MIND

Come On, I Thought I Knew That!

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Even course outlines provided by a teacher, a textbook or other outside source can create a false sense of security, some research suggests. In one experiment, researchers found that participants studying a difficult chapter on the industrial uses of microbes remembered more when they were given a poor outline — which they had to rework to match the material — than a more accurate one.

One reason for this has to do with a cognitive quality known as fluency, a measure of how easy a piece of information is to process. The brain automatically associates perceptual fluency, or ease of storage, with retrieval fluency, ease of recall. This is a good rule of thumb for lots of new facts: some people are especially good at remembering directions, others are better with names, still others with recipe ingredients, sports statistics, jokes. But it's not as good a guide when studying difficult concepts that don't fall easily into a person's areas of expertise or interest.

"For example, we know that if you study something twice, in spaced sessions, it's harder to process the material the second time, and people think it's counterproductive," said Nate Kornell, a psychologist at Williams College. "But the opposite is true: You learn more, even though it feels harder. Fluency is playing a trick on judgment."

A study to be published this year in the journal Psychological Science, led by Dr. Kornell, shows how strong this effect can be. Participants studied a list of words printed in fonts of varying sizes and judged how likely they would be to remember them on a later test. Sure enough, they were most confident that they'd remember the words in large print, rating font size (ease of processing) as more likely to sustain memory even than repeated practice.

They got it exactly backward. On real tests, font size made no difference and practice paid off, the study found.

And so it goes, researchers say, with most study sessions: difficulty builds mental muscle, while ease often builds only confidence. At least one group has demonstrated this principle in dramatic fashion, also using fonts.

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In a recent study published in the journal Cognition, psychologists at Princeton and Indiana University had 28 men and women read about three species of aliens, each of which had seven characteristics, like “has blue eyes,” and “eats flower petals and pollen.” Half the participants studied the text in 16-point Arial font, and the other half in 12-point Comic Sans MS or 12-point Bodoni MT, both of which are relatively unfamiliar and harder for the brain to process.

After a short break, the participants took an exam, and those who had studied in the harder-to-read fonts outperformed the others on the test, 85.5 percent to 72.8 percent, on average.

To test the approach in the classroom, the researchers conducted a large experiment involving 222 students at a public school in Chesterland, Ohio. One group had all its supplementary study materials, in English, history and science courses, reset in an unusual font, like Monotype Corsiva. The others studied as before. After the lessons were completed, the researchers evaluated the classes' relevant tests and found that those students who'd been squinting at the stranger typefaces did significantly better than the others in all the classes — particularly in physics.

“The reason that the unusual fonts are effective is that it causes us to think more deeply about the material,” a co-author of the study, Daniel M. Oppenheimer, a psychologist at Princeton, wrote in an e-mail. “But we are capable of thinking deeply without being subjected to unusual fonts. Think of it this way, you can't skim material in a hard to read font, so putting text in a hard-to-read font will force you to read more carefully.”

Then again, so will raw effort, he and other researchers said. Concentrating harder. Making outlines from scratch. Working through problem sets without glancing at the answers. And studying with classmates who test one another.

The payoff may go beyond a higher grade.

“Students these days are on a treadmill, there's so much going on in their lives,” Dr. Bjork said. “But monitoring learning is not simply a matter of a higher G.P.A., it's more efficient — potentially a great savings in time.”

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