

Practice Does Not Make Perfect

Lasting learning requires practice beyond the point of mastery.

By Daniel T. Willingham

Intuition tells us that more practice leads to better memory. Research tells us something more precise. Memory in either the short- or long-term requires ongoing practice.

Let's first consider memory in the short term, meaning days or weeks. Suppose I am trying to learn the procedures necessary for a bill to become a federal law.

I might study these facts (using any number of techniques) and periodically test myself. Suppose further that I study until I perform perfectly on my self test. Do I know these facts? Yes, I know them *now*. But what about tomorrow?

In order to protect this learning from the ravages of forgetting, I need to practise beyond one perfect recitation. Studying material that one already knows is called 'over-learning'.

Because memory is prone to forgetting, one cannot learn material to a criterion and then expect the memory to stay at that level very long.

There are situations where short-term knowledge is all that is required. For example, a science teacher may want students to have a series of facts about certain species at their fingertips so that he can introduce an important abstract concept concerning evolution on which these facts depend.

Once the student has used the facts to gain a firm understanding of evolution, no great educational harm is done if the particular facts about particular species are forgotten.

For other material, we most certainly do want longer-term retention. In this case, practice past the point of mastery is essential.

In the case of over-learning, the practice begins with active studying for the purpose of learning. Over time, practice will take the form of using old material in the course of studying some new material.

Over-Learning

In an illustrative experiment*, subjects were read a brief paragraph about a fictional country and then asked 22 questions based on the paragraph. If the subject answered a question correctly, the question was discarded. Then the subject heard the paragraph again and was asked those questions that he or she had missed. The procedure was repeated until the subject successfully answered all of the questions.

Another group of subjects participated in a second condition that required over-learning. A question was not discarded until it had been answered correctly three times rather than once.

All subjects received a surprise retest after a delay of either 15 minutes or two days. The over-learning group performed better at the short delay (22 questions correct versus 15) and also at the long delay (17 questions correct versus 13).

*Gilbert, T. (1957). "Overlearning and the retention of meaningful prose". *Journal of General Psychology*, 56, 281-289

For example, students will initially study the terms *isthmus* and *delta* to master their meanings, and they will later practise these meanings as they use the terms in their continued study of geography. Although practice takes on a different character for the longer term, it is no less important.

Studies show that if material is studied for one semester or one year, it will be retained adequately for perhaps a year after the last practice but most of it will be forgotten by the end of three or four years in the absence of further practice.

If material is studied for three or four years however, the learning may be retained for as long as 50 years after the last practice. There is some

forgetting over the first five years but, after that, forgetting stops and the remainder will not be forgotten even if it is not practised again.

Researchers have examined a large number of variables that potentially could account for why research subjects forgot or failed to forget material, and they concluded that the key variable in very long-term memory was practice.

Exactly *what* knowledge will be retained over the long term has not been examined in detail, but it is reasonable to suppose that it is the material that overlaps multiple courses of study. Students who study Canadian history for four years will retain the facts and themes that came up again and again in their history courses.

It is difficult to overstate the value of practice. For a new knowledge to become long-lasting, sustained practice *beyond the point of mastery* is necessary.

That students would benefit from practice might be deemed unsurprising. After all, doesn't practice make perfect? The unexpected finding from cognitive science is that practice *does not* make perfect. Practise until you are perfect, and you will be perfect only briefly. What's necessary is sustained practice.

By sustained practice, I mean regular, on-going review or use of the target material. This kind of practice *past* the point of mastery is necessary to meet any of these three important goals of instruction: acquiring facts and knowledge, learning skills, or becoming an expert.

(Adapted with permission from "Practice Makes Perfect" in American Educator, the magazine of the American Federation of Teachers, Spring 2004). Dr. Willingham is associate professor of cognitive psychology and neuroscience at the University of Virginia.)