Keep an Eye on the Time

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Neuroscience-based research makes the case for chunked, spaced learning.

The trend is clear. Increasingly more learning programs are occurring in small chunks. Technological delivery improvements and more challenging schedules seem to make the move inevitable as online learning lends itself to brief, modular, learning. On the scheduling side, with a combination of travel, remote work, and general overwhelm, getting buy-in for dedicated, intensive programs is hard. For better or worse, learning budgets reflect this understanding, and we all know that trends follow the money.

ASTD's 2013 *State of the Industry* report shows that 39 percent of formal training is occurring via technology, with signs pointing toward an upward trend. And there seems to be little institutional support for holding onto old ways of conducting learning.
A 2008 CEB report reveals that 56 percent of managers believed they would see better performance, or at least no worse, if learning and development were to go away. The good news is a trend toward smaller, modular chunks can have benefits for making learning last. Two lessons from neuroscience suggest how to chunk learning most effectively: working with attention, and addressing the time between sessions and building across them.

Single focus of attention

There are two findings about attention that are most helpful for creating small chunks of learning. First, attention has limits of only about 20 minutes before needing a refresher. Second, multitasking is the enemy of learning.

Studies have demonstrated that we can pay full attention only 20 minutes at a time. The brain will lose focus unless its attention is recaptured or allowed to divert roughly every 20 minutes. Most trainers have techniques for capturing or rejuvenating attention, but the frequency of using them is woefully low. That is not because education needs to be entertaining, but because recall is aided quite a bit by focused attention on the subject to be recalled.

Understanding why attention fatigues at the neuroscience level helps suggest solutions. First, the networks involved in voluntary attention are relatively energy-hungry brain regions. For example, a great deal of the effort in sustaining attention has to do with inhibiting alternative sensory inputs, impulses, and thoughts.
To stay focused on the lecturer at the front of the room, the learner must frequently inhibit the look, sounds, and smell of the room; the desire to move, interrupt, use the bathroom; and the thoughts about personal issues, such as shopping needed on the way home. These forms of inhibition likely rely to some degree on a single prefrontal brain region. Dubbed "the brain's braking system," the region tires quickly, inhibiting our capacity for sustained voluntary active attention.

However, a wonderful thing happens when we let our default task-oriented attention circuits rest briefly. The alerting networks in the brain reset, and new goals and expectations get a chance to update, which allows us to focus on any new information just gathered.
For the trainer, this means that after about 20 minutes of sustained attention either provide downtime to refresh the attention brain networks or introduce something novel or unexpected, such as a chance for learners to focus inward, be active, ask questions, change learning format, and discuss.

If learners understand this principle, they can apply it internally: How many times have you sat in a training session and wondered, "When will this get interesting," while fighting to stay focused? In those moments, learners can try deliberately tuning out for a minute to recharge and consider what's novel in the material or look at it from a new context. Changing mental gears every 15 to 20 minutes appears to be an important aspect of holding attention.
Now let's consider why this matters for memory. After all, perhaps we can learn simply by being exposed to information—picking it up in the background. But for conscious recall, the kind of learning we often want from training programs, a single focus of attention is important.

Across multiple research paradigms, findings have shown that loss of attention leads to worse memory. The opposite of a single focus of attention is multitasking. For example, even when multitaskers have learned to achieve the same level of outcomes as single-focus research participants, they needed more time to make up for their learning losses due to switching focus between tasks.

When we take a look at what's happening in learning environments, we see multitasking has been creeping in. More interactivity is being brought into learning, with social media platforms finding their way into the minute-to-minute learning experience.

For example, there is a move to shift learning to iPads and similar devices, with some schools in favor of digital media over books. This is a problem because of the cost these tools exact on attention. Multitasking on a laptop during a lecture, for instance, has been shown to lower scores on an immediate test after the lecture compared with those who do not multitask. Moreover, according to the March 2013 *Computers & Education* article "Laptop Multitasking Hinders Classroom Learning for Both Users and Nearby Peers," people who are in direct view of a multitasking peer will score lower on a test compared with those who are not.

Now the most painful lesson about multitasking: People who are drawn to do it tend to be bad at it. Individuals who report multitasking more frequently are worse at it than less-frequent multitaskers. In addition, although participants in research who multitasked with two visual tasks obtained poor results, they believed they performed better than when only carrying out one task.

To make best use of attention for learning that lasts, aim for a single focus of attention on the point to be remembered. Recognize that attention probably will fatigue and drift roughly every 15 to 20 minutes, so allow it to by shifting to discussion, digestion, or a break.

Optimal spacing between sessions

There are ways in which small-chunk learning modules really shine, and they pertain to the relative ease with which they allow trainers to create optimal spacing between sessions. The primary lesson to learn here is that people do not store memories. We grow them. We grow new connections between neurons. Unlike the instant storage of a file box or computer, this growth takes time. And it happens most effectively when that time includes sleep.

As with multitasking, there are misperceptions about the value of space between learning. People tend to believe it is less effective than cramming the learning into one marathon session as we might have done in school before an exam. This is so ingrained that even when we perform better after spacing, we can be unaware of it.

One study found that 90 percent of participants had better performance after spacing than cramming. However, 72 percent of the participants reported that cramming was more effective than spacing. Misperceptions about the value of cramming for a test versus spacing out one's learning probably stem from the experience that cramming can be effective for test taking in school. But when there is no test, and only a need to have learned something (as is more common in the workplace) spacing out the learning sessions is the far better choice.

Are there optimal or minimal spacing gaps? As a general rule for a minimum, at least a day is good. However, there are some exceptions.

Spacing out sessions has been shown to have a lasting benefit on long-term memory with just 12 hours (in particular, though, a 12-hour spacing gap that includes sleep). There also can be some benefit when the spacing is on the order of minutes. A 2010 study by Jeffrey Karpicke and Henry Roediger found that recall, tested one week later, was better when study participants spaced the reading of texts by a few minutes (with a filler task), as compared with reading all the passages all at once—even though they had the same time to read the text.

The optimal efficient gap between study sessions depends on when the information will be tested in the future. In the November 2008 issue of *Psychological Science,* Nicholas Cepeda and his colleagues conclude that the optimal spacing gap equaled 10 percent to 20 percent of the test delay. Specifically, a one-day gap was best for a test seven days later; an 11-day gap was best for a test 35 days later; and a 21-day gap was best for a test 70 days later.

In those business contexts in which the learning is not going to be needed at some specific time point only, but rather for an indefinite period of months or more, the take-home message could be that it is best to revisit the information on the order of days one time, of weeks one time, and of months one time.

Given the state of scientific knowledge, we suggest that best practices for any learning would include learning on one day, followed by re-learning on another. Small-chunk modular learning is ideal for this suggestion. However, to make best use of it, chunks should be connected in series.

One thing to watch out for is that they should include a way to revisit the information that does not conflict with holding attention. Simply repeating the same content an earlier module contained is likely to bore an audience. However, if learners teach, summarize, and revisit so that they can build on, self-evaluate, or use any number of other creative approaches to re-study, attention can be enhanced.

Pay attention

To get the most out of learning sessions, start by paying attention to attention. Change focus every 20 minutes or so, either in content or context. Remove multitasking wherever you find it. Educating learners about the importance of a single focus so that their brains know to encode new information can go a long way.

Take advantage of the move within training and development toward small-chunk learning modules as an easy way to build space between study sessions. It is hugely beneficial for long-term recall, and much easier in small-chunk learning than in traditional intensive learning sessions. Where possible, allow for or require sleep in between sessions. Sleeping gives a brain the ideal conditions to thoroughly encode what has been learned.