

Test-Enhanced Learning in the Classroom: The Columbia Middle School Project, Year 2



Mark A. McDaniel, Kathleen B. McDermott, Pooja K. Agarwal, and Henry L. Roediger, III

BACKGROUND

Tests are usually thought to serve assessment purposes, but they can also benefit long-term learning better than repeated studying.¹

Multiple tests are better than single tests in enhancing learning.¹

Feedback provided after testing also enhances learning.²

Prior laboratory research supports these principles, yet none have been thoroughly tested in a classroom setting using a true experimental design.

We examined whether a test-enhanced learning program, integrated with daily classroom practices, is an effective method of enhancing retention in a middle school setting.

METHOD

This research was conducted at a public middle school in Illinois.

Materials

Textbook material from Social Studies and Science classrooms

Multiple-choice quizzes followed by immediate feedback

Within-subjects design: Half of the target facts were quizzed during lessons, half were not tested (but non-tested items were covered during the class lecture by the teacher)

Procedure

Students took a multiple-choice pre-test over tested items.

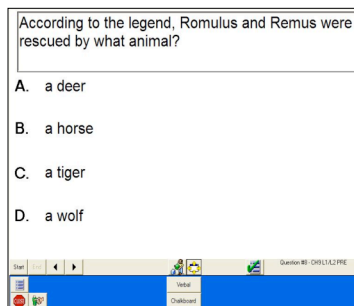
The teacher was not present for the pre-test and did not know which target facts were tested.

Following the pre-test, the teacher taught the lesson for the day.

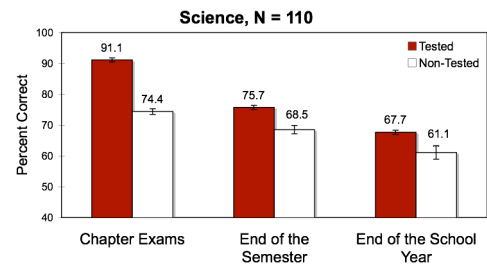
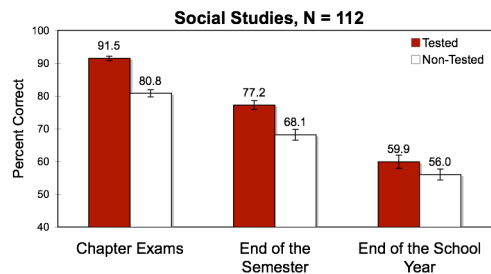
Immediately after the lesson, students took a multiple-choice post-test over tested items.

Approx. 2 days later, students took a review test over tested items.

Retention was measured 2-14 days later with multiple-choice exams comprised of all (tested and non-tested) target facts.



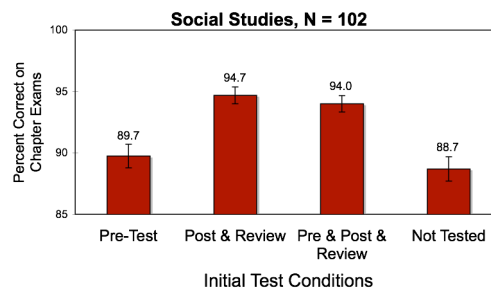
EXPERIMENT 1



Testing information led to significant benefits in retention, even over the long term. Further analyses revealed that students with lower standardized test and pre-test scores showed greater benefits of testing ($r = -.38$ and $r = -.39$, respectively).

EXPERIMENT 2

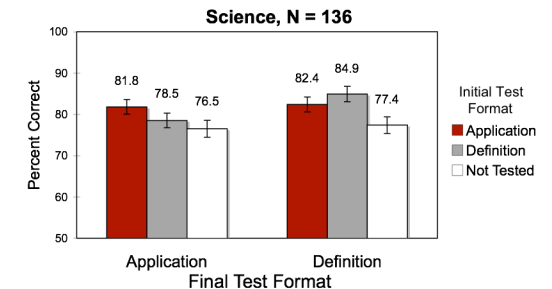
In Social Studies, we evaluated the effect of pre-tests on retention.



A significant effect of testing was obtained, but pre-tests did not enhance retention.

EXPERIMENT 3

In Science, we evaluated the effect of testing on transfer between application and definition questions.



Significant testing effects were obtained and a pattern of transfer appropriate processing³ was revealed.

CONCLUSIONS

A test-enhanced learning program can be successfully implemented in a classroom setting.

Results are consistent with the notion of desirable difficulty: more effortful learning conditions (e.g., post-test) produce larger long-term benefits than less effortful learning conditions (e.g., pre-test).⁴

Educational implications: Quizzes can be used as a method to enhance long-term learning.⁵

References

- Roediger, H.L. & Karpicke, J.D. (2006). Test-enhanced learning: Taking memory tests improves long-term retention. *Psychological Science*, 17, 249-255.
- McDaniel, M.A. & Fisher, R.P. (1991). Tests and test feedback as learning sources. *Contemporary Educational Psychology*, 16, 192-201.
- Morris, C.D., Bransford, J.D., & Franks, J.J. (1977). Levels of processing versus transfer appropriate processing. *Journal of Verbal Learning & Verbal Behavior*, 16, 519-533.
- Bjork, R.A. (1994). Memory and metacognition considerations in the training of human beings. In J. Metcalfe and A. Shimamura (Eds.), *Metacognition: Knowing about knowing* (pp. 185-205). Cambridge, MA: MIT Press.
- Roediger, H.L. & Karpicke, J.D. (2006). The power of testing memory: Basic research and implications for educational practice. *Perspectives on Psychological Science*, 1, 181-210.

This research was supported by the Institute of Education Sciences, U.S. Department of Education, through Grant R305H060080-06 to Washington University in St. Louis. The opinions expressed are those of the authors and do not represent the views of the Institute or the U.S. Department of Education.

Poster presented at the 3rd Annual Institute of Education Sciences Research Conference (Washington, DC, 6/11/08).

Correspondence: Mark A. McDaniel (mmdaniel22@wustl.edu)