

Mark your Calendar now for ITLAL Winter Events

December 16, 2016

**Winter Interlude
With special guest,
Michael Sweet, Ph.D.**

**Teaching for Critical Thinking
and Deep Engagement**
10:00-11:30am & 1:00-2:30pm
ITLAL Underground (Library 69)

Join us for this pair of workshops that will introduce frameworks for designing student activities to cultivate the most essential thinking skills in our students. Participants will leave with concrete practices they can use in their classes.

January 9 & 11, 2017

**Team-Based Learning
Academy**

(By application)
9:30am—3:30pm

ITLAL Underground (Library 69)

Learn the TBL method and its techniques, and redesign your course for higher-level learning goals and greater student engagement.

January 21, 2017

**Teaching with Cases
A Saturday Gathering of
UAlbany Teachers**

10:00am—12:00 noon

ITLAL Underground (Library 69)

Learn how to construct effective cases, ask students questions that will get them thinking more like experts, and manage the conversations that follow. You will leave with concrete ideas for building and implementing cases in your upcoming courses.

To register for events or request services, please visit
<http://albany.edu/teachingandlearning>
Or
Telephone: (518)442-5521
Or
E-mail: teachingandlearning@albany.edu

Making it Stick: Undoing Student Confusions about Learning and Memory with Counterintuitive Teaching

Why do our bright, nimble-minded students often arrive in class not understanding or remembering much of the assigned reading, what was discussed in class last week, or even material they knew on the last exam? While it's tempting to see these gaps as evidence of poor motivation, the fact is many students do spend a great amount of time trying to learn and remember. So what's going on? According to Henry Roediger and Mark McDaniel, cognitive psychologists and co-authors of *Make It Stick: The science of successful learning*, many students don't understand how learning really works. The good news is that some strategic changes in our teaching can make a difference!

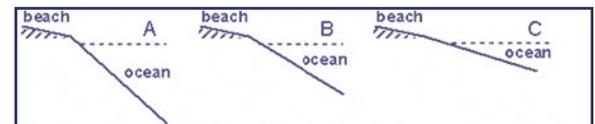
Confusion 1: The seduction of easy learning. Let's watch two friends using flashcards to prepare for a vocabulary test in their Chinese course. Anna studies the words and tests herself. Once she knows a word, she stops testing herself on it but continues to re-read the word to keep it fresh in her mind. Her friend Bella stops studying vocabulary she knows well but keeps retesting herself on all the words. Who performs better on the test? If you chose Bella, you're right. Anna did what many of our students do when they "study": she focused on reviewing, while Bella focused on repeatedly retrieving words from memory through self-testing. Both students were using the same study tools to prepare for the test, but they used very different levels of mental effort. As Roediger and McDaniel state when they review the studies on which this anecdote is based, "We're easily seduced into believing that learning is better when it's easier, but the research shows the opposite: when the mind has to work, learning sticks better" (2014, p. 43).

So what can we do? Teach for *effortful retrieval!* In our classes, this means pushing students to use what they've initially committed to memory. Use of learned material is a much more involved form of retrieval than simply recalling information. For example, rather than ask students to restate the biggest cybersecurity threats listed in the chapter they read for homework, require them to activate what they've learned with a task like this: "Rank these five cybersecurity threats from most to least worrisome for national security and explain why you ranked them that way." The mental work this task requires will increase the likelihood that the learning will last.

Confusion 2: Illusions of knowing. Students whose studying consists mostly of re-reading rather than retrieval practice often believe that they know more than they really do. Listen in on Anna's friend Carlos reading his oceanography textbook: "Here's the section on currents and tides and coastal processes. Okay, that makes sense! Here's some more information in this graph. I got it! This stuff is pretty easy." What do Anna and Carlos have in common? They're both passively encountering well-organized information and decidedly *not* encountering their own understanding of that information. It may seem counterintuitive, but excellent lectures, well-written textbooks, and beautifully-organized notes can actually impede learning and remembering. Because the presentation makes sense as they passively read, listen, or write, weaker students feel confident in their conceptual understanding, when in fact they have not questioned or explored it. Roediger and McDaniel warn us that this kind of unfounded confidence or "illusion of knowing" will actually prevent students like Carlos from doing the cognitive work that will help them regulate their learning more fully.

So what can we do? Teach to surface misunderstandings! Students should spend less time passively taking in well-organized presentations of information and more time confronting their misconceptions so they can monitor and adjust their own learning. When Carlos comes to class, consider how much thinking (and evaluating of his thinking!) he'll have to do to work on this problem:

At which location in the diagram would the waves break closer to the beach? A, B, or C?*



At first, students accustomed to being passive will resist tasks that surface their mistakes and misconceptions because it doesn't feel like learning to them, but as teachers we must persist in the work of dispelling illusions of knowing. Their resistance reveals yet another important set of confusions about learning and memory.

Confusion 3: The tyranny of facts before application. Let's follow Anna into her child development course. Her professor is introducing the concept of resilience with a short documentary about migrant farmworkers and their family life. Next, he asks students to respond individually and then in groups to this prompt: "The families interviewed discussed four needs: higher wages, childcare, access to quality schooling, and more time together as a family. Choose which two of these needs we should address to best ensure the healthy development of the children. Why?" Anna is confused, thinking angrily, "Why do we have to do this? We haven't even read the chapter on families! I wish he would just tell us what he wants us to know." Like many of our students, Anna's experience has shown her that teaching starts with students passively receiving foundational facts, and only after those facts have been "covered" will they be asked to act on what they've learned.

So what can we do? Teach with tasks that force students to generate understanding! Roediger and McDaniel emphasize the power of the "generation effect," which is the phenomenon of remembering and understanding something well when it's generated from our own efforts instead of being presented to us. Why does this counterintuitive approach work so well? When we begin to activate and explore our prior knowledge on a new topic, we prepare the cognitive resources that we have and that we'll need to make sense of that new topic. We also become aware of what we don't know or understand and are particularly receptive to information and solutions when they are presented. And as Roediger and McDaniel write, "the more that you can elaborate on how new learning relates to what you already know, the stronger your grasp of the new learning will be, and the more connections you create to remember it later" (2014, p. 208). So Anna's professor is on the right track when he asks his students to begin making some meaningful decisions before they have all the information. However, as we'll see next, this approach doesn't come naturally.

Confusion 4: Mistaking performance for learning. Anna comes home to find her roommate, Dorrie, bragging about the B she made on her biology test. She was up all night before the test writing out definitions again and again, moving chapter by chapter through the unit on cell biology in her textbook. Although Dorrie made a good grade on the test, her efforts will not produce lasting or meaningful learning. Psychologists Elizabeth Bjork and Robert Bjork explain that students like Dorrie confuse *performance* (how they do on an exam the day after an all-night cram

session) and *learning* (long-lasting understanding that can transfer to new and varied contexts over time). Cramming the night before a test tempts students, especially when it leads to good grades. They do not, however, recognize that "conditions that create challenges and slow the rate of apparent learning often optimize long-term retention and transfer" (Bjork & Bjork, 2011, p. 57). They don't recognize that the study strategies that help them *perform* well in the short term may not lead to *learning*.

So what can we do? Teach so that topics are interleaved throughout our courses! Students tend to see learning as a process that moves in a linear fashion from one topic to the next, in part because this is how traditional courses are structured. However, Roediger and McDaniel's review of the research suggests that interleaving topics and distributing student practice will lead to better retention. Interleaving means moving back and forth between topics or concepts throughout the semester, switching to new topics before students fully understand the topic they are currently working on. This counterintuitive approach more accurately reflects the complex nature of conceptual relationships in our disciplines. When we structure our courses so that students encounter and grapple with key concepts throughout the semester, we help them create more meaningful connections to the material by asking them to repeatedly confront and modify their understanding of topics. This means that instead of testing students on cell biology once, which can encourage cramming, Dorrie's biology instructor should require students to continue retrieving and using concepts from cell biology throughout the course.

What do all four of these teaching moves have in common?

All of these counterintuitive strategies push students to process course concepts more deeply, to forge powerful connections between their prior experiences and our course concepts, to re-engage with those concepts continually, and to encounter their own misunderstandings throughout the course. Roediger and McDaniel remind us that our courses need to be structured around these "desirable difficulties," which structure effort and reflection into student work for learning that lasts.

References

- Bjork, E. L. & Bjork, R. (2011). Making things hard on yourself, but in a good way: Creating desirable difficulties to enhance learning. In M. A. Gernsbacher, R. W. Pew, L. M. Hough, & J. R. Pomerantz (Eds.), *Psychology and the real world: Essays illustrating fundamental contributions to society* (pp. 56-64). New York: Worth Publishers.
- Brown, P. C., Roediger, H. L., & McDaniel, M. A. (2014). *Make it stick: The science of successful learning*. Cambridge, MA: The Belknap Press of Harvard University Press.
- *The correct answer to the oceanography question is A. This is an example of a Conceptest question, and can be found at <http://serc.carleton.edu/introgeo/conceptests/examples/waves.html>



INSTITUTE FOR TEACHING, LEARNING
AND ACADEMIC LEADERSHIP

UNIVERSITY AT ALBANY STATE UNIVERSITY OF NEW YORK
LIBRARY 069
1400 WASHINGTON AVENUE
ALBANY, NY 12222-0001

Non-Profit
Organization
US Postage
PAID
Albany, New York
Permit No. 205