Surprising Results from Research on Learning

Carl Wieman Science Education Initiative
2013 End-of-Year Event

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with contributions from Sarah Gilbert, Kerry Knox,
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Homework copying

*According to an MIT study, which of the following is associated with **higher** levels of homework copying (cheating)?*

A. More frequent and shorter assignments
B. Replacing written homework with online homework
C. Desire to learn rather than desire to pass the course or obtain higher grade
D. Being a potential business major
E. Due dates earlier in the course

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Homework copying - notes

Ans: D is the correct answer. Rather than commenting on this further, it is more interesting to look at the other choices: For instance, short frequent online assignments seem to decrease homework cheating. It has also been found that students cheat more on later assignments, which is not surprising because they often try to fill the gaps at the end of the term. This however should make us think about workload. Not surprisingly, students with a desire to learn cheat less on their homework.

“cheating” on a question is defined as – to obtain and submit an answer with essentially no intellectual engagement with the question.

Those who didn’t cheat very much at all completed about half of the problems two days before the due date.

Students are more likely to copy a problem if it is difficult, if it is later in the assignment, if they do it close to the deadline, or if the assignment is later in the term.

If students copied, they did indeed get lower exam scores.

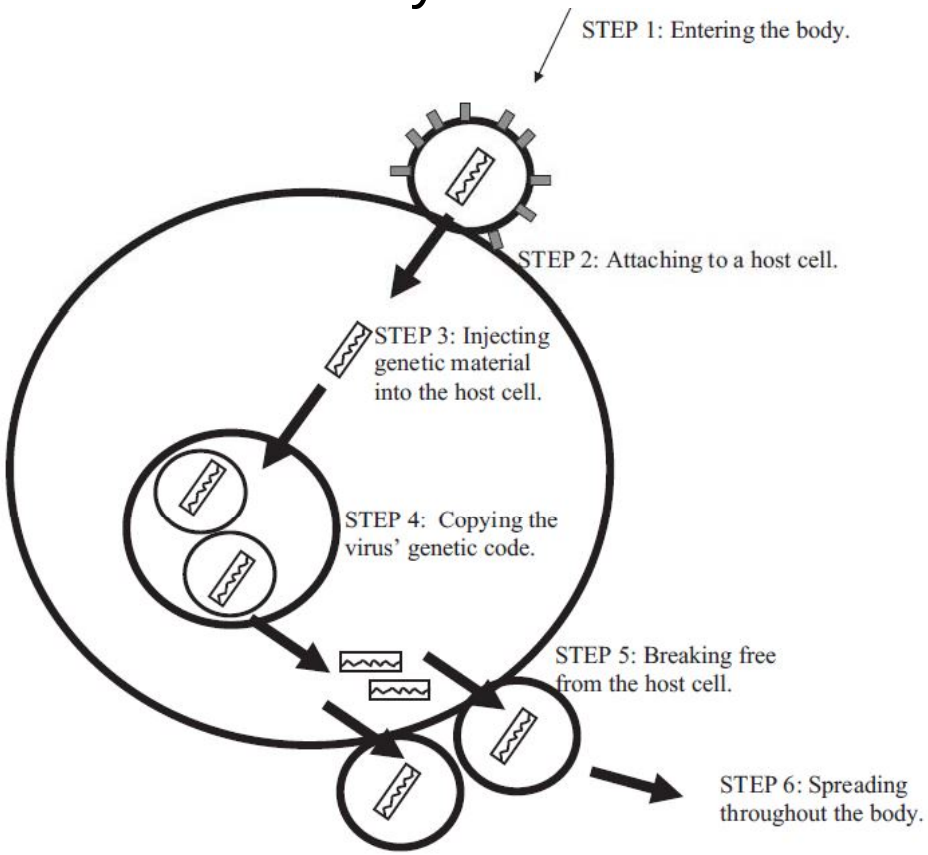
Copying written homework was more prevalent than copying online homework (self report).

“In summary, by far the strongest correlate of copying is delaying the start of effort on the homework until close to the due time. Lack of skill is a weak correlate of copying. That this lack of effort and the associated copying is in part a conscious decision is suggested by the strong correlation of demographic factors with copying. Predominately male students who are more interested in business than science or engineering, in getting an MIT degree than learning their major subject, in obtaining a passing grade than learning in introductory physics, and who do not consider copying homework as morally wrong as other students are far more likely not to allocate (perhaps by choice) enough time before the due day to make much progress on their homework and copied it in order to receive the credit.”

Interesting details

What is the effect of adding interesting details that are related to the topic but not relevant to the learning goals?

Lesson on how a cold virus infects the human body



<u>Interesting detail example:</u> A study revealed that people who have sex once or twice a week are more immune to colds than folks who abstain from sex.

vs.

<u>Uninteresting detail:</u> A virus is about 10 times smaller than a bacterium, which is approximately 10 times smaller than a typical human cell. …

Interesting details

On tests of retention and transfer (e.g. explain implications), students who are given the more interesting details:

A. Do better on both the retention and transfer tests
B. Do about the same on the both the retention and transfer tests
C. Do about the same on the retention test but worse on the transfer test
D. Do worse on the retention test but better on the transfer test
E. Do worse on both retention and transfer tests

Interesting Details - Results

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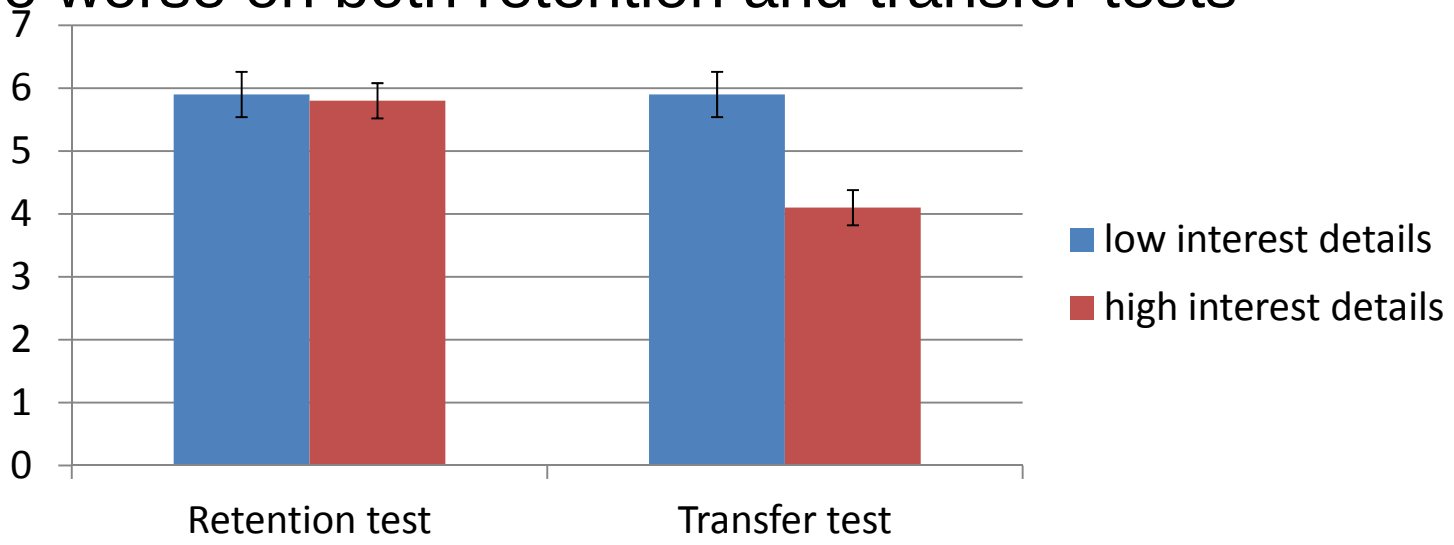

Mayer, R.E., Griffith, E., Jurkowitz, I.T.N., & Rothman, D. (2008). Increased interestingness of extraneous details in a multimedia science presentation leads to decreased learning. *Journal of Experimental Psychology, 14*, 329-339.

Interesting Details - notes

Retention test: Based on the lesson you just read, describe how a cold virus attacks the body.

Transfer test question examples:
Suppose you are exposed to a cold virus from an infected person who sneezes on you, but you do not get sick. Why not?
If you could, how would you change the human body to minimize the chances of viral infection?
What would happen to viruses if the cells in our bodies developed thicker membranes?

Textbooks and instructors often spice up instruction with interesting details, some of which are not relevant to the learning goals.

Material that is interesting but not relevant to the instructional goal is called a *seductive detail.* According to the seduction hypothesis, high-interest details draw more of the learner's cognitive processing capacity than do low-interest details, thereby leaving less capacity for making sense of the essential material. With less processing capacity available, learners are most likely to cut back on deeper cognitive processing—mentally organizing the material and integrating it with prior knowledge. The seduction hypothesis predicts the high-interest group will perform lower than the low-interest group, particularly on transfer performance (which is intended to tap deep learning).

Possible score ranges from 0 to 13.

Study vs. test

Students studied and were quizzed on word pairs (e.g. *mashua* means *boat*). In some groups, word pairs were "dropped" from studying and/or testing. They repeated a particular pattern of studying/testing four times.

Which of the following groups do you think did best on a test of the word pairs 1 week after the studying/testing session? Those who…

A. Studied all words and were tested on all words
B. Studied the words that were missed on the previous test and were tested on all words
C. Studied all words and were tested on words that were missed on the previous test
D. Studied words that were missed on the previous test and were tested on words that were missed on the previous test

Results

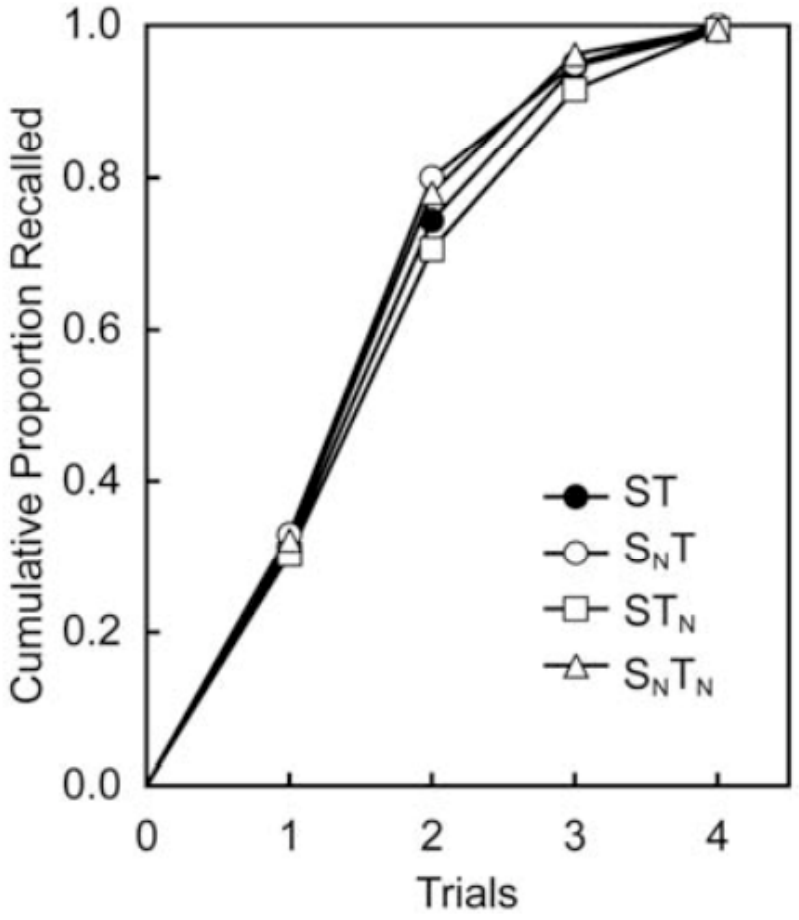

Fig. 1. Cumulative performance during the learning phase.

1 week later:

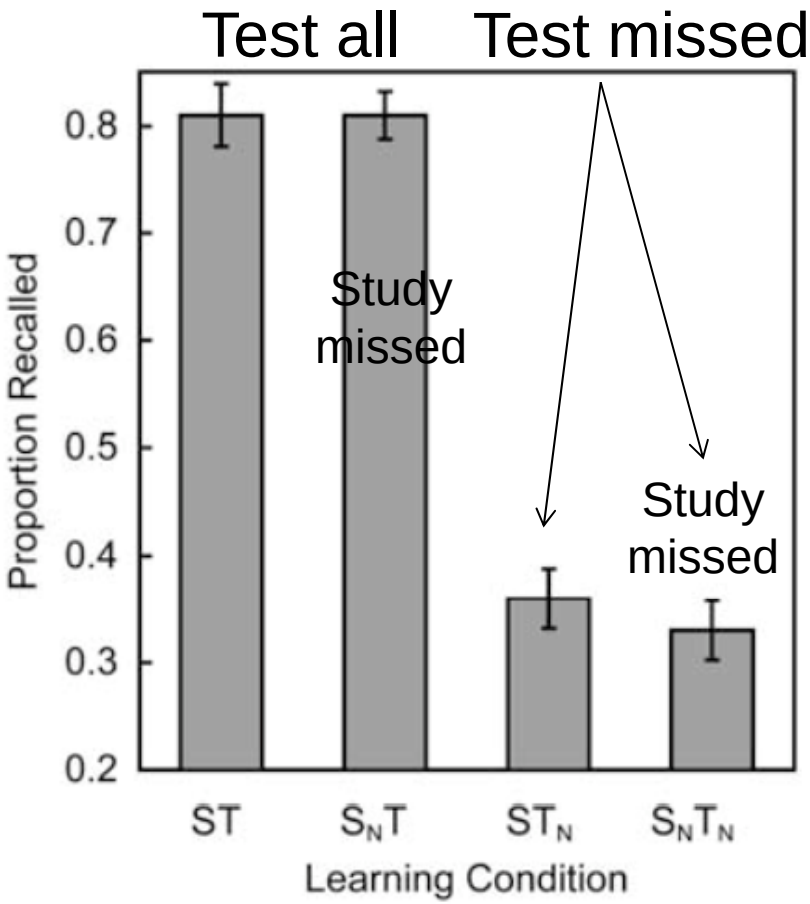

Fig. 2. Proportion recalled on the final test 1 week after learning. Error bars represent standard errors of the mean.

Karpicke, J. & Roediger, H. (2008). The critical importance of retrieval for learning. *Science, 319*, 966-968.

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Study vs. test - notes

All groups predicted that they would remember 50% of the word pairs in one week.

There was zero overlap in the ranges of retention (10-60% for the study conditions and 63-95% for the test conditions).

SNT and STN had about the same number of trials.

Effect of choice

Students were given the choice for an extra credit essay of:

- 6 potential topics on which to write, or
- 30 potential topics.

What was the effect of the number of choices on
(i) their motivation to write the essay
(ii) the quality of the essay written

*Were the students who were given **30 topics**:*

A. More likely to complete the essay, and more likely to do it well?

B. More likely to complete the essay, but less likely to do it well?

C. Less likely to complete the essay, but more likely to do it well if they did?

D. Less likely to complete the essay, and less likely to do it well if they did?

Effect of choice - Results

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30 choices: 60% of students completed the essay.
Mean grade: 7.69

6 choices: 74% of students completed the essay.
Mean grade: 8.09

"Choice overload" led to decreased motivation and performance.

Iyengar, S.S. & Lepper, M.R. (2000). When choice is demotivating: Can one desire too much of a good thing? *Journal of Personality and Social Psychology, 79*, 995-1006.

Effect of choice - notes

Other studies: “The recurring empirical finding… is that the provision of choice increases intrinsic motivation and enhances performance on a variety of tasks.” However, typically in those studies a choice of between ~ 2 and 6 options (conditions of “limited choice”) was compared with having no choice at all. This study compared the effects of conditions of “extensive choice” with those of “limited choice”.

Both completion rate and grade differences are statistically significant ($p<0.05$)

Findings contradict, in the words of the authors, “the popular notion that the more choice, the better—that the human ability to manage, and the human desire for, choice is unlimited.”; “Having unlimited options, then, can lead people to be more dissatisfied with the choices they make.”

Or, put very simply: some choice is good, but too much choice can be unhelpful.

“in both studies, people actually seemed to prefer to exercise their opportunity to choose in contexts where their choices were limited, and, in Study 2, they even performed better in such limited-choice contexts”

References

Iyengar, S.S. & Lepper, M.R. (2000). When choice is demotivating: Can one desire too much of a good thing? *Journal of Personality and Social Psychology, 79*, 995-1006.

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