

Adequate Learning Vs Overlearning: How Many Repetitions Is Enough?

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You know those happy moments in the practice room when you experience a tiny breakthrough, and after having struggled for a while, can finally play a passage exactly like you want?

Feels like cause for celebration, right?

Well, as a kid, I would reward myself for my achievement by putting my violin down and taking a practice break. Sometimes stretching into the next day...

This seemed like a reasonable enough thing to do at the time. Of course, now that I have kids, this sort of thing drives me nuts. I mean, you get through your Tae Kwon Do pattern without incident just once, and you're ready to move on? What?!!

But how important is it really to practice beyond this point? Sure, we can always do more, but might it be that learning to the point of proficiency is enough sometimes?

Adequate learning vs. overlearning

Say you are working on a passage and keep having memory glitches or play a few notes out of tune, but with a bit of work, finally get through the tricky spots without incident. Moving on to a new skill or a new passage at this point would be called "adequate" learning, because presumably, you've ironed out the problem areas and have reached a certain level of proficiency.

If, however, you continued to work on the passage, beyond the point of reaching proficiency, you would be engaged in "overlearning."

Surprisingly, there isn't as much research out there on overlearning as one might think, but it does seem that there are some benefits - particularly in the area of retention.

Sustaining skills over time

For instance, [a US Army study](#) followed the learning curve of 38 reservists who were trained in how to disassemble and assemble an M60 machine gun. A control group practiced until they could achieve one error-free performance. An "overlearning" group practiced until the same point, and then some (specifically, their training was extended by however many repetitions it took them to get to an error-free level; so if it took them 30 tries to get it right, they did a total of 60 repetitions). A third group practiced until proficiency, and 4 weeks later, had a "refresher" session where like the

overlearning group, they did as many repetitions as it took for them to get it right in the first session.

8 weeks after their initial training session, all three groups were tested on their M60 disassembly/assembly performance.

How'd they do?

As you can imagine, both the overlearning group and refresher group outperformed the control group at the 8-week mark (by 65% and 57%, respectively). And while their performance at 8 weeks was pretty similar, there were some meaningful differences between the two, which suggests that overlearning may have been a more effective approach overall.

The overlearning group not only executed the skill (mostly) flawlessly during their extended training time, but they also got *faster*, cutting 12.74 seconds off their time (189.6 to 152.2 seconds) from their first error-free performance to their last practice attempt of the day. To me, this speaks to greater automaticity of the skill - the ability to perform the skill more efficiently and effectively without having to think one's way through every step.

By comparison, the refresher group had forgotten quite a bit by the time they had their refresher course 4 weeks later, averaging more than 5 errors on their first practice attempt. In fact, most of the soldiers failed to complete an error-free trial before the end of their refresher training session, and the overlearning group demonstrated *better performance after 8 weeks* of not touching an M60, than the refresher group did after *4 weeks*.

Which suggests that overlearning leads to gains that *last longer* than simply practicing up to the "good enough" point.

Surgical training

In [another study](#), 20 surgical residents were tasked with practicing a common gall bladder removal procedure.

Everyone practiced the procedure until they reached "proficiency" which was defined as achieving a score of 80. Once they reached proficiency, 10 of the residents did no further practice of the skill. Meanwhile, the other 10 residents continued to practice, putting in as many repetitions as it took for them to reach the score of 80 in the first place (i.e. 100% overlearning).

To gauge the impact of overlearning, both groups were tested 1, 4, and 12 weeks later, and evaluated on their simulator score, how long it took for them to perform the procedure, and accuracy.

How'd they do?

Overall, the overlearning group appeared to learn the procedure and retain their skills better, outperforming the “adequate-learning” group by an average score of 76 vs. 68, while making fewer mistakes and completing the procedure about 20% faster.

So while extra practice does take more time and effort in the short term, it seems to have benefits in the long run. And like the soldiers in the previous study, the overlearning group's ability to perform the procedure faster suggests a higher level of automaticity.

Like the difference between a capable but hesitant new driver on a learner's permit, and an experienced cabbie who can navigate city traffic and parallel park without a second thought. I mean, if you accidentally chopped off the tip of a finger while preparing dinner, which one would you want driving you to the hospital?

How much overlearning is enough?

While overlearning seems to be a good thing, it's not so clear how *much* overlearning is best. More seems to be better, but there is a point of diminishing returns. Where doing more takes a ton of time and energy, but yields relatively little gain. Besides, overlearning for the sake of overlearning can lead to mindless, ineffective practice, and do more harm than good.

There does seem to be some evidence that 50% overlearning is the minimum to get some benefit (i.e. if it took you 40 repetitions to reach proficiency, you'd do an additional 20 repetitions past that point, for a total of 60 reps). And 100% overlearning appears to give us more bang for our buck than 150% or 200% overlearning. So ultimately, 100% may be the best place to start.

But what I like most about the idea of overlearning, is how the overlearning protocol could increase motivation and focus *during* practice. Because if you know that the amount of overlearning you have to engage in is a function of how long it took you to get it right in the first place, wouldn't you be really motivated to figure out how to achieve a level of proficiency in fewer repetitions?

So the next time my kids are slopping through their Tae Kwon Do patterns, maybe this will be a twist that could boost their motivation to buckle down and make each repetition count. Then again, they're pretty crafty little buggers, and have foiled most of my attempts to “psychology” them in the past...