\* See appendix for a more complete bibliography.