

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



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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.

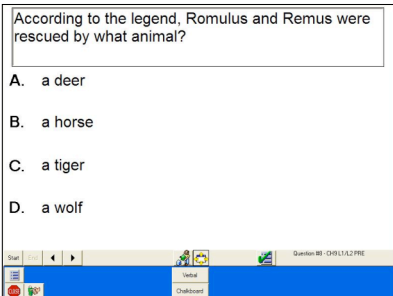
The teacher was not present for the pre-test and did not know which target facts were tested.

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

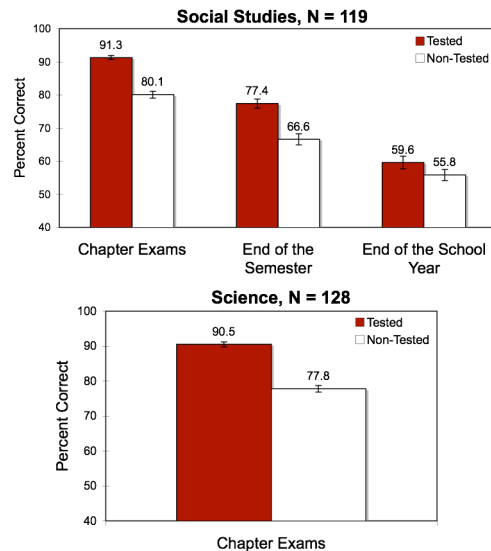
Immediately after the lesson, students took a multiple-choice post-test over tested items.

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.



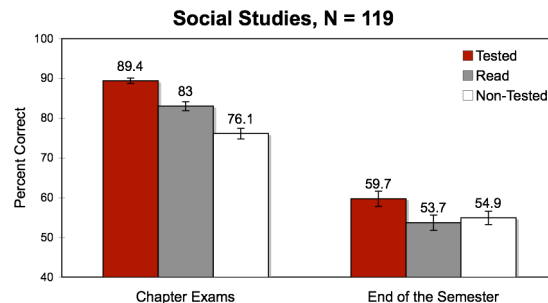
EXPERIMENT 1



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 $r = -.41$, respectively).

EXPERIMENT 2

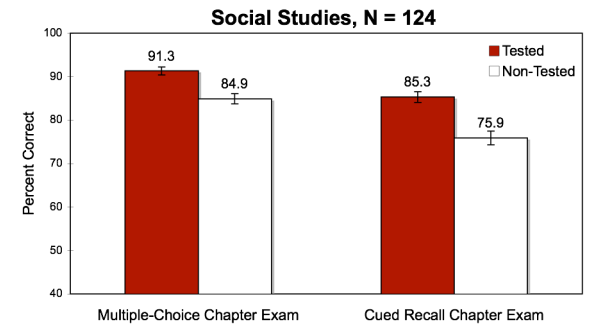
In Social Studies, we added a third condition where some target facts were read (instead of tested).



Testing information led to greater benefits than rereading information. The size of the testing effect was negatively correlated with students' standardized test performance ($r = -.30$).

EXPERIMENT 3

In Social Studies, students were exposed to tested items during a pre-test and all material during the class lecture. Then, students could test themselves on tested items online. A significant testing effect was still obtained.



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., testing) produce larger long-term benefits than less effortful learning conditions (e.g., re-reading).³

Educational implications: When facilitating long-term learning, educators and students should be encouraged to use quizzes as a method to enhance learning.⁴

References

1. Roediger, H.L. & Karpicke, J.D. (2006). Test-enhanced learning: Taking memory tests improves long-term retention. *Psychological Science*, 17, 249-255.
2. McDaniel, M.A. & Fisher, R.P. (1991). Tests and test feedback as learning sources. *Contemporary Educational Psychology*, 16, 192-201.
3. Bjork, R.A. (1994). Memory and metamemory 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.
4. 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.

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