

# Test-enhanced Learning

March 01, 2006

Every student hates tests, and teachers often aren't fond of them either. A pain to study for and a pain to take, they are also time-consuming to give and to grade. No wonder then, that many college professors give tests so infrequently, sometimes just twice or three times in a semester-long course.

But new research by Henry L. Roediger, III and Jeffrey D. Karpicke of Washington University in St. Louis shows that not giving tests may be bad educational practice — and *not* just for the obvious reason that tests make students study. In two experiments, the researchers showed that being tested — even without additional studying — improved long-term retention of material.

The testing effect, as it is called, has actually been known about for almost a century and has been studied using things like word lists; but until now no one has studied it in a more educationally realistic way. In one of their experiments, the researchers had participants study passages on science topics and take free-recall tests (like essay tests). Those in a control condition studied the same material and then studied it a second time instead of taking the test. Both groups were then evaluated on their retention five minutes, two days, or one week later.

The students who took the test retained the material better over the long term than those who restudied the material, even though the test-takers received no feedback on their initial test. According to the authors, “Clearly, testing enhances long term retention through some mechanism different from restudying the material.”

Similar results were found in a subsequent experiment in which repeated testing of material (again, without additional study) was compared to repeated restudying. Those in the testing condition — who read the material only 3.4 times on average but were tested on it repeatedly — recalled it at a rate of 61 percent a week later. Those who weren't tested but who read the material an average of 14.2 times — over four times as much — recalled at a rate of only 40 percent.

Findings were different when the final assessment was given shortly after the period of study or testing. In this case, students did better, which confirms what learning researchers already know — that massed study (i.e. cramming) results in high short-term gains, but that those gains don't hold over time.

Massed study also produces overconfidence. The participants who studied more actually had higher confidence in their having learned the material than did those in the testing group, despite the fact that their long-term retention was actually poorer.

These findings challenge the widespread assumption that tests are only good for giving grades. “Testing can be used as a powerful means for improving learning, not just assessing it,” according to the researchers. “Incorporating more frequent classroom testing into a course may improve students' learning and promote retention of the material long after the course has ended. In addition, one powerful

means for students to improve their own learning may be self-testing while they are studying.”

To learn more about the testing effect, see [“Test Enhanced Learning”](#), and “Test-Enhanced Learning: Taking Memory Tests Improves Long-Term Retention,” in the [March issue](#) of *Psychological Science*.