Should Learning Be Easy? How Effortful Processing Improves Retention (Sep 14)

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“It is important to challenge learners. Oblige them to process your material in a deep and personal way. And slow them down so that they need to spend more time interacting with your material. Implementing a more rigorous training program will require you to reassure your learners, and your supervisor, that the harder work is justified because it will produce greater long-term benefits.”

Theodore Roosevelt is oft quoted as saying that “Nothing worth having was ever achieved without effort.” This month I am going to extend last month’s discussion of how difficulties and challenges enhance the learner’s ability to retain information.

To get started, I have a question for you. True or false? “The best training programs are easy for the student and produce rapid learning.” Most trainers immediately agree with this statement. After all, if the training is easy the learner is happy, and if it produces rapid results the organization is happy. It must be great, right?

Maybe. But maybe not.

Researchers from neuroscience, psychology, education, and even kinesiology have studied the question from many perspectives and have reached the surprising conclusion that infusing training with strategic difficulties and challenges dramatically improves the learner’s long-term retention. I’d like to illustrate this body of research by describing the creative work of my colleague Dr. Kellie Green-Hall at the California Polytechnic State University.

Take me out to the ball game

Dr. Green-Hall is an avid baseball fan and she wanted to develop a training methodology that would help her college baseball team to hit the ball more effectively. Before I explain more, let me provide a bit of background to those who know nothing about the sport. A college baseball pitcher throws a ball at about 80 miles an hour and, within less than half a second, a batter has to judge its vector and attempt to hit the ball. It is said to be one of the most difficult challenges in all of sports. The task is especially difficult because in addition to throwing the ball fast, a skilled pitcher can also make the ball curve, rise, drop, slide, screw, or have an erratic, unpredictable motion.
Green-Hall watched her team and she noted that, during batting practice sessions, the pitcher would routinely notify the batter that he was going to throw a series of a particular sort of pitch, so that the batter could develop his skills at hitting this sort of pitch. Green-Hall wondered about the wisdom of this. She wondered, "If I want to teach someone to become a better hitter, should I train him with one type of pitch at a time or am I better off mixing it up, throwing some random series of fastballs, curves, and droppers?"

The consensus among coaches is that batters do better if you teach them to hit one type of pitch at a time. Green-Hall was skeptical, however, and she convinced the coach to put his beliefs to the test. As a result, each day, the players were permitted 45 additional pitches of batting practice. Half of the players received 45 pitches grouped into three blocks: fifteen fastballs, fifteen changeups, and fifteen curveballs. These players quickly adapted to each type of pitch and hit them easily.

The other players received 45 pitches presented in a random order. They too received fifteen fastballs, fifteen changeups, and fifteen curveballs, but on any particular pitch, they did not know which one to expect. These players found this task more difficult, they learned more slowly, and they hit the ball less consistently.

This initial result suggests that the coaches were right and it supports the more general notion that "the best training programs are easy for the student and produce rapid learning."

But there is the more to the Cal Poly study. After some days, the researchers did a follow up assessment and here the results were quite different. During the follow up, the players who practiced with random pitches actually did markedly better than the players who received the pitches grouped together. In fact, the random batters did better during the assessment phase, whether these pitches were delivered in blocks or randomly (see Figure 1).

![Figure 1](image)

**Figure 1**: The players who practiced with the pitches delivered in blocks performed significantly better during the training periods. However, the players who practiced with the more difficult, randomly-delivered pitches did significantly better during the post-training tests.
The finding is actually quite remarkable. The group of players who learned more slowly, and who hit the ball less consistently during training, actually did better when it counted, during the assessment.

**Why is difficult better?**

The players in the block-training condition knew what to expect on every pitch. As a result, they quickly adapted to the repetitive challenge of hitting a curve ball and their performance during the training phase improved. But they were practicing a simple repetitive action (which is a form of massed practice); this relies only on retrieving information from short-term memory. Such training does not require accessing long-term memory and, as a result, little improvement occurs. In contrast, the players in the random-training condition did not know what to expect on any pitch. Their task was more complex (it is a form of spaced training) and it required the hitter to constantly make reference to long-term memory. As a result, their performance during the acquisition phase was only mediocre. But in the background, this slow learning was producing steady and long lasting learning. And in turn, they were able to demonstrate the long-term benefits of this learning during the assessment phase.

These results illustrate a general phenomenon we see throughout the learning literature: the training techniques that produce the best long-term effects:

- Incorporate strategic difficulties,
- Require the learner to exert more effort, and
- Often slow down learning.

This lesson has clear implications when we are teaching employees a physical skill in a manufacturing setting, but the same logic applies when we are teaching soft skills like leadership. It is important to challenge learners. Oblige them to process your material in a deep and personal way. And slow them down so that they need to spend more time interacting with your material.

**People may resist**

Training that requires effortful processing produces better long-term learning, but this does not mean that learners are going to like it. In fact, many learners are likely to resist effortful processing. By definition, effortful processing requires more hard work, and as Thomas Edison used to say “A man will resort to almost any expedient to avoid the real labor of thinking.” As a result, implementing a more rigorous training program will require you to reassure your learners, and your supervisor, that the harder work is justified because it will produce greater long-term benefits.

**The illusion of mastery**

Green-Hall’s experiment also makes the important point that trainers are often misled when a learner appears to have mastered material. A trainer may assume that, just because a learner is able to answer questions following training, they have somehow mastered the material. Their ability to answer questions after training, however, demonstrates only that the learner is able to retrieve information out of their short-term memory and it tells us nothing about whether this information is being consolidated in their long-term memory.

All of us want to provide training that is popular, easy, and that produces immediate results. But keep in mind that people (such as baseball coaches) often misunderstand how to produce real learning. Furthermore, our ultimate goal is to produce long-term retention and behavior change in the workplace. When we want to determine “the best training method,” we should **not** be counting (a) whether learners like our training, (b) how easily they learn, or even (c) how quickly they master a task. Instead, your real measure of success needs to be how well your learners retain the knowledge and then apply it in the workplace. To maximize this retention and transfer, you need to add desirable difficulties into your training routines.
There are several ways to make training and retrieval more challenging, and next month we will look at how to incorporate “desirable difficulties” such as spacing, interleaving, and contextual variation. We will also examine difficulties that are gratuitous and that can actually reduce long-term retention.

Digging deeper

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The Thomas Edison quote has become part of the lore surrounding America’s greatest inventor. However, the quote actually has a long heritage and you should check out this fascinating article on the history of the quote.

I also encourage you to read the actual research article about the Cal Poly baseball team. The entire article, “Contextual Interference Effects with Skilled Baseball Players,” is available online.

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