MAGNA ONLINE SEMINARS

Supplemental Materials

Evidence-Based Teaching in Higher Education: Strategies to Improve Student Learning

Presented by:

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References to Materials Cited in the Program

Bjork, R. Here's a link to Professor Bjork discussing desirable difficulties: *[Slide 9]*
http://www.gocognitive.net/interviews/desirable-difficulties-slowing-down-learning

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*. Retrievable from the Society for the Teaching of Psychology web site: http://teachpsych.org/ebooks/asle2014/index.php

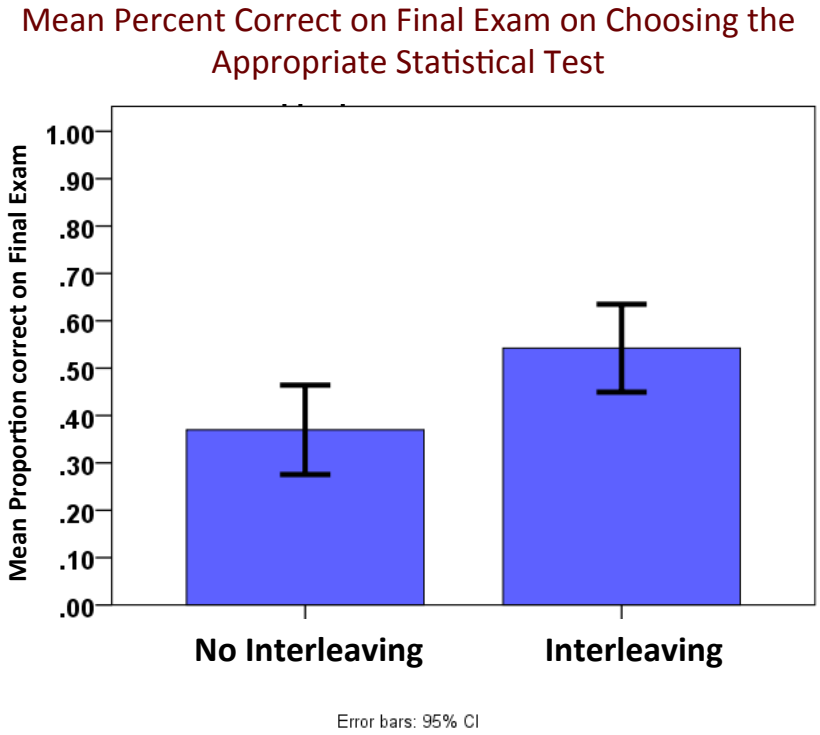
Daniel, D. (2012). Promising principles: Translating the science of learning to educational practice. *Journal of Applied Research in Memory and Cognition, 1*, 251-253.

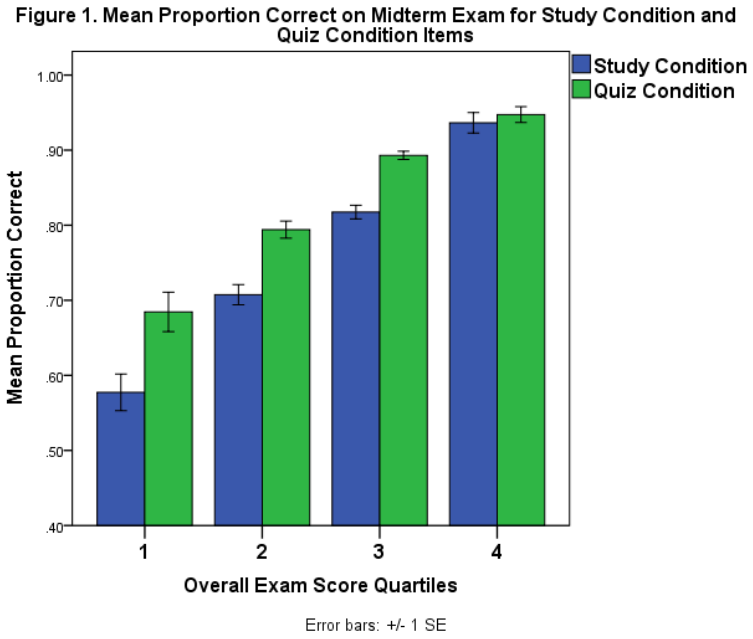
Dunlosky, J., Rawson, K., Marsh, E., Nathan, M.J., Willingham, D. (2013). Improving students' learning with effective learning techniques: promising directions from cognitive and educational psychology. *Psychological Science in the Public Interest*, 14, 4-58.

Mayer, R. E. (2011). *Applying the science of learning*. Upper Saddle River, NJ: Pearson.

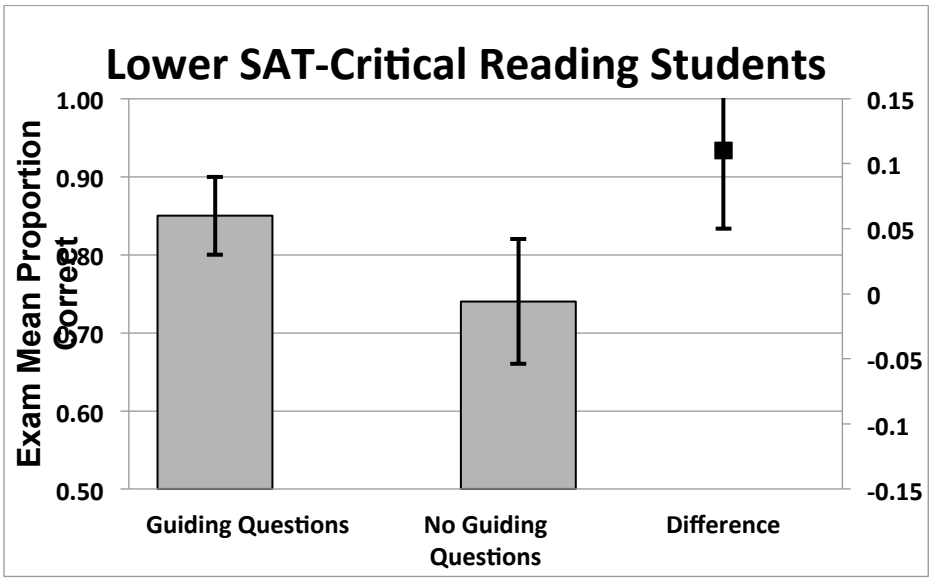
Roediger, H. L., & Pyc, M. A. (2012). Inexpensive techniques to improve education: Applying Cognitive Psychology to enhance educational practice. *Journal of Applied Research in Memory and Cognition, 1*, 242-248.

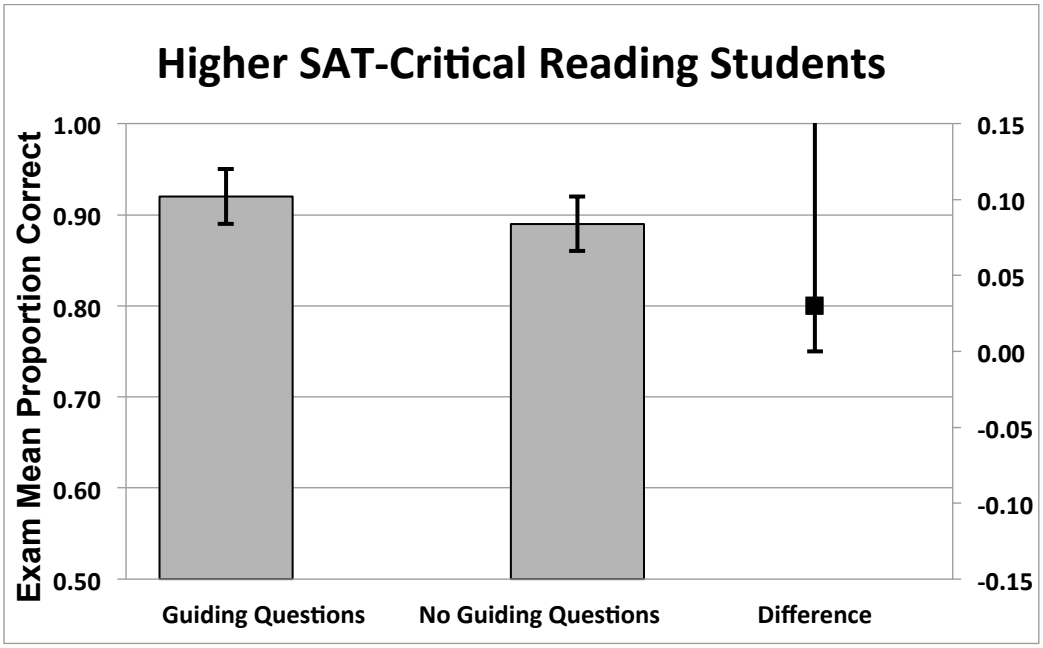
Bar Graphics Discussed in the Program





Benefits of adjunct questions for skilled and less skilled readers





Mean Exam Scores (on Left) for Questions for Which Lower SAT-Critical Reading (Top) and Higher SAT-Critical Reading Students (Bottom) Either Did or Did Not Submit Written Answers to Material Assessed on the Exam. Provided on the Right of ach Graph is the Difference Score Between the Experimental Conditions. The Error Bars are 95% Confidence Intervals.

Other Resources Worth Checking Out

These resources, mostly from outside cognitive psychology, describe the application of some of the learning principles described in the program.

Brame, C. J., and Biel, R., (2015). Test-enhanced learning: The potential for testing to promote greater learning in undergraduate science courses. *Cell Biology Education—Life Sciences Education, 14* (Summer), 1-12. [open access journal]

"The term 'testing' evokes a certain response from most of us: the person being tested is being evaluated on his or her knowledge or understanding of a particular area and will be judged right or wrong, adequate or inadequate, based on the performance given. This implicit definition does not reflect the setting in which the benefit of 'test-enhanced learning' have been established. In the experiments done in cognitive science laboratories, the 'testing' was simply a learning activity for students. . . .Thus, the term 'retrieval practice' may be a more accurate description of the activity the promoted students' learning." (p. 9)

Brown, P. C., Roediger III, H. L., and McDaniel, M. A. *Make it Stick: The Science of Successful Learning.* Cambridge, Mass.: The Belknap Press of Harvard University Press, 2014.

A highly accessible overview of findings emerging from the science of learning, including research discussed in the program. Here's what the authors say about re-reading as a study strategy. "Rereading has three strikes against it as a study strategy. It is time consuming. It doesn't result in durable memory. And it often involves a kind of unwitting self-deception, as growing familiarity with the text comes to feel like mastery of the material." (p. 10)

Cohen, D., Kim, E., Tan, J., and Windelmans, M., (2013). A note-restructuring intervention increases student exam scores. *College Teaching, 61* (3), 95-99.

Here's a creative assignment with design features that develop student note-taking skills and that give students a set of notes that expedite study and review. When students did this note-taking assignment they scored significantly higher on test questions covering the material they'd restructured.

Cornelius, T. L. and Owen-DeSchryver, J., (2008). Differential effects of full and partial notes on learning outcomes. *Teaching of Psychology, 35* (1), 6-12.

This study is an example of the work supportive of giving student partial notes vs. complete notes. In this case, the cohort who got the partial notes got statistically significant higher scores on the third and fourth exams in the course, they did better on conceptual questions on exams and they got statistically significant higher course grades.

Eddy, S. L., Converse, M., and Wenderoth, M. P., (2015). PORTAAL: A classroom observation tool assessing evidence-based teaching practices for active learning in large science, technology, engineering, and mathematics classes. *Cell Biology Education-Life Sciences Education, 14* (Summer), 1-16. [open-access journal]

These faculty researchers describe how they took a number of research findings including some discussed in the program, translated them into concrete, observable actions and constructed an instrument that teachers can use to give themselves and others feedback on the extent to which certain evidence-based practices are being used.

Discussion Questions about Evidence-Based Teaching

It's usually thought of as a practice, strategy, teacher action, activity or approach which has been documented by research to positively impact learning outcomes, most often achievement, as measured by test scores and grades.

What activities would you list as evidence-based?

How much evidence does there need to be in order for something to be deemed evidence-based? One study? More than one? How many?

What if the research results are mixed? In some cases, the results of a practice are positive and in others they have no impact or a negative one.

In the lab, an instructional activity, practice or teacher action can be studied in isolation, but when executed in the classroom what's being done is being used in combination with other activities. Does that grouping influence how the individual strategy functions?

Overall, how evidence-based do you think teaching is? How evidence-based is your instructional practice?

What's needed to infuse more evidence-based practices into teaching? How do we prevent "evidence-based teaching" from becoming nothing more than a buzz word in higher education?

Are there ways we could better bridge the research-practice divide?

The following review appeared in the February, 2014 issue of the *Teaching Professor*. The book is still free and available for down load at the link provided in the article.

Book Review

Applying Science of Learning: Infusing Psychological Science into the Curriculum

Edited by Victor A. Benassi, Catherine E. Overson, and Christopher M. Hakala

The Book in a Nutshell: The title makes the book sound a bit daunting, but what the editors say about it clarifies its content and focus. "The overarching theme of this book is on the interplay between the science of learning, the science of instruction and the science of assessment." [those three labels are attributed to Mayer]. A few definitions are helpful at this point. "The field of specialization known as the science of learning is not, in fact, one field. Science of learning is a term that serves as an umbrella for many lines of research, theory, and application. A term with an even wider reach is Learning Science (attributed to Sawyer). The present book represents a sliver, albeit a substantial one, of the scholarship on the science of learning and its application in educational settings." (p. 1)

"Substantial sliver" may a bit of an understated description for this 300 page 24 chapter volume and that's not counting the introduction which overviews the content and highlights various features of the work. Chapters appear in three sections which introduce important concepts, principles, theories and research findings related to learning. The 14 chapters in Part I address a wide range of topics, most of them aspects of learning about which the typical college teacher knows little: the spacing and interweaving of study and practice, errorful and errorless learning, the expertise reversal effect, what practice tests contribute to learning, why self-explanation supports learning, to name a few.

Often when faculty confront unfamiliar educational language they dub it jargon and too quickly disparage and then dismiss the work. To do so in this case would be a mistake. These chapters focus on aspects of learning that regularly confront teachers. For example, is it easier for students to learn something when it comes to them error free as teachers usually deliver it, or is making mistakes something that enhances the learning process? What about working groups where other students can add confusion and misunderstanding? Doesn't that get in the way of learning? Most faculty would be surprised to find out that the role of errors in learning has been studied at length and what is known is clearly presented in the chapter on it.

Part 2 shares approaches to working with faculty on applying the science of learning in their classrooms and Part 3 "provides six examples of research that has been done in real academic settings and that applied one or more science of learning principles." (p. 2)

What's impressive about this book: All sorts of things starting with the fact you don't need to be an educational expert to read this book. "We instructed authors to write their chapter so that teachers from any field or discipline could read and understand its content." (p. 3) That doesn't make the various chapters easy reading. The science of learning (like science in every other field) is complex, but this book makes it accessible and does so without diluting the content. It's a book you have to work at reading but what you learn makes it well worth the effort.

It's impressive because the chapters are mostly written by researchers and not just any researcher but those doing work in the areas about which they are writing. You are learning about various aspects of the science of learning from experts.

It's impressive because the chapters are uniformly structured, especially those in Part 1. They start with an overview that defines the terms and previews the content. That's followed by a discussion of the research which is summarized and mostly presented in accessible language. And finally the chapter addresses application issues—what it is teachers might considering doing based on what is known about this particular aspect of learning. Some of these chapters are among the best summaries and distillations of research I've read. And it is indeed rare when researches explore the implications of their findings. They do so here with concrete suggestions that teachers can implement in their courses.

It's impressive because although the book is an amazingly well integrated and coherent whole, you don't have to read it from cover to cover. The chapters stand alone and those overviews at the beginning allow readers to decide whether the topic is of current interest, although I started several of the chapters thinking they might not of interest only to discover I was wrong.

All of these features make this the most impressive book on teaching and learning that I've read in 2013. I cannot believe how much I learned and I still haven't divulged its most impressive feature.

What's the most impressive feature: You can have this ebook for free. No kidding. It's available for download at: http://teachpsych.org/ebooks/asle2014/index.php This amazing resource is being provided by the American Psychological Association's Society for the Teaching of Psychology. Hats off to them and a heartfelt thanks.

A bit from the book: Stephen L. Chew opens the second paragraph of a particularly useful chapter on "Helping Students to Get the Most Out of Studying" with this sentence: "For students to be critical thinkers, they must first be critical learners." (p. 215) He identifies four things that critical learners must be able to do.

- "They must be able to discern the critical concepts from the less important and tangential information."
- "They must develop a schematic understanding of the subject." This means that learning does stop with knowing the concepts. Whatever the student is learning must be developed into some sort of structure that links the ideas together.
- "They must be able to retrieve and apply the information appropriately." Knowledge isn't much good if it can't be used. A student has to be able to find the information they need to apply to the situation at hand.
- "Their schematic understanding must be generative; it must lay the foundation for further, more sophisticated learning."