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Research Says / Which Strategy Works Best? Bryan Goodwin

Which teaching strategy works best?" This is a question that many educators ask my colleagues at McREL. It's an earnest question, but it's a bit like walking into a gym full of workout equipment and asking a trainer, "So which exercise is best?" The answer, of course, depends on where you are in your fitness regime and what you're trying to accomplish.

So, too, with instruction. Different teaching strategies support different stages of the learning process—so when it comes to delivering instruction that sticks, the question isn't so much *what* to do, but *when* and *why* to do it. And answering that question starts with a clear understanding of how the brain translates new information into long-term memory.

The Long Journey

Brain researchers and cognitive psychologists tell us that before new knowledge finds a home in long-term memory, it traverses a long and perilous journey through three stages of information processing (Souza, 2011):

1. *Short-term memory*. To learn anything, we must first notice it, or put it into our *sensory registry*. By design, though, our brains ignore or quickly forget most stimuli in our sensory registry. Only a small subset of input is retained in our short-term memory, and it remains there for only about 30 seconds.
2. *Working memory*. When we consciously focus on stimuli, we begin to move that information from short-term memory into working memory, where we can hold information for about 20 minutes before it either decays or continues the journey to long-term memory.
3. *Long-term memory*. Factors like repetition or rehearsal then determine whether information moves into long-term storage. Instead of being stored like folders in a filing cabinet, though, brain research suggests that long-term memories are actually networks of neural pathways and are often retrieved through association with other words, settings, or sensations (Jensen, 1998)—which may explain why the smell of fresh cookies can remind us of our grandmother's home or recalling that we read *Macbeth* beneath a tree can help us conjure up the words that follow the line "tale told by an idiot."

Understanding what happens at each of these stages of learning offers a useful starting point for mapping teaching practices onto the learning process, thus helping students develop "sticky" long-term memory and deep knowledge. Here's what research suggests about where some tried-and-true instructional strategies might be most effective.

For Short-Term Memory, Call in Emotion

Because our senses are constantly bombarded with stimuli, our brains rely on a pecking order to filter out most of them. Stimuli that trigger fight-or-flight responses get our attention first, followed by those with emotional weight. Experiences that offer new learning without emotional content are less likely to make it past the filter and into our sensory registry (Souza, 2011).

This hierarchy suggests that students must feel safe and emotionally engaged before much learning occurs, supporting what most educators intuitively know—positive relationships with teachers are crucial to student success (Goodwin & Hubbell, 2013). It also confirms the value of including an emotional hook at the launch of a lesson. A study of 104 college students found that students who were shown films designed to elicit *positive* emotions like amusement or contentment demonstrated better attention and greater openness to new knowledge, contemplation, and effort than did students who viewed films designed to elicit *negative* emotions like anger or anxiety (Fredrickson & Branigan, 2005).

In Working Memory, Manage Cognitive Load

Once we've gotten students' attention, we must help them move information into their working memory. Researchers have found that when information is simply presented orally, we only retain 10 percent of it three days later, but when it's presented along with a powerful image, we recall 65 percent (Medina, 2008). Such findings suggest that nonlinguistic representations, such as graphic organizers (Beesley & Apthorp, 2010), may be useful at this stage of learning to help students process new information.

It's also important to recognize that our working memories generally hold only about seven bits of information at a time. (For younger students, it's even fewer.) If we introduce too much information at once, we may overload students' working memories, causing fatigue and frustration.

One way around this limitation is helping students mentally cluster information into larger concepts, or main ideas (Bailey & Pransky, 2014). We also know that working memory tends to time out after 5 to 10 minutes for preadolescents and 10 to 20 minutes for adults (Souza, 2011), so it may be best to present new information chunked into shorter segments, providing opportunities for processing in between.

For Long-Term Memory, Incorporate Rehearsal

Whether knowledge moves from short- to long-term memory depends on a variety of factors, starting with the extent to which learners make personal meaning by relating new knowledge to their own experience (Souza, 2011). Over the years, psychologists have conducted many studies of this *self-reference effect*. A meta-analysis of 129 such studies, for example, found significant effects on memory when participants memorized lists of words by relating them to personal experiences (Symons & Johnson, 1997).

Not surprisingly, classroom research has found positive effects for asking students to set personal learning goals and objectives (Beesley & Apthorp, 2010). This research suggests that the most powerful time to emphasize personalized learning goals—to help students answer the question, "What's in it for me?"—may not be when we want to capture students' attention, but rather when we want to help them move learning into long-term memory.

Perhaps the most important key to long-term memory lies in the simple notion of repeat, repeat, repeat; rehearsing new knowledge and practicing new skills to reinforce neural pathways in our brains (Souza, 2011). But not all practice is created equal. *Massed* practice (sessions grouped together) can be useful to develop automaticity with a new skill, but *distributed* practice (sessions spread over time) is more strongly correlated with long-term memory (Rawson & Kintsch, 2005). Similarly, *rote rehearsal* (for example, memorizing lists through mnemonics or other techniques) can speed automaticity and information recall, but *elaborative rehearsal* (for example, paraphrasing or summarizing learning, engaging in reciprocal teaching, making predictions, or generating questions about learning) seems to be more effective in supporting long-term memory and accuracy (Benjamin & Bjork, 2000).

Not Just What, But When

The teaching strategies mentioned here reflect only a small fraction of an expert teacher's repertoire. The key point, though, is that just as different physical exercises serve different purposes—to build strength, shed weight, or improve cardiovascular health—different teaching techniques serve different purposes in the learning cycle. Expert teachers need to have as much knowledge of cognition and learning as personal trainers have of physiology and exercise (if not more) so that they understand not just what to do, but when and why to do it. With that expertise, teachers can serve as personal trainers for student learning.

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