THE BIG IDEAS

Distributed Learning
Think: Watering your lawn.

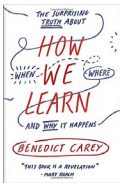
Enemy #1 for Learning
= Fluency illusion.

Can You Teach It?
Powerful way to learn.

Mix It Up
To strengthen the learning

Sleep + Naps
= Learning with your eyes closed.

Zeigarnick
Long-term projects.



How We Learn

The Surprising Truth About When, Where, and Why It Happens

BY BENEDICT CAREY · RANDOM HOUSE © 2015 · 272 PAGES

> "The treasure at the end of this rainbow is not necessarily 'brilliance.' Brilliance is a fine aspiration, and Godspeed to those who have the genes, drive, luck, and connections to win that lottery. But shooting for a goal so vague puts a person at risk of worshipping an ideal—and missing the target. No, this book is about something that is, at once, more humble and more grand: How to integrate the exotica of new subjects into daily life, in a way that makes them seep under our skin. How to make learning more a part of living and less an isolated chore. We will mine the latest science to unearth the tools necessary to pull this off, and to do so without feeling buried or oppressed. And we will show that some of what we've been taught to think of as our worst enemies—laziness, ignorance, distraction—can also work in our favor."
>
> ~ Benedict Carey from *How We Learn*

Benedict Carey is a science writer for *The New York Times*.

This book is his exploration of what the latest research says about, you guessed it, *How We Learn*.

I read it as part of my preparation for Learning 101. Check out our Notes on *Make It Stick* (written by a story teller + two leading cognitive scientists focused on the science of learning) and *A Mind for Numbers* (written by a math teacher who taught one of the most popular classes in history) for more learning goodness. (And, check out the Notes on *The Talent Code* + *Focus* for more related wisdom.)

The book is packed with fascinating research studies that challenge some of the conventional ideas of how to best learn. (Get a copy here.)

I'm excited to share some of my favorite Big Ideas we can apply to our lives today so let's jump straight in!

" If the brain is a learning machine, then it's an eccentric one. And it performs best when its quirks are exploited."

~ Benedict Carey

DISTRIBUTED LEARNING (THINK: WATERING YOUR LAWN)

"The technique is called distributed learning, or, more commonly, the spacing effect. People learn at least as much, and retain it much longer, when they distribute—or 'space'—their study time than when they concentrate it. Mom's right, it is better to do a little today and a little tomorrow rather than everything at once. Not just better a *lot* better. Distributed learning, in certain situations, can double the amount we remember later on. ...

I like to think of the spacing effect in terms of lawn care in Los Angeles. L.A. is a city with a coastal desert climate and cultural commitment to the pristine lawn. I learned while living there for seven years that, to maintain one of those, it's far more effective to water for thirty minutes three times a week than for an hour and a half once a week. Flooding the lawn makes it look slightly more lush the next day, but that emerald gloss fades, sure enough. A healthy dose every

" More important than how long you study is how you distribute study time you have. Breaking up study or practice time-dividing it into two or three sessions, instead of one-is far more effective than concentrating it."

~ Benedict Carey

couple days and you can look your neighbors in the eye, while using the same amount of water—or even less. Same goes for distributed learning. You're not spending any more time. You're not working any harder. But you remember for longer."

Distributed learning. Aka the spacing effect.

Basic idea: If you have, say, three hours to study, you'd be better off breaking them into three, 1-hour chunks spread over a few days, than one, 3-hour chunk in one day.

Why? Because that break gives your brain a chance to do a little forgetting such that when you show up for the next study session you have to work a little harder to bring to mind what you had studied. That difficulty is a VERY good thing—the process of revisiting the material makes it stick MUCH (!!!) better than just buzzing through it in one session.

As I read about this research on the power of distributed learning/the spacing effect, I was reminded of the same type of wisdom shared in our recent Notes on movement.

In *Move Your DNA*, Katy Bowman tells us to space out our walks—three, 1-mile walks are better than one, 3-mile walk.

And, in *True to Form*, Eric Goodman tells us: *"It cannot be stressed too often or too strongly that restoring your body's natural strength and flexibility comes not through intensity of effort but through consistency."*

We can apply the same wisdom (and watering metaphor) to our meditation practice. Here's how Matthieu Ricard puts it in *Why Meditate?*: *"For a plant to grow well, you have to water it a little every day. If you just pour a bucket of water on it once a month, it will most likely die between waterings. The same applies to meditation."*

Consistency over intensity.

THAT's where it's at—whether we're talking about learning or movement or meditation or anything else we want to master. Keep the long view in mind.

. s . p . a . c . e ... o . u . t . your studying!

P.S. One thing with which Benedict tells us we *don't* need to be consistent is the location of our studying. Fascinating research points to the benefits of varying the location—which, for some mysterious reason, appears to deepen the learning!

ENEMY #1 FOR LEARNING: THE FLUENCY ILLUSION

"Let's recall the Bjorks' 'desirable difficulty' principle: The harder your brain has to work to dig out a memory, the greater the increase in learning (retrieval and storage strength). Fluency, then, is the flipside of the equation. The *easier* it is to call a fact to mind, the smaller the increase in learning. Repeating facts right after you studied them gives you nothing, no added memory benefit.

The fluency illusion is the primary culprit in below-average test performances. Not anxiety. Not stupidity. Not unfairness or bad luck.

Fluency.

The best way to overcome this illusion and improve our testing skills is, conveniently, an effective study technique in its own right. ...

The technique is testing itself. Yes, I am aware of how circular this logic appears: better testing through testing. Don't be fooled. There's more to self-examination than you know. A test is not only a measurement tool, it alters what we remember and *changes* how we subsequently organize that knowledge in our minds. And it does so in ways that greatly improve later performance."

" Robert and Elizabeth Bjork called any technique that causes forgetting a 'desirable difficulty,' in that it forces the brain to work harder to dig up a memory or skill-and that added work intensifies subsequent retrieval and storage strength (learning)."

~ Benedict Carey

The fluency illusion.

That's what learning scientists call the feeling of "getting" something.

You know, when you (or your kids) are re-reading your notes or highlights of a chapter and you're saying to yourself, *"Oh, yah. Totally get that. Yep. Easy. Got it."*

That sense of *perceived* mastery or "fluency" FEELS good, but it's D.A.N.G.E.R.O.U.S. for true mastery. In fact, Benedict tells us that fluency is THE primary culprit for poor test performance.

Why? Because we *think* we get it but, alas, we don't.

The antidote? Test yourself.

Close the book, and ask yourself, *"What was that chapter/lesson/whatever all about?"*

See if you can "actively retrieve" the information you're trying to learn. That pops the bubble of fluency immediately. In fact, it feels uncomfortable.

Researchers call THAT feeling "desirable difficulty."

Here's how the *Make It Stick* guys put it: *"To be most effective, retrieval must be repeated again and again, in spaced out sessions so that the recall, rather than becoming a mindless recitation, requires some cognitive effort. Repeated recall appears to help memory consolidate into a cohesive representation in the brain and to strengthen and multiply the neural routes by which the knowledge can later be retrieved."*

In *The Talent Code*, Dan Coyle talks about the research done by Robert Bjork who tells us: *"We think of effortless performance as desirable, but it's really a terrible way to learn."*

Remember: Testing yourself is, in and of itself, a SUPER effective studying technique—one of the best ways to really master something.

Let's do a little pop quiz!

What have you learned so far in this Note? Pause for a moment, embrace the discomfort of digging around in your brain for some goodness and KNOW that the process of trying to retrieve that wisdom is helping you more deeply embed it!

P.S. Malcolm Gladwell wrote a whole (fascinating) book on the basic theme of embracing desirable difficulties. Check out our Notes on *David and Goliath* for more.

CAN YOU TEACH IT? (<— POWERFUL WAY TO REALLY LEARN!)

"Many teachers have said that you don't really know a topic until you have to *teach* it, until you have to make it clear to someone else. Exactly right. One very effective way to think of self-examination is to say, "Okay, I've studied this stuff; now it's time to tell my brothers, or spouse, or teenage daughter what it all means.' If necessary, I write it down from memory. As coherently, succinctly, and clearly as I can.

Remember: These apparently simple attempts to communicate what you've learned, to yourself or others, are not merely a form of self-testing, in the conventional sense, but *studying*—the high-octane kind, 20 to 30 percent more powerful than if you continued sitting on your butt, staring at that outline. Better yet, those exercises will dispel the fluency illusion. They'll expose what you don't know, where you're confused, and what you've forgotten—and fast."

Want to *really* master something?

TEACH IT.

This is a key idea shared in all the great books on how to learn.

"To build and retain foreign vocabulary, scientific definitions, or other factual information, it's best to review the material one or two days after initial study; then a week later; then about a month later."

~ Benedict Carey

The *Make It Stick* crews call it "elaboration" and put it this way: *"In a cartoon by the Far Side cartoonist Gary Larson, a bug-eyed school kid asks his teacher, 'Mr. Osborne, can I be excused? My brain is full!' If you're just engaging in mechanical repetition, it's true, you quickly hit the limit of what you can keep in mind. However, if you practice elaboration, there's no known limit to how much you can learn. Elaboration is the process of giving new material meaning by expressing it in your own words and connecting it with what you already know. The more you can explain about the way your new learning relates to your prior knowledge, the stronger your grasp of the new learning will be, and the more connections you create that will help you remember it later."*

Barbara Oakley echoes this wisdom in *A Mind for Numbers*, telling us: *"The legendary Charles Darwin would do much the same thing. When trying to explain a concept, he imagined someone had just walked into his study. He would put his pen down and try to explain the idea in the simplest terms. That helped him figure out how he would describe the concept in print. Along those lines, the website Reddit. com has a section called 'Explain like I'm 5' where anyone can make a post asking for a simple explanation of a complex topic.*

You may think you really have to understand something in order to explain it. But observe what happens when you are talking to other people about what you are studying. You'll be surprised to see how often understanding arises as a consequence of attempts to explain to others and yourself, rather than the explanation arising out of your previous understanding. This is why teachers often say that the first time they ever really understood the material was when they had to teach it."

Explain what you're studying to someone. Teach it to them.

And, remember: The process of teaching something is often what helps us truly understand it!

Your homework assignment, should you choose to accept it: Teach your favorite Big Ideas from this Note to your spouse, kid, brother/sister, friend, whomever!

Introduce a little more desirable difficulty into your life and take a step toward deeper mastery!

MIX IT UP TO STRENGTHEN IT UP

"It's not that repetitive practice is *bad*. We all need a certain amount of it to become familiar with any new skill or material. But repetition creates a powerful illusion. Skills improve quickly and then plateau. By contrast, varied practice produces a slower *apparent* rate of improvement in each single practice session but a greater accumulation of skill and learning over time. In the long term, repeated practice on one skill slows us down."

Alright. So, we know that spacing out our learning is wise. So is testing ourselves. And, so is teaching others. All of those add a level of "desirable difficulty" to pop the fluency illusion bubble. Here's another trick: Rather than practice one skill at a time in what researchers call "blocked" or "massed" practice, mix it up!

Whether it's math problems or badminton serves, the research CLEARLY demonstrates that varied practice results in far superior performance than massed practice.

Researchers call this "interleaving."

Get this: You can bring kids into a lab and have them throw beanbags at a target (blindfolded, no less!). One group practices throwing bean bags at a target three feet away. Another group practices by throwing the bags at targets that vary between two and four feet away.

Then, they're tested on a target that's three feet away. Who do you think does best?

You'd *think* the group that's been practicing on the three-foot target would crush it, but the group that VARIED their practice does the best.

" Interleaving. That's a cognitive science word, and it simply means mixing related but distinct material during study."

~ Benedict Carey

Another example: Badminton. Apparently there are three different types of serves: the short serve, the long serve and the drive. Researchers had people practice for three days a week over three weeks, thirty-six serves each time. They split them into three groups: One group performed *blocked* practiced: twelve short serves, then twelve long serves, then twelve drives. The other group did *serial* practice: one short, one long, one drive; repeat. The final group did *random* practice: doing any serve they wanted but never the same twice in a row.

Who did best? The random group. By a wide margin. Same results apply to math problems (much better to mix up different types of problems rather than the same.exact.types), hitting curveballs, learning art styles, and a bunch of other stuff.

Lesson for us: VARY your practice.

Here's a fun example: Shooting free throws. Practice them a foot closer than the free throw line, a foot behind the line, a few feet to the left, a few feet to the right. Sounds weird but that varied practice is better.

How can *you* introduce this a bit more?

P.S. The funny thing about this (and other techniques) is that the "massed" practice *feels* better. "Hello, fluency illusion!" Benedict tells us: *"This much is clear: The mixing of items, skills or concepts during practice, over the longer term, seems to help us not only see the distinctions between them but also to achieve a clearer grasp of each one individually. The hardest part is abandoning our primal faith in repetition."*

SLEEP (+ NAPS) = LEARNING WITH YOUR EYES CLOSED

"Napping is sleep, too. In a series of experiments over the past decade, Sara Mednick of the University of California, San Diego, has found that naps of an hour to an hour and half often contain slow-wave deep sleep and REM. People who study in the morning—whether it's words or pattern recognition games, straight retention or comprehension of deeper structure—do about 30 percent better on an evening test if they've had an hour-long nap than if they didn't. 'It's changed the way I work, doing these studies,' Mednick told me. 'It's changed the way I live. With naps of an hour to an hour and half, we've found in some experiments that you get close to the same benefits in learning consolidation that you would from a full eight-hour night's sleep.'"

Sleep. It's a HUGE driver in effective learning. So much so that Benedict has a chapter called "You Snooze, You Win" in which he walks us through all the research that proves its power.

" I no longer think of naps or knocking off early as evidence of laziness, or a waste of time, or, worst of all, a failure of will. I think of sleep as learning with my eyes closed."

~ Benedict Carey

For now, check out our Notes on Sara Mednick's *Take a Nap, Change Your Life!* plus *Power Sleep* by James Maas and *Sleep Smarter* by Shawn Stephenson. And, of course, Sleep 101!

Remember that even naps as short as SIX minutes can give you a boost!

And, keep this in mind: *"I've always loved my sleep, but in the context of learning I assumed it was getting in the way. Not so. The latest research says the exact opposite: that unconscious downtime clarifies memory and sharpens skills—that it's a necessary step to lock in both. In a fundamental sense, that is, sleep is learning."*

Plus: "*I no longer think of naps or knocking off early as evidence of laziness, or a waste of time, or, worst of all, a failure of will. I think of sleep as learning with my eyes closed."*

ZEIGARNIK LONGER-TERM CREATIVE PROJECTS

"**Q: *Is there any effective strategy for improving performance on longer-term creative projects?***

A: Yes. Simply put: *Start* them as early as possible, and give yourself permission to walk away. Deliberate interruption is not the same as quitting. On the contrary, stopping work on a big,

" If learning is building up skills and knowledge, then forgetting is losing some of what was gained. It seems like the enemy of learning. It's not. The truth is nearly the opposite."

~ Benedict Carey

complicated presentation, term paper, or composition activates the project in your mind, and you'll begin to see and hear all sorts of things in your daily life that are relevant. ... This is all fodder for your project—it's interruption working in your favor—though you do need to return to the desk or drafting table before too long."

This is from the final section that has some great, succinct Q&A on how to optimize learning. That idea is inspired by what's known as the Zeigarnik Effect.

Benedict walks us through the fascinating research conducted by Bluma Zeigarnik in which she demonstrated that our mind best recalls stuff that isn't quite complete. (Specifically, she found that waiters who hadn't been paid yet remembered orders better than those who had.)

We chatted about it in *Organize Tomorrow Today* where Jason Selk tells us: *"Working from Zeigarnik's research, Lewin came up with the concept of 'task-specific-tension,' which persists in both the conscious and subconscious mind until the task is completed. In other words, the mind doesn't like unfinished business! High-level mathematicians and successful writers have been using this technique for years as a tool for pushing their work forward. Before going to bed, they take a few minutes to read over the mathematical or literary work they did during the day—especially if they've reached a plateau or feel stuck. The mind then works all night to close the loop, and they wake up in the morning with 'inspiration.' It seems magical, but it isn't so much magical as it is the result of the effective priming of the mental pump."*

So, know that your subconscious mind is there to help and that taking breaks and distracting yourself can actually help you (when done wisely, of course!). And... It's always fun to prime the mental pump before we go to sleep! :)

Here's to optimizing how we learn as we actualize our potential!

Brian Johnson,
Chief Philosopher

If you liked this Note, you'll probably like…

- Make It Stick
- A Mind for Numbers
- Spark
- Focus
- The Talent Code
- David and Goliath
- Take a Nap, Change Your Life
- Organize Tomorrow Today

About the Author of "How We Learn"

BENEDICT CAREY

Benedict Carey is an award-winning science reporter who has been at *The New York Times* since 2004, and one of the newspaper's most emailed reporters. He graduated from the University of Colorado with a bachelor's degree in math and from Northwestern University with a master's in journalism, and has written about health and science for twenty-five years. He lives in New York City.

About the Author of This Note

BRIAN JOHNSON

Brian Johnson loves helping people optimize their lives as he studies, embodies and teaches the fundamentals of optimal living—integrating ancient wisdom + modern science + common sense + virtue + mastery + fun. Learn more and optimize your life at brianjohnson.me.