TEACHING TIDBITS

What Kinds of Practice Exercises Promote Long-term Learning?

The indefatigable investigators here at the IELT Research Laboratory, Spa & Discothèque™ want to help students learn as effectively and efficiently as possible so that the students can excel in their work while we indulge in aromatherapy saunas and ready ourselves to audition for our dance debuts. Designing teaching and learning techniques that promote deep learning requires us to understand the difference between learning and performance, and the types of practice that can improve both outcomes.

Learning v. Performance

If my students learn to do something well in my class today, how can I be sure they will remain able to do it equally well next week? Or that they will be able to do something very similar in someone else's class this afternoon? The major goal of all teaching is—or at least probably *should* be—to equip students with knowledge and skills that are both durable and flexible. We want to develop proficiencies that students retain over time and can be applied in different contexts; that is, which are "transferrable." Without retention and transferability, information and skills quickly recede into irretrievability and irrelevance. (How many of us non-biologists actually remember whether a zoological phylum ranks above or below a kingdom in taxonomic classification?)

Researchers who study learning carefully distinguish between improved ***performance*** that can be measured during a specific period of training, and true ***learning*** that remains observable well after the instruction is complete. Teachers can spur improvement in

performance by focused practice and repetition using in-class problems, questions, and exercises. But most teachers want more—we hope our students truly learn the material, and can maintain whatever gains they have achieved even after our classes are over.

Of course we expect memory to fade over time, but we do want students to hold on to the gist of what we are teaching (quick: what are the elements of negligence?) or the skills they are developing (how should you read and apply *Palsgraf*?) long after they leave our classrooms. But this desire for retention and transferability creates an assessment problem: how can you tell whether you're seeing transient performance gains that will drop away or learning that is deep, long-lasting and usable?

The education literature reveals some specific techniques that might help promote learning that sticks.

Mixing and Spacing

Mix it up. Suppose my kid laughs at me for being utterly unable to make a basketball free throw while we are playing one-on-one. Unable to tolerate the mockery, I vow to improve. How should I go about it? My first impulse is to go out to the court every day and stand on the free throw line and keep at it until I improve. Will my performance improve? Almost definitely. But surprisingly, I am more likely to improve my free throw average if I practice the same number of shots without *ever* standing on the free throw line. While I move my shooting position on the court forward and back, right and left, I am developing greater overall "basket-making awareness." This more generalized awareness translates to far greater competence, both at the unique task of shooting from the free throw line, and at shooting baskets overall. Research shows that practicing a skill in multiple related ways is *far* more effective than repeated practice in same way over and over again.

Do the benefits of mixed practice apply to developing intellectual skills as well as kinetic ones? Signs point strongly to yes: in studies of how students can best practice applying mathematical principles, ***interleaved*** problem sets (defined as exercises incorporating questions that employ differing problem-solving techniques) were found to promote greater

comprehension and retention than individually-focused “blocked” study (exercises that rehearse the same problem-solving methodology repeatedly). The additional mental effort required to categorize the kind of problem posed and to decide which tools to use to solve it have been pretty definitively shown to advance both comprehension and retention.

Space it out. Back to my free throw practice—now that I know *how* to do it, how often should I practice and over what time period? Parents of children learning a musical instrument have known for decades that the same amount of practice done in small chunks over time is far more efficacious than cramming the same work into a single practice session all at once.

Why? Spreading review over time permits distractions and loss of attention in between review sessions. This creates what learning theorists call a ***desirable difficulty***, in which we must work harder to actively recall the material when we return to it rather than work on it sequentially. Like the best athletic cross-training, these minor additional difficulties work us in less accustomed ways. More challenging review means we engage both our short-term and long-term memory; it therefore builds skills which are deeper, broader, and more thoroughly retained.

How to Use These Techniques in Class

Simple: as you plan your classes, increase the number of practice opportunities you offer your students and vary the kinds of activities you require. Change modalities—*e.g.*, switch from short answer problems to policy questions to multiple choice responses and back again. Revisit topics that you have already covered, and include them in problem sets addressing more recent material. Try to find ways to include quick quizzes/problems/exercises in class time and not just as assigned review or homework.

Be warned though—this kind of learning works better precisely because it makes people’s brains work harder, and people don’t always like to work harder. In fact, studies consistently find that learners *believe* they are accomplishing more through intensive focused study of only one topic at a time rather than in short randomized multi-mode practice sessions. But

they are wrong. Study after study shows that deep and lasting learning is significantly enhanced through changeable and repeated review.

If you've found a way to incorporate these kinds of approaches in your courses, we would love to know more about it!

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